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FAST SCIENCE:

A HISTORY OF TRAINING THEORY

AND METHODS FOR ELITE RUNNERS THROUGH 1975

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FAST SCIENCE:
A HISTORY OF TRAINING THEORY AND METHODS FOR ELITE RUNNERS THROUGH 1975

by

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Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

The University of Texas at Austin

August, 2008

DEDICATION

To my mother and father, Edna and Harry Bourne;

To my sister, brother-in-law and nephew, Jackie, Alan and Matthew Langdon

and

To the rest of my friends and family who have encouraged me along the way

Acknowledgements

First and foremost I would like to thank Dr. Jan Todd of the Department of Kinesiology and Health Education at the University of Texas at Austin. Without her initial suggestion, encouragement, guidance, support and friendship, this dissertation would never have been completed. Although it is a cliché, words do not do justice to my feelings of appreciation. I would also like to acknowledge my other committee members. Special thanks go to Dr. Terry Todd, former professor at the Department of Kinesiology and Health Education at the University of Texas at Austin who helped bridge the gap between the world of academia and the practical training of athletes. To Dr. Christine Green of the Department of Kinesiology and Health Education at The University of Texas, to Dr. Janet M. Davis of the Department of History at The University of Texas, and to Dr. Roger Farrar of the Department of Kinesiology and Health Education at The University of Texas. I am grateful for your patience, willingness to be on my committee and for your insightful feedback.

A special thank you goes to a dear friend, Dr. Kim Beckwith who not only led the way but also helped in a multitude of ways—I've lost count of how many dinners I owe you! Deepest gratitude is extended to coach and mentor Dan Pfaff who epitomizes the reasons why coaches take up such a noble profession. I am indebted to Vern Gambetta (former editor of *Track Technique*) and James Dunaway, frequent contributor to *Track and Field News* who provided valuable feedback on specific training and history related

questions throughout the course of this dissertation. I would also like to thank coaches Jeff "Mad Dog" Madden, Ed Nordenschild and Lance Hooton, who helped me "cut my teeth" as a strength and conditioning coach at the University of Texas. Moreover, I would like to extend my gratitude to Mark Verstegen and the coaches and staff at Athletes' Performance in Tempe, Arizona and Los Angeles, California who welcomed me into their fold and continue to offer the finest services available to enhance an athlete's performance.

I am grateful to the ever helpful but under-recognized staff at the PCL and Life Science libraries at the University of Texas at Austin who promptly delivered (even while in the UK) many of the materials necessary to write this dissertation. In particular, I would like to thank Nancy Elder, Head Librarian at the Life Science Library for her patience and help with the occasionally temperamental Endnote program.

The ultimate dedication and acknowledgment goes to my immediate family—Edna and Harry Bourne, Jackie, Alan and Matthew Langdon for their love, encouragement and support. Whatever accomplishments I have achieved are ultimately down to them.

FAST SCIENCE:

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Publication No._____

Nicholas David Bourne, Ph.D.

The University of Texas at Austin, 2008

Supervisor: Janice S. Todd

This dissertation examines the history of the application of science to the training of elite runners through 1975. In particular, it details the changes that occurred in the ruling theories of training within the framework of what Thomas Kuhn, author of *The Structure of Scientific Revolutions* refers to as a "paradigm shift."

The quest for the origins of training began in ancient Greece where the earliest written histories of athletics were recorded. There, according to the sophist Philostratus, a rudimentary form of periodization (a process of structuring training into phases) was born. Examination of eighteenth and the bulk of nineteenth century training practices revealed little difference in the training of horses, fighting cocks, greyhounds, pugilists (boxers), and runners. In the lead up to WWI, training could be classified as "light,"

where athletes stayed competitive with very little training. Athletic training between WWI and WWII was characterized by the advent of "moderate" training loads and the introduction of innovative training methods—fartlek and interval training. Arthur Lydiard's recommendations of preliminary marathon training for distance runners (800-10,000 meters) in the late 1950s, along with the training of Emil Zátopek, Peter Snell, and Jim Ryun, epitomized a transition from moderate to "heavy" training loads that occurred between 1945 and 1975. Meanwhile, other eminent coaches such as Payton Jordan of Stanford University and William Bowerman of the University of Oregon offered balance to the heavy volume training approach by emphasizing quality over quantity.

Following WWII, in the battle for world ideological supremacy, the Soviet Union utilized sport as a political tool to demonstrate the superiority of its communist system. Integral to achieving the best sporting results was the application of "cutting edge" sport science and the advent of modern-day periodization. The first detailed English-language overview of Professor Lev Pavlovich Matveyev's groundbreaking theory of periodization by Frank Dick of Great Britain in 1975 caused a major shift in the paradigm of planning an athlete's training—so much so, that by the turn of the twenty-first century, periodization formed the foundation of most modern coaching theory and practice and the basis of every serious athlete's training.

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INTRODUCTION

> You say, 'I want to win at Olympia.' Hold on a minute. Look at what is involved both before and after, and only then, if it is to your advantage, begin the task. If you do, you will have to obey instructions, eat according to regulations, keep away from desserts, exercise on a fixed schedule at definite hours, in both heat and cold; you must not drink cold water nor can you have a drink of wine whenever you want. You must hand yourself over to your coach exactly as you would to a doctor.[1]

The passage above was written nearly two thousand years ago, in A.D. 101 by Epictetus (ca.55—135), a Stoic philosopher. It describes the level of preparation and sacrifice necessary to excel at the ancient Olympic Games, held at Olympia, Greece, at the turn of the second century. Epictetus's advice to his would-be athlete sounds surprisingly modern as it encapsulates many of the fundamental components of training essential for the preparation of athletes in the twenty-first century. These include the discipline required to adhere to a structured training program necessary to facilitate ongoing improvement; avoidance of potential vices such as drugs and alcohol that could adversely affect performance; sound nutritional practices to aid recovery, promote optimal body composition, and provide the necessary energy to train and compete; and finally, strict adherence to the advice of a coach or specialist who can guide and nurture an athlete's development in their chosen sport.

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[1] Epictetus quoted in: Waldo E. Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations* (New York: Oxford University Press, 1987), 114.

Despite the significant impact training has on athletic performance and the fact that for the vast majority of professional sports, training comprises well over ninety percent of an athlete's vocational time, surprisingly little has been written about the evolution of training practices as they apply to sport. Ultimately, the goal of any training program is to help realize an athlete's potential by preparing them physically, technically, tactically, and psychologically for their chosen event.[2] The Greek philosopher, Aristotle (384-322 B.C.), considered one of the most influential philosophers in Western thought, neatly sums up the rationale for training**,** "Excellence is an art won by training and habituation…We are what we repeatedly do. Excellence then is not an act but a habit."[3] Sir Steve Redgrave, Britain's most successful Olympian, put this philosophy into practice by winning five consecutive Olympic gold medals (1984-2000) in the sport of rowing. Redgrave highlights the potential role of training in significantly elevating the chances of success with his somewhat "tongue in cheek" comment—"I do not train to win, I train to eliminate the possibility of defeat."[4]

The purpose of this dissertation is to examine the evolution of the various theories and training methodologies used by elite male runners to prepare themselves for high-performance sport through 1975. I chose male runners primarily to limit the size of my task, but also because even as late as the 1960 Rome Olympics, the longest distance female runners were allowed to run was a mere 800 meters. This injustice meant that

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[2] Dietrich Harre, ed., *Principles of Sports Training* (Berlin: Sportverlag, 1982), 10.

[3] "Aristotle," University of California at Berkeley, http://www.ucmp.berkeley.edu/history/Aristotle.html. (accessed February 18, 2005).

[4] "Sir Steve Redgrave," steveredgrave.com, http://steveredgrave.com (accessed February 2, 2006). Email enquiry to Roxanne (Sir Steve Redgrave's administrative assistant) confirming the above quote.

female runners were unable to reap the benefits of some of the greatest innovations in track and field training (covered in this dissertation) until the latter part of the twentieth century.[5] Furthermore, as a sport historian and performance coach I was interested in how ideas about the preparation of sprinters and other runners had changed over time, and particularly, how the emerging field of sport science had influenced the practical advice coaches offered athletes to enhance their performance. I was particularly interested in how Western athletes' training seemed to evolve differently compared to athletes in the former Soviet Union. In the late 1960s it became apparent that Soviet athletes were benefiting from a particularly sophisticated method of planning an athlete's training—a process called periodization. Periodization refers to the logical, cyclical method of manipulating training variables in order to increase the potential for achieving specific performance goals, such as peaking at the right time.[6]

I chose to focus on track and field because out of all athletic activities, it represents sport in its purest form.[7] As Dean Cromwell, the legendary track and field coach from the University of Southern California, insightfully noted, "How old is your own participation in this ancient sport? Older than your memory. It began when you found out you were strong enough to pick up a rattle or a cereal spoon and throw it; when you learned to move under your own leg power for the first time. It's born in you to want

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[5] David Wallechinsky, *The Complete Book of the Olympics* (London: Aurum Press Limited, 2000), 209.

[6] Michael H. Stone, "The Concept of Periodization" (paper presented at the Leading Edge in Strength and Conditioning (National Coaching Foundation), Bisham Abbey, England, December 1998).

[7] Track and field is synonymous with the term athletics and refers to the collection of sporting events that involve running, throwing and jumping commonly seen at the Olympic Games. For further details see "Athletics: Olympic Sport since 1896," International Olympic Committee, http://www.olympic.org/uk/sports/programme/index_uk.asp?SportCode=AT (accessed February 20, 2007).

to run and jump and throw things. Born in you also is an urge to excel, a competitive spirit. Put together these inbred characteristics and you have track and field—every man's sport."[8]

Like many sports, participation in track and field is contested at local, national, and international levels. I have focused on the training of male, elite-level, international performers in my discussion of the twentieth century in this dissertation because of my personal involvement with the international track and field community. This is not a vantage point most historians of sport are privileged to occupy, and I recognize that I have been allowed insights into the training methods of high-performance athletes that would not be found merely by reading the published literature on track and field. As a volunteer and then professional assistant track and field coach (to Coach Dan Pfaff) between 2000 and 2004 I was fortunate to witness the training of numerous elite runners including Donovan Bailey, winner of the 1996 Atlanta Olympics 100 meters in a world record time of 9.84 seconds. I therefore naturally gravitated towards the training of runners and their accomplishments. During this period I witnessed the multifactorial nature of training and the assistance that sports science can give to enhance performance. Donovan Bailey utilized a myriad of "scientific" measures to enhance performance including nutritional supplements, blood profiling to determine nutritional deficiencies, chiropractic treatments that incorporated highly skilled soft tissue release, acupuncture, the acquisition of track shoes and running uniforms specially designed by a leading sports manufacturer to enhance speed, highly sophisticated training regimens aimed at peaking

[8] Dean B. Cromwell, *Championship Techniques in Track and Field: A Book for Athletes, Coaches and Spectators* (London: Mc Graw-Hill, 1941), 3.

at the right time, weight training to enhance explosive power, field tests and time trials to determine optimal progress, and blood lactate analysis during training to determine the contribution of different energy systems that affect performance.[9]

In the spring and summer of 2004, as a physical therapist and assistant track and field coach, I furthered my practical experience by personally assisting Obadale Thompson of Barbados in preparation for the 2004 Olympic Games where he placed seventh in the final of the 100 meters.[10] In 2007, after a period of focusing attention on this dissertation I began an internship, followed by full-time employment with the world renowned training center Athletes' Performance—responsible for training some of the leading athletes in sport. The founder and president, Mark Verstegen bases his training philosophy on the applied use of science integrating the four cornerstones of performance—mindset, movement, nutrition, and recovery.[11]

The use of science to assist performance dates back to the ancient Greeks. The highly respected sport historian Allen Guttmann notes in *Ritual to Record* that the Greeks generated a whole branch of science that parallels the modern production of manuals, guides, and scholarly papers in sports medicine and exercise science.[12] A further comment by Aristotle, is particularly revealing. "We argue about the navigation of ships

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[9] Lactic acid (lactate) is a by-product of anaerobic glycolysis. Anaerobic glycolysis refers to the non-oxidative (without oxygen) breakdown of glycogen (storage form of glucose) to restore levels of adenosine triphosphate (ATP) –the primary short-term source of energy used to fuel muscular contractions.

[10] Obadale Thompson was the Olympic bronze medalist in the 100 meters at the 2000 Olympic Games. He is also the holder of the fastest ever time (9.69 seconds) recorded in the 100 meters (wind-aided) set in El Paso, Texas in April 1996.

[11] For further information see: Athletes' Performance, www.athletesperformance.com (accessed February 25, 2008).

[12] Allen Guttmann, *From Ritual to Record: The Nature of Modern Sports* (New York: Columbia University Press, 1978), 43.

more than about the training of athletes, because [navigation] has been less well organized as a science."[13] A modern historian of science describes the practice of science as the "aggregate of systematized and methodical knowledge, concerning nature, developed by speculation, observation and experiment, so leading to objective laws governing phenomena and their explanation."[14] It is by the use of the "scientific method" that scientists over time endeavor to construct an accurate, reliable, consistent and non-arbitrary representation of the world.[15] The application of science to sport allows coaches to move away from hearsay, trial and error, and the use of empirical knowledge to move toward a more objective evaluation of athletic performance with greater prediction and control over the training process. Thomas Kuhn, author of the seminal *The Structure of Scientific Revolutions*, would be pleased to note that as is the case with other branches of science, "scientific revolutions" have also occurred in track and field in which a dominant training theory—what Kuhn would call a "paradigm"—gave way to new methods and ideas that gradually became the dominant philosophy for a new generation of coaches and trainers.[16]

This dissertation is organized chronologically and traces the evolution of the training theories and methods used by elite runners through 1975. The decision to end this analysis in that year is based on the introduction in 1975 of a new paradigmatic training theory from the Soviet Union, a concept called periodization. Over the past thirty

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[13] Harold Harris, *Greek Athletes and Athletics*, *Hutchinson & Co.* (London: Hutchinson & Co., 1964), 173.
[14] Thomas Crump, *A Brief History of Science* (London: Constable, 2001), xiii.
[15] E. Bright Wilson, *An Introduction to Scientific Research* (New York: Dover Publications Inc., 1990), 21-35.
[16] Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962).

years periodization has replaced many of the earlier training methodologies discussed in this dissertation. Periodization's overtaking of earlier track training methods in the United States represents a classic example of a Kuhnian paradigm shift.[17] To properly understand the modern world of track and field, however, it is important that we also understand what periodization has replaced methodologically—and why periodization took root so quickly in the cultural climate of American track and field. To understand the phenomenon of periodization, we must, therefore, understand what came before it. Although track and field training occurs in nearly every country in the world, this dissertation focuses primarily (although not exclusively) on the American story of track and field preparation. Chapters Two through Four and Chapter Six, in particular, are focused on the development of track and field training in the United States and as an organizing principle, the literature on American training methods before 1975 is further broken down into three areas of inquiry: 1) the training theories of prominent coaches; 2) the training methods of prominent athletes, and 3) the role of the exercise science community in helping create and disseminate new discoveries about training and its impact on human physiology and athletic performance.

LITERATURE REVIEW

Despite its prominence in the Olympic Games and its world wide popularity, the academic literature on the history of track and field is surprisingly limited. In the ProQuest Dissertation and Thesis Database, there are only nineteen (19) monographs

[17] Ibid.

listed for track and field and the majority of these studies are narrow in scope and do not provide a comprehensive overview of the sport's history.[18] A few scholars have focused specifically on the national history of track and field. Joseph Turrini's dissertation "Running for Dollars: An Economic and Social History of Track and Field in the United States (1820-2000)" explores the social milieu of the sport with a special focus on the emergence of governance bodies in track and field.[19] Guy Schultz also explores issues of governance in his thesis on the relationship of the I.A.A.F. to the I.O.C. between 1912 and 1932. Shultz is primarily concerned with the fight for women's participation in the Olympic Games, however, and there is no discussion of training methodologies in his work.[20] Another dissertation of note is the history of the marathon written by Pamela Cooper.[21] Cooper does an excellent job documenting the history of long-distance running but does not, of course, discuss sprint training or the role of exercise science in training methods.

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[18] Anita Cryshanna Jackson, "Measuring the Impact of Title Nine for Women of Color: The Case of the University of Akron" (Ph.D. diss., 2006); Ryan Snelgrove, "Subcultural Identification and Motivation of Spectators at the 2005 Pan American Junior Athletic Championships" (M.H.K., University of Windsor, 2006); Erik Norman Jensen, "Images of the Ideal: Sports, Gender, and the Emergence of the Modern Body in Weimar, Germany" (Ph.D. diss., The University of Wisconsin, 2003); Margaret Mary Gehring, "Career Longevity of Four Women Cross Country and Track and Field Coaches at the National Collegiate Athletic Association Division Three Level" (Ph.D. diss., The Ohio State University, 2002); Bradley J. Davison, "Forechecking in Captivity: Sport in the Lives of Canadian Prisoners of War at Three German Camps During the Second World War" (M.H.K., University of Windsor, 2006); William Philip Ebner, "A Personal History Case Study of Attrition in Intercollegiate Athletics in Non-Scholarship Institutions" (Ed.D. diss., Columbia University Teachers College, 1998); Andrew David Morris, "Cultivating the National Body: A History of Physical Culture in Republican China" (Ph.D. diss., University of California, 1998).

[19] Joseph M. Turrini, "Running for Dollars: An Economic and Social History of Track and Field in the United States, 1820-2000" (Ph.D. diss., Wayne State University, 2004), 13-14.

[20] Guy A. Scultz, "The I.A.A.F. And I.O.C.: Their Relationship and Its Impact on Women's Preparation in Track and Field at the Olympic Games, 1912-1932" (Ph.D. diss., The University of Western Ontario, 2000).

[21] Pamela Cooper, "26.2 Miles in America: The History of the Marathon Footrace in the United States" (Ph.D. diss., The University of Maine, 1995).

One dissertation which bears tangentially on some of the issues explored in this monograph is Ted Butryn's study which utilizes a narrative approach to study the effects of technology on the life-histories of seven elite track and field athletes. The author focuses on various aspects of technology such as event-specific equipment, track surfaces, medicine and drugs, but forgoes any in depth analysis of various training regimes and methods.[22] The only monograph that truly explores the same academic terrain as this dissertation project is the 1966 dissertation entitled "Changing Concepts in the Teaching of Track and Field Athletics in the United States of America from 1896 to 1960" written by Ernest Carter.[23] Carter examined the reasons why track and field performances significantly improved between 1896 and 1960 with detailed analysis of equipment, facilities, teaching and training methods. However, the author paints with a broad brush and by covering all track and field events he inevitably dilutes insight into each track and field event. Furthermore, the dissertation lacks athlete biographical information and while the author acknowledges the contribution of science to the new methods of training he fails to offer detailed information regarding the evolution of coaching science during the aforementioned era.

Sport historian Roberta Park's "Athletes and their Training in Britain and America, 1800-1914," provides a rare but enlightening example of a comprehensive sport

[22] Ted M. Butryn, "Posthuman Podiums: The Technological Life-History Narratives of Elite Track and Field Athletes" (Ph.D. diss., The University of Tennessee, 2000).
[23] Ernest Newton Carter, "Changing Concepts in the Teaching of Track and Field Athletics in the United States of America from 1896 to 1960" (Ed.D. diss., University of California, 1966).

history specifically devoted to the training of athletes.[24] Park's fifty-page treatise includes sections on: "The Early Nineteenth-Century Concepts of Training," "An Embryonic Science of Athletic Training versus the Persistence of Tradition," and "Efforts to Scientifically Study Athletes and Their Training." The author's analysis contains a myriad of primary sources that are indispensable to the understanding of the evolution of training during this era.[25]

A number of sport history texts provide key background information concerning the evolution of sport (including selective track and field information) in America. Betty Spears and Richard Swanson provide a basic framework by tracing the *History of Sport and Physical Activity in the United States* from the peoples that influenced American sport (1492 onwards) until the mid 1970s.[26] Nancy Struna's *People of Prowess: Sport, Leisure, and Labor in Early Anglo-America* is regarded as the preeminent scholarly work that deals with colonial life in America.[27] Benjamin Rader's richly researched text that extends from the era of folk games (1607-1850) to the era of spectator-centered sport

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[24] Roberta J. Park, "Athletes and Their Training in Britain and America, 1800-1914," in *Sport and Exercise Science Essays in the History of Sports Medicine*, ed. Jack W. Berryman and Roberta J. Park (Urbana: University of Illinois Press, 1992), 57-107.

[25] Ibid. Examples of key primary sources used by Park include: John Sinclair, *The Code of Health and Longevity: Or a Concise View of the Principles Calculated for the Preservation of Health and the Attainment of Long Life* (Edinburgh: Arch. Constable and Co., 1807); Walter Thom, *Pedestrianism: Or an Account of the Performances of Celebrated Pedestrians During the Last and Present Century with a Full Narrative of Captain Barclay's Public and Private Matches and an Essay on Training* (Edinburgh: Arch. Constable and Co., 1813); Charles Westhall, *The Modern Method of Training for Running, Walking, Rowing, and Boxing, Including Hints on Exercise, Diet, Clothing, and Advice to Trainers*, 7th ed. (London: Ward, Lock and Tyler, 1863); Archibald Maclaren, *A System of Physical Education, Theoretical and Practical* (Oxford: The Clarendon Press, 1865); Archibald Maclaren, *Training in Theory and Practice*, 2nd ed. (London: Macmilan and Co., 1874).

[26] Betty Spears and Richard A. Swanson, *History of Sport and Physical Activity in the United States* (Dubuque, Iowa: William C. Brown Co., 1978).

[27] Nancy Struna, *People of Prowess: Sport, Leisure, and Labor in Early Anglo-America* (Urbana: University of Illinois Press, 1996).

(1920-1980) provides significant insight into nineteenth century sport and the significance of the Caledonian Games that helped forge track and field in America.[28] Ronald Smith, an authority in the area of intercollegiate athletics, fosters vital information on the formative years of collegiate sport—including track and field—between 1850 and 1915.[29] Other key sport history texts that harnessed further background knowledge and selected sport-specific track information included Steven Reiss's *The American Sporting Experience: A Historical Anthology of Sport in America* and *Sport in Industrial America 1850-1920,* Melvin L. Adelman's *A Sporting Time: New York City and the Rise of Modern Athletics, 1820-1870,* and John Rickards Bett's *America's Sporting Heritage.*[30]

There are also a number of histories of track and field written for the popular market. The best of these is Roberto Quercetani's *Athletics: A History of Modern Track and Field Athletics (1860-2000).* Additional information can be found in David Wallechinsky's *The Complete Book of the Olympics* (2000) and in Gerald Lawson's *World Record Breakers in Track and Field Athletics* (1997) which provides detailed

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[28] Benjamin G. Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 2nd ed. (Englewood Cliffs: Prentice Hall, 1990).

[29] Ronald Smith, *Sports and Freedom: The Rise of Big-Time College Athletics* (New York: Oxford University Press, 1988).

[30] Steven A. Reiss, *The American Sporting Experience: A Historical Anthology of Sport in America* (West Point, N.Y.: Leisure Press, 1984); Steven A. Reiss, *Sport in Industrial America 1850-1920* (Wheeling, Ill.: Harlan Davidson Inc., 1995); Melvin L. Adelman, *A Sporting Time: New York City and the Rise of Modern Athletics, 1820-1870* (Urbana: University of Illinois Press, 1990); John Rickards Betts, *America's Sporting Heritage* (Reading, Mass.: Addison-Wesley Publishing Co., 1974).

information on the profiles, performances and ratings of the world record breakers in each track and field event since the inauguration of the modern Olympic Games.[31]

Other academic histories of track and field primarily fall into three main categories: articles and books about the lives of prominent Olympic track and field athletes; articles about the growth and interagency rivalries of the various governing institutions in track and field, and articles and books on the relationship of track and field to the Olympic movement.[32]

Although there is an abundant scholarly literature on track and field in the Olympic Games, the fusion of track and field history under the larger umbrella of Olympism has created its own unique problems.[33] Because the Olympics occur only once

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[31] Roberto Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)* (Milan: SEO Editrice, 2000); David Wallechinsky, *The Complete Book of the Olympics*; Gerald Lawson, *World Record Breakers in Track and Field Athletics* (Champaign, Ill.: Human Kinetics, 1997).

[32] Examples include: Frank Zarnowski, "Thomas F. Kiely: A Biography," *Journal of Olympic History* 14, no. 2 (August 2006); Jeoen Heijmans, "Ken Jones: 30 December 1921 - 18 April 2006," *Journal of Olympic History* 14, no. 2 (August 2006); Mark Dyreson, "Prolegomena to Jesse Owens: American Ideas About Race and Olympic Races from the 1890s to the 1920s," *International Journal of the History of Sport* 25, no. 2 (February 2008); William H. Freeman, "In the Interest of Sport: Bill Bowerman's Part in the Formation of the U.S. Track and Field Federation," *Canadian Journal of History of Sport and Physical Education* 7 (May 1976): 54-65; Eric Danoff, "The Struggle for Control of Amateur Track and Field in the United States-Part 1," *Canadian Journal of History of Sport and Physical Education* 6, no. 1 (May 1975): 43-85.

[33] Alfred Senn, *Power, Politics and the Olympic Games* (Champaign, Ill.: Human Kinetics, 1999); Allen Guttmann, *A History of the Modern Games* (Urbana: University of Illinois Press, 1991); Richard Espy, *The Politics of the Olympic Games* (Berkeley: University of California Press, 1981). There is also extensive literature concerning the negative aspects of the Olympic Games focusing particularly on corruption. For example see, William O. Johnson, *All That Glitters Is Not Gold: The Olympic Games* (New York: G.P. Putnam's, 1972); Andrew Jennings, *The New Lord of the Rings: Olympic Corruption and How to Buy Gold Medals* (New York: Pocket Books, 1996); Andrew Jennings and Vyv Simon, *Dishonored Games: Corruption, Money, and Greed at the Olympics* (New York: SPI Books, 1992). John Lucas, emeritus Professor of Sports and Olympic History at the University of Pennsylvania has written extensively on the general topic Olympic movement but failed to provide any specific information pertaining to the evolution of training practices. Examples of Lucas's scholarly contribution include: John Lucas, *The Modern Olympic Games* (New Jersey: A.S. Barnes, 1980); John Lucas, *Future of the Olympic Games* (Champaign, Ill.: Human Kinetics, 1992); John Lucas, "The Durable Strength of the Olympic Games," *Olympic Review*, no. 157 (1980): 632-637; John Lucas, "The Death and Burial of Coubertin," *Journal of Olympic History* 9, no. 3 (September 2001): 7-12.

every four years, events in the inter-Olympic Games years have received very little attention. One of the goals of this dissertation, therefore, is to write about the daily lives of athletes and not merely chronicle their pinnacle achievements. Thus, except for Roberta Park's seminal article on the training of athletes in the nineteenth century and Ernest Carter's now outdated dissertation on teaching track and field in a school setting, no other monograph attempts to tell the history of training methodologies in American track and field.

Only a small number of other articles and books have focused on the history of training methods. Paleologos Cleanthis examines "Origin of the Modern Theory of Training" and argues that the training of Greek athletes was not too dissimilar from modern day athletes. William Freeman's offers an excellent appraisal of "Distance Training Methods, Past and Present," that details the evolution of distance training and racing between 1880-1975, while Chris Walsh's, 1990 *Track and Field Quarterly Review* article narrows the historical focus by examining the background of various distance training methods from 1930 onwards.[34]

The only study, however, which bears any true resemblance to the aims of this dissertation, is the 2006 article written by German historian Arnd Krüger entitled "Training Theory and Why Roger Bannister was the first Four Minute Miler." Krüger's article, examines in detail a particular era in the training of track and field athletes from a

[34] Cleanthis Paleologos, "Origin of the Modern Theory of Training," *Track and Field Quarterly Review* 8, no. 1 (1987): 26-29; William H. Freeman, "Distance Training Methods, Past and Present: The Evolution of Distance Training and Racing, 1880-1975," *Track and Field Quarterly Review* 75, no. 4 (1975): 4-11; Christopher Walsh, "Bowerman Oregon Distance Tradition Meets Bompa Training Theory: Periodized Mile and 5km Trainng," *Track and Field Quarterly Review* 90, no. 2 (1990): 12-20.

European perspective. As will be discussed in detail in Chapter Four, Krüger argues that Bannister, the first man to break the four minute mile, was successful primarily because of his modern, scientific approach to training. What Krüger does not do is offer a comparative analysis of what separated Bannister from the other two key competitors (John Landy and Wes Santee) in the race to run the first ever sub-four minute mile. Furthermore, Krüger offers only fleeting coverage of Franz Stampfl, Bannister's coach, who was arguably instrumental in Bannister's successful attempt to conquer the Mount Everest of track and field.[35]

Before putting pen to paper (or at least fingertips to keyboard) it was important to examine the framework from which modern sport evolved. Allen Guttmann's path-breaking *From Ritual to Record* which has helped guide the field of sports history provided the necessary background to understand the evolution of modern sport while Melvin Adelman's *A Sporting Time: New York City and the Rise of Modern Athletics, 1820-1870* refined Guttmann's work by identifying additional characteristics of modern sport.[36] Furthermore, through practical experience and reading the author was aware that significant events in the nature of training practice had occurred in the final quarter of the twentieth century. To explore these changes the author chose to use the methodological framework of Thomas Kuhn whose groundbreaking text *The Structure of Scientific*

[35] Arnd Krüger, "Training Theory and Why Roger Bannister Was the First Four-Minute Miler," *Sport in History* 26, no. 2 (August 2006): 305-324.
[36] Guttmann, *From Ritual to Record: The Nature of Modern Sports*; Adelman, *A Sporting Time: New York City and the Rise of Modern Athletics, 1820-1870*.

Revolutions has become one of the most influential texts on the philosophy of science during the twentieth century.[37]

In writing this dissertation the author made extensive use of the Todd-McLean Physical Culture Collection in the H.J. Lutcher Stark Center for Physical Culture and Sports at the University of Texas at Austin. The collection is regarded as the largest and finest compilation of archival materials related to physical culture, strength, body building, and alternative medicine in the world. Examination of its contents revealed a wealth of track and field and training information, including original copies of John Sinclair's *The Code of Health and Longevity* (1807) and Hieronymus Mercurialis's *De Arte Gymnastica* (1569).[38] Training information was supplemented by the use of the Perry-Casteneda Library at the University of Texas at Austin and its inter-library loan service that afforded access to rare training materials including original Soviet and German articles and a copy of Lev Pavlovich Matveyev's pioneering text *The Fundamentals of Training*.[39]

The primary literature used in the writing of this dissertation can be divided into several distinct types. I began with a search for didactic literature on the subject of track and field training from all eras of history. I wanted to know what people knew about training at different times in history and who dispensed such advice. The search for the origins of training for sport and running in Western thought begins, not surprisingly, in

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[37] Kuhn, *The Structure of Scientific Revolutions*; "Thomas Kuhn," Stanford University Encyclopedia of Philosophy, http://plato.stanford.edu/entries/thomas-kuhn/ (accessed November 12, 2007).
[38] Sinclair, *The Code of Health and Longevity*; Hieronymus Mercurialis, *De Arte Gymnastica Aput Ancientes* (Venice: 1569).
[39] Lev Pavlovich Matveyev, *Fundamentals of Sports Training*, trans. Albert P. Zdornykh (Moscow: Progress Publishers, 1981).

ancient Greece where the earliest written histories of athletics were recorded. Extensive use was made of classic and secondary interpretations of these texts such as Norman Gardiner's *Greek Athletic Sports and Festivals* and *Athletics of the Ancient World*, Rachel Sargent Robinson's *Sources for the History of Greek Athletics* and more modern appraisals of sport in classical times such as David C. Young's *The Olympic Myth of the Greek Amateur Athletics* and Donald Kyle's *Athletics of the Ancient Athens.*[40] Eminent medical historian Jack Berryman's **"**Exercise and the Medical Tradition from Hippocrates through Antebellum America: A Review Essay," provided critical information on the early link between exercise and medicine.[41] The Renaissance saw a revival of interest in exercise for health epitomized by Hieronymus Mercurialis's *De Arte Gymnastica,* published in 1569, although Mercurialis does not address track and field training *per se* in that volume.[42] However, at the turn of the nineteenth century training advice begins to appear in such works as Sir John Sinclair's massive, four volume *Code of Health and Longevity: A Concise View of the Principles Calculated for the Preservation of Health and the Attainment of Long Life* (1807) and, more directly in

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[40] Philostratus, *Philostratus: Concerning Gymnastics by Thomas Woody* (reprint, *Research Quarterly*, May 1936, Vol. VII, No.2); Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*; Norman E. Gardiner, *Athletics of the Ancient World* (Oxford: University Press, 1930); Robert Montraville Green, *A Translation of Galen's Hygiene (De Sanitae Tuenda)* (Springfield, Mo.: Charles C. Thomas, 1951); Hippocrates, *Regimen*, trans. W.H.S. Jones (Cambridge, Mass: Harvard University Press, 1967); Norman E. Gardiner, *Greek Athletic Sports and Festivals* (London: Macmillan and Co., 1910); Rachel Sargent Robinson, *Sources for the History of Greek Athletics* (Ohio: the author, 1955); David C. Young, *The Olympic Myth of the Greek Amateur Athletics* (Chicago: Ares, 1984); Donald G. Kyle, *Athletics of the Ancient Athens* (Leiden: E.J. Brill, 1987).

[41] Jack W. Berryman, "Exercise and the Medical Tradition from Hippocrates through Antebellum America: A Review Essay," in *Sport and Exercise Science: Essays in the History of Sports Medicine*, ed. Jack W. Berryman and Roberta J. Park (Urbana: University of Illinois Press, 1992), 1-56.

[42] P.C. McIntosh, "Hieronymus Mercurialis 'De Arte Gymnastica': Classification and Dogma in Physical Education in the Sixteenth Century," *British Journal of Sports History* 1, no. 1 (1984): 73-84.

Walter Thom's *Pedestrianism* (1813), a book that detailed the performances of celebrated pedestrians during the eighteenth and early part of the nineteenth century.[43]

Tom McNab, Peter Lovesy and Andrew Huxtable's *An Athletics Compendium: An Annotated Guide to the United Kingdom Literature of Track and Field,* although confined geographically, provided an abundance of descriptive references (including many American and international) dating back to the works of Sir John Sinclair and Walter Thom. It included a specific section on the training of athletes that helped me navigate the literature necessary for this project.[44]

Following Park's illuminating analysis (discussed earlier) on the training of athletes between 1800-1912, Gerald Redmond's *The Caledonian Games* (1971), Benjamin G. Rader's "The Quest for Subcommunities and the Rise of American Sport," and Samuel Crowther and Arthur Ruhl's *Rowing and Track Athletics* (1905) helped trace the origins of track and field in America during the nineteenth century.[45]

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[43] Sinclair, *The Code of Health and Longevity*; Thom, *Pedestrianism*.

[44] Tom McNab, Peter Lovesy, and Andrew Huxtable, *An Athletics Compendium: An Annotated Guide to the United Kingdom Literature of Track and Field* (Boston Spa: The British Library, 2001).

[45] Gerald Redmond, *The Caledonian Games in Nineteenth-Century America* (Rutherford: Associated University Press, 1971). Redmond traces the history of the Caledonian Games that impact on the evolution of track and field in America. The different events competed at the games included: throwing the hammer, putting the stone, the standing high jump, the running long jump, the running high jump, hop, step and jump, vaulting with a pole, tossing the caber, walking match (eight times round one mile) and the short race. Benjamin G. Rader, "The Quest for Subcommunities and the Rise of American Sport," *American Quarterly* 29, no. 4 (1977): 359-361. Rader notes how the Scottish Caledonian clubs may have been the most significant ethnic community in encouraging the growth of nineteenth-century American sport and the single most important promoters of track and field in the country. For the Caledonians and the Turners (who originated in Germany) sport helped coalesce and preserve traditional cultural patterns as the two groups made the transition into American society. Samuel Crowther and Arthur Ruhl, *Rowing and Track Athletics* (New York: The Macmillan Company, 1905). Arthur Ruhl was responsible for track athletics and devoted a whole chapter to "The History of Track in America," along with "The Organization of Athletic Clubs," "Track Athletics in Colleges," and technical chapters on sprinting, the distance events and throwing events.

In the twentieth century as coaching became codified as part of the preparation of track and field, a rich didactic literature simultaneously emerged in which eminent coaches shared their theories and practices with the layman. Examples include Samuel Mussabini's *The Complete Athletic Trainer* (1913), Michael C. Murphy's *Introduction to Athletic Training* (1918), Clyde Littlefield's *Track and Field Athletic* (1933), Dean B. Cromwell's *Championship Techniques in Track and Field* (1941), Franz Stampfl's *On Running* (1955), Percy Cerutty's *Athletics: How to Become a Champion* (1960), Arthur Lydiard and Garth Gilmour's *Run to the Top* (1967), Payton Jordan's and Bud Spencer's *Champions in the Making: Quality Training for Track and Field* (1968), and William Bowerman's *Coaching Track and Field* (1974).[46] Within this group, the contributions of Kenneth Doherty were particularly valuable. Between 1953 and 1976 Doherty wrote his two classic texts. *Modern Track and Field: Promotion, History and Methods* appeared first and then Doherty published the *Track and Field Omnibook* that provides a blueprint for track and field training that in many ways represents the best knowledge of the period in the English language.[47]

The next group of primary sources examined for this project were biographical studies published in books and popular magazines in which athletes recounted their

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[46] Michael C. Murphy, *Introduction to Athletic Training* (New York: Charles Scribner's Sons, 1918); Clyde Littlefield, *Track and Field Athletics* (Austin: Von Boeckmann-Jones, 1933); Cromwell, *Championship Techniques in Track and Field*. Franz Stampfl, *Franz Stampfl on Running* (London: Herbert Jenkins, 1955); Percy Cerutty, *Athletics: How to Become a Champion* (London: Stanly Paul, 1960); Arthur Lydiard and Garth Gilmour, *Run to the Top* (Auckland: Minerva Limited, 1967); Payton Jordan and Bud Spencer, *Champions in the Making: Quality Training for Track and Field* (Englewood Cliffs: Prentice-Hall, 1968); James E. Counsilman, *Science of Swimming* (Englewood, NJ.: Prentice Hall, 1968); William J. Bowerman, *Coaching Track and Field* (Boston: Houghton Mifflin Company, 1974).

[47] Kenneth J. Doherty, *Modern Track and Field: Promotion, History and Methods* (New York: Prentice Hall, 1953); Kenneth J. Doherty, *Modern Track and Field*, 2nd ed. (Englewood Cliffs, NJ: Prentice-Hall Inc., 1963); Kenneth Doherty, *Track and Field Omnibook*, 2nd ed. (Los Altos, Calif.: Tafnews, 1976).

training methods and discussed their accomplishments. Examples include Glenn Cunningham's *Never Quit* (1981), Jesse Owens's *Jesse Owens: A Spiritual Biography* (1978), Roger Bannister's *The First Four Minutes* (1955), Peter Snell's and Garth Gilmour's *No Bugles, No Drums* (1965), and Jim Ryun's and Mike Philips's *In Quest of Gold* (1984).[48]

Although actually secondary sources, the biographical literature used in Chapter Four deserve specific attention. *The Perfect Mile* (2004) by Neil Bascomb relies considerably on personal interviews and details the training and lives of Roger Bannister, Wes Santee and John Landy. It takes its place alongside George Smith's *All Out for the Mile*: *A History of the Mile Race 1954-1955* (1955) as the preeminent texts on the story of the first ever sub-four minute mile.[49] Arnd Krüger, as mentioned earlier, also provides a rigorous and enlightening appraisal of "Training Theory and Why Roger Bannister was the First Four-Minute Miler."[50] Krüger isolates "twelve good reasons" that were critical to Bannister's success. These three appraisals are essential reading—along with Roger Bannister's *The First Four Minutes* (1955)—in understanding why Bannister triumphed, where everyone else faltered.

By the middle of the twentieth century, track and field training had gained sufficiently in importance to support several publications aimed at coaches and

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[48] Glenn Cunningham, *Never Quit* (Lincoln, Va.: Chosen Books, 1981); Jesse Owens, *Jesse Owens: A Spiritual Biography* (Plainfield: Logos International, 1978); Roger Bannister, *The First Four Minutes* (London: Putnam, 1955); Peter Snell and Garth Gilmour, *No Bugles No Drums* (Sydney: Hodder and Stoughton Ltd., 1965); Jim Ryun and Mike Philips, *In Quest of Gold* (San Francisco: Harper & Row, 1984).

[49] Neil Bascomb, *The Perfect Mile* (New York: Houghton Mifflin, 2004); George William Smith, *All out for the Mile: A History of the Mile Race 1954-1955* (London: Forbes Robertson, 1955).

[50] Krüger, "Training Theory and Why Roger Bannister Was the First Four-Minute Miler."

practitioners. *Track and Field News* began in 1948 and *Track Technique* magazine opened shop in 1960 in an attempt to educate coaches and familiarize Americans with European methods.[51] These (and other) journals contained many useful articles for this project, but special mention should be made of the *How They Train* series, edited by Fred Wilt, the inaugural editor of *Track Technique.*[52] Wilt's series contained information on the workout programs of athletes ranging from Joe Binks, who established the world record in the mile in 1902, to many of the most successful track athletes of the twentieth century such as Paavo Nurmi, Gunder Hägg, Rudolph Harbig, Emil Zátopek, John Landy and Bobby Morrow. In addition, *The Journal of Health and Physical Education, Research Quarterly*, *Scholastic Coach* and *The Athletic Journal* regularly contained articles on training and track technique by mid century.

While the execution of correct athletic technique is not the focus of this dissertation, it is nonetheless considered essential to maximize performance. Articles that address the more technical aspects of training include Tom McNab's "Roots of Athletic Technique" that explores the fundamental aspects of teaching athletics.[53] Other articles that demonstrate the importance of technique include Franklin Henry's "Force-Time Characteristics of the Sprint Start," John Tansley's "Arm Action in Running," and Al

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[51] In the fall of 1960, due to a void in technical coaching information in the United States, *Track & Field News,* the so-called "bible of the sport" launched a new coaching quarterly titled *Track Technique—The Journal of Technical Track & Field Athletics*. Nineteen sixty-five witnessed the first edition of another track and field journal, *Track and Field Quarterly Review* produced by the United States Track Coaches Association which was "dedicated to the promotion of the world's oldest sport."

[52] Fred Wilt, *How They Train: Half Mile to Six Mile* (Los Altos, Calif.: Track and Field News, 1959); Fred Wilt, ed., *How They Train: Sprinting and Hurdling*, 2nd ed., vol. III (Los Altos, Calif.: Track and Field News, 1973).

[53] Tom McNab, "The Roots of Athletic Technique," *Coach*, no. 30 (September-October 2005): 50-55.

Wright's "Three Points in Sprint Starting" all of which contain information that could be incorporated into an athlete's training to help them run faster.[54]

A second category of literature examined for this dissertation explored the history of science as it applies to sport and, specifically, to track and field. John D. Massengale and Richard A. Swanson's extensive appraisal of *The History of Exercise and Sport Science* provides a framework to examine the application of science to sport and includes sections on sport pedagogy, sport sociology, sport history, philosophy of sport, motor behavior, exercise psychology, biomechanics and exercise physiology.[55]

The emergence of modern day scientific training can be traced to the middle of the nineteenth century when physiologists such as William H. Byford and Claude Bernaud published seminal works on the physiology of exercise and homeostasis.[56] Charles Westhall, Archibald Maclaren, James Irvine Lupton and James Money Kyrle Lupton's teachings provide examples of emerging scientific training that dismissed the traditional methods of purging, physicking, forced "sweating" and restriction of fluids espoused by Sir John Sinclair and Walter Thom.[57] At the end of the nineteenth century athletes were discouraged from overexertion and overtraining for fear of a condition dubbed the "athlete's heart." A discussion of this phenomenon, utilizing the medical

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[54] Franklin M. Henry, "Force-Time Characteristics of the Sprint Start," *Research Quarterly* 23, no. 3 (October 1952): 301-317; John Tansley, "Arm Action in Running," *Scholastic Coach* 40, no. 6 (February 1971): 54-56; Al Wright, "Three Points in Sprint Starting," *Scholastic Coach* 44, no. 6 (February 1975): 48.

[55] John D. Massengale and Richard A. Swanson, eds., *The History of Exercise and Sport Science* (Champaign, Ill.: Human Kinetics, 1997).

[56] W.H. Byford, "On the Physiology of Exercise," *American Journal of Medical Science* 30 (1855): 32-42; Claude Bernard, *An Introduction to the Study of Experimental Medicine* (New York: Macmillan Company, 1927).

[57] Westhall, *The Modern Method of Training for Running, Walking, Rowing, and Boxing*; Archibald Maclaren, *Training in Theory and Practice* (London: Macmillan and Co., 1866); James Irvine Lupton and James Money Kyrle Lupton, *The Pedestrian's Record* (London: W.H. Allen & Co., 1890).

journals of the time (*Boston Medical and Surgical Journal, American Journal of the American Medical Association, Philadelphia Medical Journal* and *Medical Record)* is included.

Arthur H. Steinhaus's extensive review of the "Chronic Effects of Exercise," and Archibald Vivian Hill's pioneering work on muscular activity in the years between the two World Wars, demonstrate the early, albeit limited, application of science to sport.[58] Thomas Cureton's analysis of the *Physical Fitness of Champion Athletes* (1951), from swimming and diving, track and field, and gymnastics provides a rare example of comprehensive research on elite athletes during this period.[59] Hans Selye's seminal work, *The Stress of Life* (1956), outlined the nature of the adaptive process and is critical to the understanding of training and improvements in performance.[60] Forbes Carlile's application of Selye's theory to sport in the series of *Track Technique* articles entitled "The Athlete and Adaptation to Stress" proved particularly useful and demonstrated how a significant bridge could be made between "hard" science and sport.[61]

Exercise physiology in the "Formative Years" (1963-1976) forged itself as a separate academic discipline as articles in the *Journal of Applied Physiology* (established in 1948) focused on the responses of humans (and animals) exposed to a variety of

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[58] Arthur H. Steinhaus, "The Chronic Effects of Exercise," *Physiological Review* 13, no. 1 (1933): 103-147; Archibald V. Hill, "The Present Tendencies and Methods of Physiological Teaching and Research," *Science* 61 (1925): 294-305.

[59] Thomas Kirk Cureton, *Fitness of Champion Athletes* (Urbana, Ill.: The University of Illinois Press, 1951).

[60] Hans Selye, *The Stress of Life* (New York: McGraw-Hill, 1956).

[61] Forbes Carlile, "Scientific Trends in Training the Sportsman," *Track Technique*, no. 3 (March 1961): 84-88; Forbes Carlile, "The Athlete and Adaptation to Stress," *Track Technique*, no. 5 (September 1961): 185-186; Forbes Carlile, "The Athlete and Adaptation to Stress," *Track Technique*, no. 7 (March 1962): 218-219.

stressors and environmental conditions—including exercise. In the early 1970s a number of key texts were published (Vaughan Thomas's *Science and Sport* (1971), Per-Olof Åstrand and Karre Rodahl's *Textbook of Work Physiology* (1970), and Donald K. Mathews's and Edward L. Fox's *The Physiological Basis of Physical Education and Athletics* (1971) that sought to bridge the gap between science, exercise and sport. Journals such as *Research Quarterly* and *Scholastic Coach* provided selective applied scientific articles relating to track while sport specific journals (*Track Technique* and *Track and Field Quarterly Review*, *Modern Athlete and Coach,* and *New Studies in Athletics*) contain an abundance of articles that acknowledged and explored various branches of science as they apply to sport. Finally, the significant contribution of biomechanics was considered. Geoffrey Dyson's classic, *The Mechanics of Athletics* that applies biomechanical principles to track and field was particularly useful.[62]

The third and final category of literature is reserved for track and training information that emanated from or pertained to the former Soviet Union. James Riordan, an authority on Soviet sport, provides extensive coverage of the history of the rise and fall of the Soviet Union's participation in the Olympics.[63] The key Western journal that provided critical insight into the Soviet sports machine and the application of scientific

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[62] Geoffrey H. Dyson, *The Mechanics of Athletics* (London: London Press Ltd, 1962).

[63] James Riordan, "Sport in Soviet Society: Some Aspects of the Development of Sport in the U.S.S.R.," *Journal of the History of Sport and Physical Education* 2, no. 1 (1976): 90-120; James Riordan, "Physical Culture in the Soviet Union," *Physical Education Review* 1, no. 1 (1978): 4-12; James Riordan, *Soviet Sport Background to the Olympics* (New York: Washington Mews Books, 1980); James Riordan, "The Role of Sport in Soviet Foreign Policy," *International Journal* 43, no. 4 (1988): 569-595; James Riordan, "The U.S.S.R. And Olympic Boycotts," *International Journal of the History of Sport* 5, no. 3 (December 1988): 349-359; James Riordan, "Soviet Sport and Perestroika," *Journal of Comparative Physical Education and Sport* 11, no. 2 (1989): 6-18; Jim Riordan, "The Rise and Fall of Soviet Olympic Champions," *The International Journal of Olympic Studies* II (1993): 25-44; James Riordan, "Rewriting Soviet Sports History," *Journal of Sports History* 20, no. 3 (1993): 247-258.

training was the *Yessis Soviet Sports Review* which began publication in December 1966. It contained translated articles from some of the Soviet Unions' leading physical culture journals including, *Theory and Practice of Physical Culture, Sports Life in Russia, Pre-School Education, Physical Culture in the Schools, Track and Field* and *Physical Culture and Sport.* However, the most important work in the field of advanced training theory is the pioneering, *Fundamentals of Sports Training* written in 1965 by Professor Lev Pavlovich Matveyev of the of the renowned Central State Institute of Physical Culture in Moscow.[64] Matveyev introduced the theory of periodization—an understanding of which is foundational to the advanced training of athletes. Meanwhile in the West, although Arnd Krüger had introduced the basic concept of periodization in *Track Technique* in 1973, it was not until 1975 that Frank Dick provided the first detailed English-language monograph on periodization in his groundbreaking article, "Periodization: An Approach to the Training Year."[65] Dick proceeded to outline the more detailed aspects of periodization including, units, microcycles, macrocycles, variations, and adaptation and loading in a series of articles in *Track Technique* during 1976 and 1977.[66] Jimmy

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[64] Lev Pavlovich Matveyev, *Periodization of Sports Training* (Moscow: Fiskultura i Sport, 1965). Matveyev's pioneering text is divided into three main parts. Part One outlines the characteristics of sport and training along with theoretical and methodological problems associated with sport. Part Two covers the training process and the preparation of an athlete for competition including how to instill the various motor abilities (strength, speed, flexibility, coordination). Finally Part Three details the structure of sports training from small training cycles (microcycles) to annual training cycles (macrocycles) and examines sport as a multi-year training process.

[65] Arnd Krüger, "Periodization or Peaking at the Right Time," *Track Technique* 54 (1973): 1720-1724; Frank Dick, "Periodization: An Approach to the Training Year," *Track Technique*, no. 62 (1975): 1968-1969.

[66] Frank Dick, "Variations in Periodization," *Track Technique*, no. 63 (March 1976): 2005-2006; Frank Dick, "Units and Microcycles," *Track Technique*, no. 64 (June 1976): 2030-2031; Frank Dick, "Macrocycles," *Track Technique*, no. 65 (September 1976): 2068-2069; Frank Dick, "Training Theory: Adaptation and Loading," *Track Technique*, no. 68 (June 1977): 2163-2164.

Pedemonte in 1986, offered an historical outline of the evolution of periodization by citing an overwhelming majority of Soviet references. However, the author strangely fails to mention Lev Pavlovich Matveyev, the so-called "Father" of periodization despite being featured three times in the list of references.[67]

While the following texts were written after 1975 and are beyond the time limitations of this dissertation, they serve to illustrate the marked influence Matveyev had on the production of advanced training theory. Texts that are heavily influenced and intimately connected to Matveyev's work include Frank Dick's British Athletics Federation publication *Training Theory* (1978), Dietrich Harre's *Principles of Sports Training* (1982), and Tudor Bompa's *Theory and Methodology of Training* (1983) and *Periodization: Theory and Methodology of Training* (1999).[68] Bompa is considered the foremost authority on periodization in the West, but as the chronology of literature clearly demonstrates, his was neither the first nor most original account of periodization.[69]

In the increasingly electronic age, the author found himself ever more reliant upon electronic sources and emails that provided key information and personal reflections from track and field coaches and related personnel. The author was in regular contact and

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[67] Jimmy Pedemonte, "Foundations of Training Periodization. Part I: Historical Outline," *National Strength and Conditioning Association* 8, no. 3 (1986): 62-65.

[68] Frank Dick, *Training Theory* (London: British Athletic Federation, 1978); Tudor Bompa, *Theory and Methodology of Training: The Key to Athletic Performance* (Dubuque, Iowa: Kendall/Hunt Publishing Co., 1983); Tudor O. Bompa, *Periodization: Theory and Methodology of Training*, 4th ed. (Champaign, Ill.: Human Kinetics, 1999).

[69] As of March 2008 Bompa, Professor Emeritus of York University, Toronto, Ontario, Canada had published fourteen books that had been translated into eighteen different languages and used in over 180 countries around the world as textbooks for universities, coaching / certifications institutions, and by individual coaches / instructors for training athletes in various sports. For further information see: "Tudor Bompa," Tudor Bompa Institute, http://www.tudorbompa.com/ (accessed February 11, 2008).

received feedback from Vern Gambetta (former editor of *Track Technique*); James Dunaway, track and field authority and frequent contributor to *Track and Field News*, and internationally acclaimed track and field coach, Dan Pfaff.[70] Key websites that contained important biographical information on athletes and coaches included USA Track and Field (http://www.usatf.org) and (http://www.olympic.org), the official website of the International Olympic Committee. Further biographical information was garnered through access to individual coaches' and athletes' websites such as Arthur Lydiard's (www.lydiardfoundation.org), Jesse Owens's (www.jesseowens.com), Jim Ryun's (www.ryunrunning.com), and Peter Snell's (www.petersnellinstitute.org).

Finally, this dissertation was supplemented by crucial oral history interviews. The author was fortunate to meet a fellow student, Shanna Dorian at the University of Texas at Austin prior to her trip to Moscow in the fall of 2001 as part of her Eastern European studies degree. There she interviewed Lev Pavlovich Matveyev—the "Father" of periodization at the Russian State Academy of Physical Culture in Moscow. The author himself interviewed Tudor Bompa, the foremost Western authority on periodization; Michael Stone, head of sports physiology for the United States Olympic Committee; Tom Tellez, coach to Carl Lewis—who with nine Olympic gold medals in his career was voted "Sportsman of the Twentieth Century" by the International Olympic Committee; and Leroy Burrell, Head Track and Field Coach at the University of Houston and former world record holder in the 100 meters. Finally, the author relied heavily on material

[70] James Dunaway was once called "The Track Nut of the World," by *Sports Illustrated* and has covered every Olympics since Melbourne (1956). He is also the author of James O. Dunaway, *Sports Illustrated Track and Field: Running Events* (Philadelphia: Lippincott, 1972).

accumulated while employed as a volunteer and professional track and field coach under the mentorship of Coach Dan Pfaff (coach to Donovan Bailey—mentioned earlier) including detailed workout and training plans.[71]

ORGANIZATIONAL OVERVIEW

This dissertation takes a chronological approach to the story of training in track and field and begins with the preparation of Greek athletes for the ancient Olympic Games.[72] Chapter One describes the role of athletics in Ancient Greek and Roman society and its deep connection to medicine as seen by the writings of three ancient physicians—Herodicus (ca. 480-? B.C.), Hippocrates (460-370 B.C.) and Galen (A.D. 129-210)—who extolled the benefits of "gymnastic medicine" to promote health.[73] During the thousand year history of the ancient Games, training became increasingly sophisticated and by the fifth century B.C., specialized athletic trainers (*gymnastes*), synonymous to today's coaches, had evolved to prepare athletes for competition. As will be shown, the ancients understood the need to manipulate the volume and intensity in training and developed a surprisingly modern approach involving a four-day tetrad system with days of varying training intensity.

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[71] Dan Pfaff was the Assistant Track and Field Coach at the University of Texas from 1995 to 2003. As of 2008 he is the head coach and COO of Tiger Bar Sports. Coach Pfaff continues to inspire and help athletes fulfill their potential as witnessed by nine athletes of his athletes who have qualified for the 2008 Beijing Olympic Games**.**

[72] Bompa, *Periodization: Theory and Methodology of Training*, 4. Guttmann, *From Ritual to Record: The Nature of Modern Sports*, 43.

[73] Berryman, "Exercise and the Medical Tradition."

Chapter Two begins with Hieronymus Mercurialis in the Renaissance and ends with World War I. It examines the impact of the early nineteenth century classic by Sir John Sinclair—The *Code of Health and Longevity*—and then explores Walter Thom's *Pedestrianism,* which included the advice of the famous Captain Barclay Allardice, the sixth Laird of Ury who walked 1,000 miles in 1,000 hours for a prize of 1,000 guineas.[74] The chapter also traces the birth of organized track and field with its roots in the German Turnvereins (athletic clubs) and the Scottish Caledonian Games of the 1840s and 1850s—the same time frame during which pedestrianism (the sport of professional walking and running) reached the height of its popularity. In addition, the chapter details the first scientific involvement with training—an involvement that primarily focused on the negative aspects of running and its ability to create a condition known as the "athlete's heart."

Chapter Three explores athletic training between the World War years (1917-1945). This time period coincided with an era commonly regarded by historians as the "Golden Age" of sport and the rise of the American sports hero. Track and field grew in popularity as the USA dominated nearly every Olympic Games—the politically charged "Nazi" Olympics of 1936 being the only exception.[75] Legendary coaches—Walter Camp, Clyde Littlefield, Brutus Hamilton, and Dean Cromwell published their ideas on training and the ingredients necessary to be successful during this era and a number of outstanding athletes—Paavo Nurmi, Glenn Cunningham, Jesse Owens, Gunder Hägg and

[74] Sinclair, *The Code of Health and Longevity*; Thom, *Pedestrianism*.
[75] Wallechinsky, *The Complete Book of the Olympics*, xiv-xv.

Rudolph Harbig became famous for their on-track performances and their new training methods.[76] The innovative new training methods—*fartlek* and interval training—dominated the discourse on training in this era.[77]

Chapter Four chronicles what has been described by many as not just one of the greatest moments in track and field history but one of the greatest moments in all of sport during the twentieth century—the quest to become the first sub-four minute miler.[78] Despite numerous attempts, nobody in nearly a decade had managed to lower Gunder Hägg's world record time of 4:01.4 set in Malmö, Sweden on 17 July 1945.[79] Three men—John Landy of Australia, Wes Santee of the United States, and Roger Bannister of Great Britain—were locked in an inter-continental battle to reach the Mount Everest of track and field. The training methods of Bannister, Santee, and Landy along with the three coaches that influenced them (Franz Stampfl, Bill Easton, and Percy Cerutty) form the central discussion of this chapter.

Chapter Five examines the training theories and methods of some of the most successful track coaches and athletes between 1945 and 1975. In 1947, just after WWII track coaches such as George Bresnahan continued to adopt a conservative approach to

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[76] Walter Camp, *Training for Sports* (New York: Charles Scribner's Sons, 1921); Littlefield, *Track and Field Athletics*; Cromwell, *Championship Techniques in Track and Field*.

[77] Raoul Mollet, "Interval Training," in *How They Train: Half Mile to Six Mile*, ed. Fred Wilt (Los Altos, Calif.: Track and Field News, 1959), 97-101; Woldemar Gerschler, "Interval Training," *Track Technique* 13 (September 1963): 391-396. *Fartlek* which in English means "speed-play," refers to the innovative system of endurance training that alternates strenuous and easy running over varied terrain that was developed by Gosta Holmer, the Swedish national coach in the 1930s.

[78] David M. Ewalt and Lacey Rose, "Bannister's Four-Minute Mile Named Greatest Athletic Achievement," Forbes.com, http://www.forbes.com/2005/11/18/bannister-four-minute-mile_cx_de_lr_1118bannister.html (accessed November 18, 2005). David Wallechinsky describes 6 May 1954, the day Roger Bannister ran the first ever sub-four minute mile, as "probably the greatest day in track and field history." For further information see: Wallechinsky, *The Complete Book of the Olympics*, 44.

[79] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 145-148.

training with short preliminary preparation periods of two to three weeks prior to competition.[80] Doherty in 1953 led the way toward a more detailed approach to training with the first of two classic texts that outlined the technical details of each track and field event.[81] Following the contributions of Franz Stampfl and Percy Cerutty (featured in Chapter Four) Arthur Lydiard in the late 1950s and 1960s introduced the concept of preliminary marathon training—100 miles per week for all distance runners from 800 to 10,000 meters.[82] Lydiard's recommendations along with the training of Emil Zatopek (winner of the 5,000 and 10,000 meters and the marathon at the 1952 Olympic Games), Peter Snell (winner of the 800 and 1,500 meters at the 1964 Tokyo Olympic Games), and Jim Ryun (former world record holder in the mile) epitomized a transition from moderate to heavy training loads that occurred during this era. Other coaches such as Payton Jordan of Stanford University offered balance to the heavy volume training approach by emphasizing quality over quantity and William Bowerman, famed University of Oregon coach, introduced the "hard-easy" approach where each day of hard training was followed by a day of light or "easy" training such as jogging or easy *fartlek*.[83] Finally, University of Indiana swim coach James "Doc" Counsilman, although not a track coach, was heavily influenced by the innovations in track and field training that evolved in the

[80] George T. Bresnahan and Waid W. Tuttle, *Track and Field Athletics*, 2nd ed. (St Louis: C.V. Mosby Company, 1947).
[81] Doherty, *Modern Track and Field: Promotion, History and Methods*. Doherty, *Track and Field Omnibook*.
[82] Cerutty, *Athletics: How to Become a Champion*. Lydiard and Gilmour, *Run to the Top*.
[83] Jordan and Spencer, *Champions in the Making: Quality Training for Track and Field*. Bowerman, *Coaching Track and Field*.

1950s and his detailed, scientific approach to swimming—which he reported in published articles—became a model employed by many who trained track and field athletes.[84]

Chapter Five continues with the accomplishments and training methods of the athletes. Emil Zatopek—the "Czech Locomotive,"—transcended the light-to-moderate training levels of the previous era (1917-1945) by winning all three long distance events—5,000 meters, 10,000 meters, and the marathon—at the 1952 Olympics.[85] The training of Peter Snell of New Zealand, and Jim Ryun of the United States are also included here. In 1964 Ryun became the first American high school athlete to run a sub-four-minute mile which he duly followed in 1966 with a world record performance, smashing the previous mile best by 2.3 seconds with a time of 3:51.3.[86] The chapter finishes with the training and accomplishments of sprinter Bobby Morrow of Abilene Christian University who at the 1956 Melbourne Olympic Games won both the 100 and 200 meters.

Chapter Six details the propagation of coaching science between 1945 and 1975. Exercise physiology was in its "embryonic years" during this era and most athletes paid little attention to the studies performed by physiologists which, for the most part continued to focus on the basic tenets of physiology (blood pressure, circulation, heart rate response) as they applied to exercise and physical fitness.[87] However, the publication of Hans Selye's *The Stress of Life* in 1956 had major implications for athletes as they

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[84] Counsilman, *Science of Swimming*.
[85] "Emil Zátopek the Hero of Helsinki," International Olympic Committee, http://www.olympic.org/uk/athletes/profiles/bio_uk.asp?PAR_I_ID=4731 (accessed February 23, 2007).
[86] Lawson, *World Record Breakers in Track and Field Athletics*, 94.
[87] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 399.

began to understand the process of adaptation and how it was influenced by different stressors of training.[88] In the "formative years" (1963-1976) exercise physiology forged itself as a separate academic discipline and a number of key texts were published aimed at bridging the gap between science and sport.[89]

The late 1950s witnessed an explosion in the application of weight training to sport. The effective use of weight training to increase speed, reduce injury and improve flexibility finally "put to bed" the long held belief that weightlifting would make someone "musclebound."[90] By the 1970s weight training had revolutionized track and field training methods.[91] Periodicals such as *Research Quarterly* and *Scholastic Coach* published sporadic track related articles but it was not until the publication of *Track Technique* in 1960 and *Track and Field Quarterly Review* in 1965 that coaches had their own journals, specifically devoted to track and field. By the late 1960s translations of Soviet and Eastern European literature began to filter through regarding the more detailed aspects of the foundations and planning of training.[92] The chapter concludes with the

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[88] Selye, *The Stress of Life*.

[89] Thomas Vaughan, *Science and Sport: How to Measure and Improve Athletic Performance* (Boston: Sports Illustrated Books, 1970); Per-Olof Åstrand and Karre Rodahl, *Textbook of Work Physiology* (New York: McGraw-Hill Book Company, 1970); Donald K. Mathews and Edward L. Fox, *The Physiological Basis of Physical Education and Athletics* (Philadelphia: W.B. Saunders Company, 1971).

[90] Jan Todd and Terry Todd, "Peter V. Karpovich," *Journal of Strength and Conditioning Research* 17, no. 2 (2003): 213-220; Terry Todd, "The Myth of the Muscle-Bound Lifter," *Iron Game History* 7, no. 3 (1985): 37-41.

[91] Gene Hooks, *Weight Training in Athletics and Physical Education* (New Jersey: Prentice Hall Inc., 1974).

[92] Carlile, "The Athlete and Adaptation to Stress," 218-219; Nikolay Ozolin, "Specific Conditioning," *Track Technique*, no. 27 (March 1967); V. Popov, "Foundations of Training Planning," *Track Technique*, no. 38 (December 1969).

application of biomechanics to sport and the contributory work of Geoffrey Dyson, author of *The Mechanics of Athletics*.[93]

Chapter Seven explores the rise of what some sports historians refer to as the "Big Red Machine."[94] Critical to the ascendancy and success of the Soviet Union on the world sporting stage was the application of sport science and the advent of periodization—both of which are the central themes of this chapter. After WWII, the Soviet Union became the sole military and political force capable of matching the United States, and sport became an arena in the battle for ideological supremacy. The Soviet Union's debut at the 1952 Helsinki Olympics was dramatic, and over the next thirty-eight years the Soviet Union with few exceptions, dominated the winter and summer Olympic Games. Although a multitude of factors were responsible for Soviet success, one of the most important was the use of periodization. Periodization refers to the "systematic, sequential and progressive approach to the planning and organization of training of all biomotor abilities (strength, speed, suppleness, stamina and skill) into a cyclic structure in order to obtain optimal development of an athlete's or a team's performance."[95] This detailed method of planning an athlete's training was first outlined by Professor Lev Pavlovich Matveyev at the Central State Institute of Physical Culture in Moscow. In the late 1950s and early 1960s Matveyev analyzed the training and performances of several thousand elite athletes and devised a general theory of sport and training that facilitated continual progress in

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[93] Dyson, *The Mechanics of Athletics*.

[94] Yuri Brokhin, *The Big Red Machine* (New York: Random House, 1978); "Inside the Big Red Machine," Time Inc, http://www.time.com/time/magazine/article/0,9171,922050-1,00.html (accessed December 22, 2007 June 23 1980).

[95] Vern Gambetta, "Concept and Application of Periodization," *National Strength & Conditioning Association Journal* 13, no. 5 (1991): 64-66.

performance and peaking at the right time. Matveyev's groundbreaking theory was contained in his book the *Fundamentals of Training* (1965) that detailed the entire structure of training from an individual training unit (session) and weekly training cycles (microcycles) to a four-year Olympic plan.[96]

Aspects of Matveyev's ideas were introduced to American coaches through the *Yessis Soviet Sports Review,* a publication started in 1966 which translated articles from leading Soviet physical culture journals such as *Sports Life in Russia, Track and Field*, and *Physical Culture and Sport*. The *Yessis Review* played an important role in the migration of Eastern-Bloc ideas to the United States and at various times included articles on the application of science to sport covering topics such as: the manipulation of training load, training theory, methods of recovery, enhancement of different biomotor abilities, youth and gender. Although Arnd Krüger introduced the basic concept of periodiation in 1973 in *Track Technique*, it was not until 1975 that Frank Dick, the Scottish National Athletics Coach, published the first detailed English-language overview of Matveyev's theory of periodization.[97] Chapter Seven also explores the more sinister aspects of Soviet training including the state-sponsored systematic doping of athletes. Finally Valeri Borzov, the "Ukraine Express," who won both the 100 and 200 meters at the 1972 Munich Olympic Games, provides an example of a Soviet athlete who applied advanced training theory and science to sport.

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[96] Matveyev, *Fundamentals of Sports Training*.
[97] Krüger, "Periodization or Peaking at the Right Time." Dick, "Periodization: An Approach to the Training Year."

This dissertation concludes in 1975, the watershed year in which the first English-language overview of periodization was presented to the track and field community. Dick was able to convey in relatively simple language, the theory of periodization and begin the all-important process of coaches incorporating this revolutionary new method of planning into the training of their athletes. The introduction of periodization had major reverberations for the training of athletes throughout the world, so much so, that by the turn of the twenty-first century, periodization formed the foundation "of most modern coaching theory and practice" and, as Tudor Bompa the foremost Western authority on periodization asserts, is "the basis of every serious athlete's training.[98]

[98] David G. Rowbottom, "Periodization of Training," in *Exercise and Sport Science*, ed. William E. Garrett and Donald T. Kirkendall (Philadelphia: Lippincott, Williams and Wilkins, 2000); Bompa, *Periodization: Theory and Methodology of Training*, 499-512.

CHAPTER ONE

ATHLETIC TRAINING IN ANCIENT GREECE AND ROME AND THE BIRTH OF PERIODIZATION

The earliest written histories of athletics were recorded during the period of the ancient Olympic Games (776 B.C.-A.D. 393).[1] So it is here, in ancient Greece that we begin the quest for the origins of training for sport and, in particular, for the origins of the training concept known as periodization. However, to understand the relative sophistication and the level of athletic training in these early cultures, we must begin by exploring what roles exercise and athletics played in Hellenic civilization.

From just after the inception of the ancient Olympic Games in 776 B.C. to the ultimate conquest of Greece by the Romans in 146 B.C. (a period of 630 years), the history of Greece is characterized by repeated wars—wars of faction, wars of state against state, and wars against foreign invaders.[2] During this early period, many Greek citizens believed that they should maintain a high level of fitness as a person's life and liberty frequently depended on his strength, endurance and physical prowess.[3] Indeed, Nigel Spivey, author of *The Ancient Olympics* and Professor of Classics at The University of Cambridge (Emmanuel College), notes how military service was a prime

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[1] Moses I. Finley and Henri W. Pleket, *The Olympic Games: The First Thousand Years* (London: Chatto and Windus, 1976).

[2] David C. Young, *A Brief History of the Olympic Games* (Malden MA: Blackwell Publishing, 2004), 57-60. During these centuries Greece suffered through the First Messenian War; the Battle of Marathon; the Persian Wars; the Peloponnesian Wars and the Macedonian Wars.

[3] Gardiner, *Greek Athletic Sports and Festivals*, 1.

requirement of full Greek citizenship and was included in the right to vote.[4] In the fourth century, for example, Aristotle reported that at the "coming of age"—termed *ephebia*—young men were required to occupy barracks for the space of one-year, where they were drilled for physical fitness and the skilled use of weapons. At the end of the year the men publicly displayed their talents and were awarded a spear and a shield at state expense before submitting to a two-year period of active duty patrolling the city's territory.[5]

Most sport historians agree that the rise of sport coincided with the need to have a fit and ready military force to defend the various city states. To the ancient Greeks, a male citizen was a potential soldier and athletic exercise and combat-related sports could be used to create military preparedness. Norman Gardiner (1864-1930), considered by classicist Thomas Scanlon, to be "the most distinguished and lucid writer on ancient athletics," describes the links between sport and military training in great detail in his seminal book on ancient sports entitled *Greek Athletic Sports and Festivals.*[6] Gardiner notes how the functional exercises performed in various athletic events translated to the battlefield. "Running and jumping made him active and sound of wind; throwing the diskos and the spear trained hand and eye for the use of weapons; wrestling and boxing taught him to defend himself in hand-to-hand warfare."[7]

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[4] Nigel Spivey, *The Ancient Olympics* (Oxford: Oxford University Press, 2004), 20. The account of military service being a prime requirement of full Greek citizenship at the coming of age (*ephebia*) is attributed to a fourth century text written by Aristotle.

[5] Ibid., 19-20.

[6] Thomas Scanlon, *Greek and Roman Athletics:A Biography* (Chicago: Ares Publishers, 1984), 17; Gardiner, *Greek Athletic Sports and Festivals*.

[7] Gardiner, *Greek Athletic Sports and Festivals*, 1-2.

Affirmation that athletics' primary role was preparation for war is echoed by Spivey, who sees the practice and participation in Greek athletics as "War Minus Shooting."[8] Moreover, Spivey asserts that the struggle for athletic prowess did not sway from the basic principles laid down by the most influential philosophers of Classical Greece—Socrates, Plato and Aristotle in that; "Ultimately there was only one intent and aim of athletic contests: to feint the stress of battle, to stay sharp and ready for war."[9] Philostratus (170-244 or A.D. 249), a leading sophist during the second and third century A.D. who spent time at the Roman imperial court, also highlights training's military role with reference to men in "older times"—men like Polymester, Glaukos, Alesias and Polydamas from Skotoussa, some of whom competed in eight Olympic Games.[10] He referred to them as excellent soldiers that fought under the city's walls who "regarded war as training for gymnastics and gymnastics as training for war**.**"[11]

Despite the practical realism of athletics helping prepare for war, gymnastic exercises along with exposure to the arts and music were also considered vital for the all-

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[8] Spivey, *The Ancient Olympics*, 1. The depiction of "war minus shooting" is a direct reference to George Orwell the famous novelist. Commenting after the 1945 ill-tempered tour of England by Dynamo Moscow Football Club, Orwell described serious sport as "war minus shooting." For further details see: George Orwell, "The Sporting Spirit," *Tribune* December 1945.

[9] Spivey, *The Ancient Olympics*, 18.

[10] Philostratus, *Philostratus: Concerning Gymnastics by Thomas Woody*. Polydamas from Skotoussa, one of the most celebrated Olympic pankratiasts was a victor in the ninety-third Olympiad in 408 B.C. and had a statue erected in his honor. He achieved legendary status by purportedly killing a lion with his bare hands and stopping a chariot dead in its tracks by seizing hold of it with one hand as it raced past him. For further details see: Ludwig Drees, *Olympia, Gods, Artists and Athletes* (New York: Praeger, 1968), 84, 104. Glaukos of Karystos, who won at Olympia in boxing (520 B.C.) was about to give up in the boxing final when his trainer successfully spurred him on by shouting "one for the plough," reminding him of the day, when still a boy on his father's farm he straightened a bent plough-share with his right fist. For further details see Drees, *Olympia, Gods, Artists and Athletes*, 92.

[11] Robinson, *Sources for the History of Greek Athletics*, 227.

round education of the Greek citizen. Gardiner argues that "One was the compliment of the other…an ill-trained body was as much a sign of an ill-educated man as ignorance of letters, and the training of the body by athletic exercise distinguished the Greek from the barbarian."[12] The mind and body were educated together, and the end was an "individual completeness and harmony of the parts."[13] Moreover, in spite of all the violence displayed in the gymnasium with sports such as boxing, wrestling and pankration (a combination of boxing and wrestling), it was still illegal to carry knives in public. By the fourth century B.C., Athens was a community based on trust—a cornerstone of civilization.[14]

[12] Gardiner, *Greek Athletic Sports and Festivals*, 2.
[13] Fred E. Leonard, *Pioneers of Modern Physical Training*, 2nd ed. (New York: Association Press, 1915), 8.
[14] Spivey, *The Ancient Olympics*, 18.

Figure 1. Reconstruction of Olympia, the site of the ancient Olympic Games.[15]

In conjunction with the military benefits of training, the Olympic Games also served (at least initially) a deeply religious purpose. The Games took place every fourth year from 716 B.C. to A.D. 395 and began as a ceremony to honor Zeus—the supreme god of Greek mythology. The Greeks traditionally believed that athletes received their prowess in part from the Gods and as such any cheating or other irregularities were

[15] Image located at: http://images.google.com/imgres?imgurl=http://www.dkimages.com/discover/previews/826/20212933.JPG&imgrefurl=http://www.dkimages.com/discover/Home/Geography/Europe/Greece/The-Peloponnese/Ancient-Sites/Ancient-Olympia/Reconstruction-Drawing/Reconstruction-Drawing-1.html&h=502&w=768&sz=49&hl=en&start=6&tbnid=o-D_wAlvsLLk7M:&tbnh=93&tbnw=142&prev=/images%3Fq%3DOlympia%2BAncient%26gbv%3D2%26hl%3Den%26sa%3DG (accessed March 12, 2008).

extremely rare and regarded as sacrilegious acts.[16] Exhibition of athletic prowess was looked upon favorably as it brought both honor to the victors and the towns and cities from which they came.[17] However, by the fourth century B.C. athletics increased in popularity with enhanced levels of participation, competition and greater rewards that ultimately lead to cheating and erosion of religious meaning. As victory at the Olympic Games became increasingly important, a sharp increase was seen in sporting specialization by both coaches and athletes. Ultimately, a "science of gymnastics" was born and as Gardiner notes, this science was closely connected with the emerging field of medicine. The word "*gymnastes*" came to mean a specialized trainer or coach who possessed medical knowledge relating to anatomy, extensive athletic experience, and who also understood how the "laws of hereditary" could affect sport performance.[18]

[16] Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*, 3.
[17] Paleologos, "Origin of the Modern Theory of Training," 26.
[18] Gardiner, *Athletics of the Ancient World*, 89; Robinson, *Sources for the History of Greek Athletics*, 212.

Figure 2. An athlete with a paidotribe.[19]

EXERCISE AND THE ROLE OF MEDICINE

Historians agree that the close connection between exercise and medicine dates back to three ancient physicians: Herodicus (ca. 480-? B.C.), Hippocrates (460-370 B.C.) and Galen (A.D. 129-210).[20] Herodicus was the first to study "therapeutic gymnastics" or "gymnastic medicine" as it was often referred to. As a physician and former *paidotribe* (preliminary athletic trainer) he was ideally placed to apply his knowledge of the beneficial effects of exercise to the prevailing theory of medicine. While instructing in

[19] Image available at: http://images.google.com/imgres?imgurl=http://ancientrome.ru/art/artwork/ceramics/gr/c0038a-0.jpg&imgrefurl=http://ancientrome.ru/art/artworken/img.htm%3Fid%3D1340&h=64&w=60&sz=3&hl=en&start=15&tbnid=xaEMPahayDOo9M:&tbnh=64&tbnw=60&prev=/images%3Fq%3Dpaidotribe%26gbv%3D2%26hl%3Den%26sa%3DG. (accessed March 17, 2008).

[20] Berryman, "Exercise and the Medical Tradition."

the so-called "heavy arts" of wrestling and boxing, Herodicus realized that the strength of his athletes could be significantly enhanced by the use of specific exercises. Herodicus united the gymnastic and medical arts and paved the way for the subsequent study of the beneficial effects of physical activity by acknowledging that physicians should "recognize bodily exercise as part of their duties under the designation of 'Conservative Medicine' or 'Hygiene.'"[21]

Figure 3. Hippocrates (National Library of Medicine)

Herodicus in turn is believed to have influenced Hippocrates into extolling the virtues of exercise combined with a balanced diet. Hippocrates is universally known as

[21] John W. F. Blundell, *The Muscles and Their Story, from the Earliest Times; Including the Whole Text of Mercurialis, and the Opinions of Other Writers Ancient and Modern, on Mental and Bodily Development* (London: Chapman & Hall, 1864), 32.

the "Father of Medicine" and physicians today are still required to take the "Hippocratic Oath" at the completion of their training in his honor.[22] Hippocrates believed that illness had a physical and rational explanation and that insight into its cause and course could be gained by a detailed clinical history and objective examination.[23] The gleaning of such information enabled the formulation of a clinical prognosis—the likely time-course and outcome of a given disease. The desire to gain insight into the future was considered a strong characteristic of the Greek mind.[24] Hippocrates rejected the commonly held view of the time that considered illness to be caused by supernatural forces, such as the possession of evil spirits and disfavor with the gods. Instead, he believed the body should be treated holistically and not just as a series of parts.[25]

Hippocrates wrote some eighty-seven treatises on Greek medicine but two were specifically devoted to regimen—the systematic plan to improve and maintain the health of a patient. *Regimen in Health* was composed of nine very short chapters and *Regimen* consisted of four long sections or books.[26] In *Regimen* (Book 1) Hippocrates laid the foundation to his theory on "preventative medicine" and the differentiation of exercise. "Eating alone will not keep a man well; he must also take exercise. For food and exercise, while possessing opposite qualities, yet work together to produce health. For it is the nature of exercise to use up material, but of food and drink to make good deficiencies.

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[22] Edward Theodore Withington, *Medical History from the Earliest Times: A Popular History of the Healing Art* (London: Scientific Press, 1894), 48.
[23] Ibid.
[24] Ibid.
[25] T. Appleboom, C. Rouffin, and E. Fierens, "Sport and Medicine in Ancient Greece," *American Journal of Sports Medicine* 16, no. 6 (1988): 594-596.
[26] Berryman, "Exercise and the Medical Tradition," 13.

And it is necessary, as it appears, to discern the power of various exercises, both natural exercises and artificial, to know which of them tends to increase flesh and which to lessen it."[27]

In Book 2, Hippocrates specifically discusses exercise and training. He divides exercise into two main categories: 1) Natural—sight, hearing, voice, thought and walking and 2) Violent—that included running, wrestling, sparring and ball games among others. Included in the book were tips on training, such as the value of "running in a cloak" to increase body temperature, swinging the arms while running and how to avoid "fatigue pains" for "men out of training."[28]

In Book 3, Hippocrates explained his theory of preventative medicine. It entailed prognosis before illness, and diagnosis of what was the matter with the body—"whether food overpowered exercise, whether exercise overpowered food or whether the two were duly proportioned." If one overpowered the other, disease processes would arise, but if they were both evenly balanced then good health was the result.[29]

[27] Hippocrates, *Regimen*, 229.
[28] Ibid., 353-359.
[29] Ibid., 383.

Figure 4. Galen (National Library of Medicine)

Just as Herodicus influenced Hippocrates, so too did Hippocrates have a major influence on the medical beliefs of Claudius Galenus (Galen). Galen directly acknowledged Hippocates's influence, "Hippocrates, I confess, has heretofore shown the path, but as he was the first to enter it, he was not able to go as far as he wished...He has opened the path, but has left it for a successor to enlarge and make plain."[30] Galen was born in Pergamum, Asia Minor, where he studied medicine before going on to practice in Alexandra and Rome.[31] As a surgeon to the gladiators in Rome during the second century A.D., Galen is considered by classicists to be the first sports physician.[32]

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30 Roswell Park, An Epitome of the History of Medicine (Philadelphia: F.A. Davis Co., 1897), 38.
31 Robinson, *Sources for the History of Greek Athletics*, 177.
32 Geoff McMaster, "Surgeon to the Gladiators," University of Alberta, http://expressnews.ualberta.ca/expressnews/articles/news.cfm?p_ID=688&S=a. (accessed February 25, 2005).

The philosophical heart of both Hippocrates's and Galen's work was what came to be known as "humoral theory" or the idea that the body possessed four humours—blood, phlegm, bile (chole), and black bile (melaina chole)—and that as these circulated in the body they determined a person's mood, health and character.[33] Galen added to this basic notion the concept of the so-called naturals, meaning those things he believed to be in accordance with nature and physiology and were essentially innate in man; the concept of the six non-naturals or those things that influenced health and were not innate to man, and his theory of the contra-naturals or those things that were pathological and against nature. His philosophy of health came to be called Galenic Medical Theory.[34] The naturals were based on the concept of two pairs of opposing principles, hot and cold and wet and dry. Combined with the belief in the four elements of earth, air, fire and water and the four humours of the body, these principles were propagated by Galen and dominated the medical field of thought well into the twentieth century.[35]

The six non-naturals were comprised of 1) air, 2) food and drink, 3) motion and rest, 4) sleep and wake, 5) excretions and retentions and 6) affections of the mind.[36] The non-naturals, like Hippocrates's conception of balance between food and exercise, needed to be correctly proportioned in terms of quantity, quality, time and order so as to maintain homeostasis and avoid the onset of disease processes. Exercise was included within the third non-natural—motion and rest. It could be utilized as part of a

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[33] The best book on the history of humoural theory is: Noga Arikha, *Passions and Tempers: A History of the Humours* (New York: Ecco, 2007).
[34] Berryman, "Exercise and the Medical Tradition," 14.
[35] Harris, *Greek Athletes and Athletics*, 172.
[36] Withington, *Medical History from the Earliest Times: A Popular History of the Healing Art*, 98.

prophylactic healthy lifestyle or in the actual treatment of various diseases. Such was the significant influence of the ancient Greek physicians that Jack Berryman, sports historian and foremost authority on the history of sports medicine, notes in an appraisal of "Exercise and the Medical Tradition: From Hippocrates Through Antebellum America," that Classical Greek preventive hygiene formed part of medical training throughout the eighteenth century. Its influence continued on into the American health reform literature of the first half of the nineteenth century when the non-naturals came to be known as the "laws of health."[37] Berryman and Roberta Park, Professor Emeritus of Physical Education at the University of California at Berkeley, further highlight in *Essays in the History of Sports Medicine* that many of our conceptions of health and exercise still bear traces of their Greco-Roman origins and that the "ghosts of Hippocrates and Galen still linger in many popular ideas and practices."[38]

THE DEVELOPMENT OF GREEK ATHLETICS

To help understand the evolution and level of sophistication of Greek training practices in preparation for sport, physical training should first be considered within the wider context of the development of athletics in Greek society. However, there is not true unanimity among historians about how Greek sports developed. The most reliable source is probably Donald Kyle, Professor of History at the University of Texas at

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[37] Berryman, "Exercise and the Medical Tradition," 3.

[38] Jack W. Berryman and Roberta J. Park, eds., *Sport and Exercise Science: Essays in the History of Sports Medicine* (Urbana: University of Illinois Press, 1992), xiii.

Arlington who argues that "the histories of Athens and its athletics were significantly related."[39]

Kyle divides the development of Greek athletics into five general periods: 1) aristocratic, pre-Solonian Athens (ca. 776-594 B.C.) with Homeric-style, pre-civic athletics; 2) the sixth century rise and expansion of civic athletics—with increased degree of state involvement, such as the official administration of contests, prizes and facilities; 3) the age of empire and democracy (ca. 490-404 B.C.) when athletics thrived with civic prosperity; 4) the age of recovery (ca. 404-355 B.C.) during which the athletic life of the city continued; and 5) Athens eclipsed, (ca. 355-322 B.C.) that Kyle classifies as proto-Hellenistic in character.[40]

Kyle's divisions were in part a response to Norman Gardiner's much more simplistic idea that the evolution of Greek athletics was a transition from a golden age of aristocratic amateur athletics (approx. 510-440 B.C.) to a pattern of decline and degeneration (approx. 440-338 B.C.) when advances in training, specialization and rewards produced professionalism.[41] Gardiner derides the advent of professionalism—a development he viewed as "the death of all true sport."[42] However, Gardiner's comments, written in the early third of the twentieth century, should be seen in the context of an era

[39] Kyle, *Athletics of the Ancient Athens*, 169.
[40] Ibid.
[41] Gardiner, *Athletics of the Ancient World*, 44.
[42] Ibid., 99.

where the privileged British upper class extolled the virtues of amateurism and viewed professionalism as ungentlemanly—an aberration of the true meaning of sport.[43]

Modern scholars tend to view the idea of professionalism differently than Gardiner. Henri W. Pleket, for example, counters in *The Olympic Games: The First Thousand Years* that the history of Greek athletics has suffered from excessive antiquarianism plus an inevitable "classicist bias" against professionalism.[44] Plecket challenged the idea that was revived by Pierre Baron De Coubertin in the 1896 inauguration of the modern Olympic Games that amateurs from ca. 800 B.C. until the fifth century B.C. participated in sport just for the sake of sport and victory and not for "value prizes." Instead, Pleket asserts that throughout history the Greeks demonstrated a strong agonistic mentality that failed to distinguish participation from the urge to win and gain prizes and prestige via victory.[45] Donald Kyle interprets this period (approx. 440-338 B.C.) as more of a "transformation" in preference to Gardiner's "decline" and de-emphasizes the financial aspects of professionalism. For Kyle, the existence of professionalism in this era related more to training and expertise than to earning a livelihood.[46]

Finally, David C. Young, Professor of Classics at the University of Florida, in his two-part appraisal of the myth and reality of Greek amateur athletics, reached the conclusion that the ancient Olympic Games were never amateur. Prominent sports leaders

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[43] Ronald A. Smith, "History of Amateurism in Men's Intercollegiate Athletics: The Continuance of a Nineteenth Century Anachronism," *Quest* 45 (1993): 430-447.
[44] Finley and Pleket, *The Olympic Games: The First Thousand Years*.
[45] Henri W. Pleket, "Games, Prizes, Athletes and Ideology," *Stadion* 1, no. 1 (1975): 52.
[46] Kyle, *Athletics of the Ancient Athens*, 124.

and intellectuals in England and the United States created the amateur Olympic myth and embedded it in the modern Olympic Games, to justify their own elite ideas of the role of sport in society.[47] If Kyle and Young are correct and the Greeks did financially compensate their winning athletes, then there is every reason to believe that those same athletes might have enough "leisure" time to train for their sports.

TRAINING FOR ATHLETICS IN ANCIENT GREECE

Despite information on the various participants and victors of the Olympic Games, Nicolaos Yalouris, former Director of the National Archaeological Museum in Athens, notes that there is only limited evidence on how athletes actually trained.[48] Most information is derived from athletic scenes represented on contemporary pottery, archaeological remains of gymnasia, coinage of certain city-states depicting an athletic event with which they were particularly associated, statues of victors (even though most are Roman copies of Greek originals), and inscriptions that provide some of the regulations of the athletic festivals and details of the officials who were in charge of them.[49] Consequently, numerous studies have preferred to use Hellenistic and later sources as examples of training practices because of the paucity and difficulty of sources for early athletics. Donald Kyle warns against the approach of relying heavily on the literary works of the likes of Philostratus, Galen and Lucian that deal specifically with athletics—works that he feels are of limited value because of their lateness, technical

[47] Young, *The Olympic Myth of the Greek Amateur Athletics*.
[48] Nicolas Yallouris, ed., *The Eternal Olympics: The Art and History of Sport* (Athens: Caratzas Brothers, 1979), 114.
[49] Judith Swaddling, *The Ancient Olympic Games* (Austin: University of Texas Press, 1999), 33.

approach and imaginative content.[50] Rachel Sargent Robinson, however, writing in her now classic work, *Sources for the History of Greek Athletics*, viewed Philostratus and Galen as reliable witnesses providing important insights into the training practices, exercise selection, and distribution of training loads.[51] However, it is important to be aware and as sport historian Jan Todd notes in her treatise of the history of women's exercise, that the fragmentary nature of ancient Greek evidential sources inevitably creates an incomplete and even inaccurate history.[52]

Donald Kyle and Norman Gardiner propose that from the time of the fifth century B.C. onwards (and perhaps before) that athletes were able to devote a significant amount of time to specialized training and may, therefore, be regarded as professionals. But what exactly did the training of Greek athletes entail? How comprehensive was the training? How was it structured and to what extent does it resemble modern training methods? One method for gaining insight into the training and competitive practices of Greek athletes is to become acquainted with the archeological remains of gymnasia where athletes worked out.

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[50] Kyle, *Athletics of the Ancient Athens*, 6.
[51] Robinson, *Sources for the History of Greek Athletics*, 212.
[52] Jan Todd, "'As Men Do Walk a Mile, Women Should Talk an Hour....Tis Their Exercise,' and Other Pre-Enlightenment Thought on Women and Purposive Training," *Iron Game History* 7 (2002): 56-70.

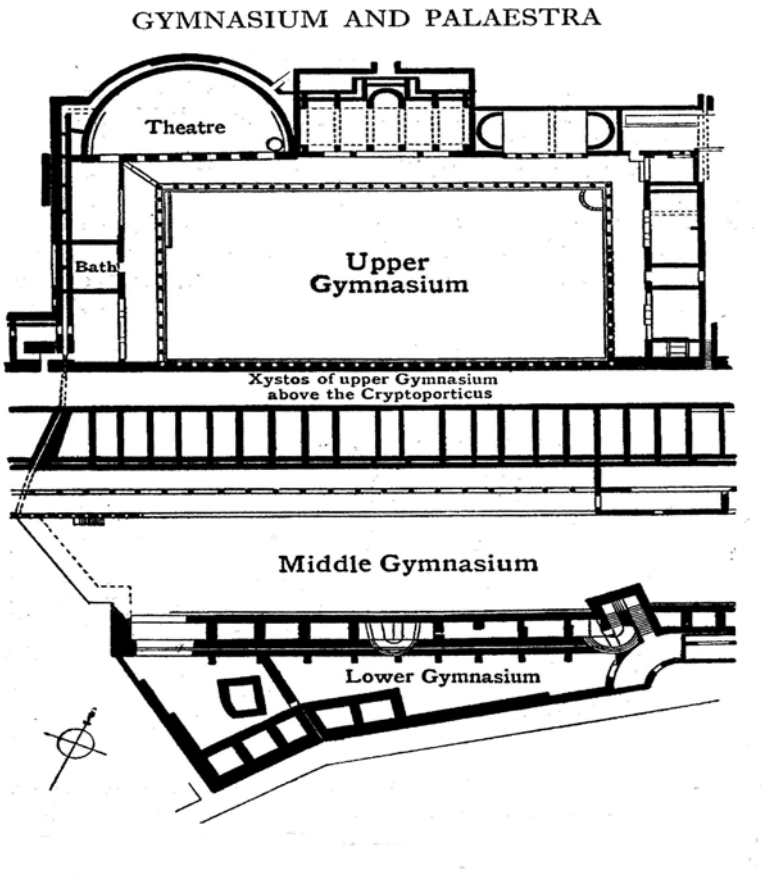

Figure 5. Gymnasium and Palaestra at Pergamum.[53]

Training for athletes took place in the *gymnasium* (sports ground) which referred to the area "in which you stripped."[54] Most gymnasia contained an open running track called the *xystos*, inside of which the javelin and discus were thrown**.** The part of the gymnasium devoted to wrestling and other "heavy events," boxing and *pankration* (a combination of boxing and wrestling) was called the *palaestra*; a building much the same

[53] Gardiner, *Athletics of the Ancient World*, 44.
[54] Ibid., 72.

as an ordinary Greek house with an open courtyard in its center.[55] It was surrounded by quadrangular or oblong colonnades with a large inner courtyard which at Olympia, had sides that measured forty-one meters long.[56] The *palaestra* also contained a variety of rooms that included hot, cold and vapor baths, washrooms and a room for ointments and salves—all of which were utilized for the preparation and recovery of athletes before and after training.

The initial physical and educational development of young athletes was entrusted to *paidagogai* (tutors). These were paid slaves who conducted Greek boys to and from school and looked after their general deportment.[57] Specialized preliminary trainers called *paidotribes* developed with the evolution of the *palaestra* and *gymnasium*. The *paidotribes* were responsible for the day-to-day, practical implementation of the athlete's training program. The increased popularity of athletics and greater rewards from the fourth century onwards led to increased sporting specialization and specialized trainers (*gymnastes*) evolved who were required to coordinate the all-round physical development of their athletes. Thus a distinction was made—the *paidotribe* became more of a preliminary physical trainer and the *gymnastes* arose as the "coach" or athletic expert.[58] Plato notes that during the fifth century B.C. Athens contained numerous groups of

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[55] Ibid.
[56] Drees, *Olympia, Gods, Artists and Athletes*, 46-47.
[57] Yallouris, ed., *The Eternal Olympics: The Art and History of Sport*, 114.
[58] Kyle, *Athletics of the Ancient Athens*, 142.

potential athletes who followed generalized training programs. However, on an advanced level, or if athletes were wealthy enough, individualized instruction took place.[59]

Early *gymnastes* were generally retired athletes who relied upon previous experience to teach their athletes.[60] By the fifth century B.C., the process of coaching had become commonplace and nearly all aspiring athletes worked with a trainer. The role of the coach also began to be recognized in this era. On several occasions Pindar ascribes the success of victors in the heavy events to the excellence of the trainer.[61] Indeed, many athletes who won glory at Olympia honored their *gymnastes* and *paidotribes* by erecting statues of them next to their own.[62]

Thus by the time of the fifth century the preparation and technique required to become a successful athlete or trainer had become involved and complex.[63] Consequently, gymnastic practice became more and more refined, to such an extent, that a science of training arose. According to Robinson, a number of manuals pertaining to physical training were available in antiquity but unfortunately only one has survived. That manual, entitled *Gymnasticus*, or *On Gymnastics*, was written by Lucius Flavius Philostratus (A.D. 170-244) and because he was an intimate of the Imperial court and spent time in Rome, Great Britain, and later, in Athens as well.[64] Within the manual,

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[59] Ibid. For further information see Plato. *Statesman* 294d-e. Isocrates, *Antidosis* 15.183 in Kyle *Athletics of the Ancient Athens,* 142.

[60] Paleologos, "Origin of the Modern Theory of Training," 26-29.

[61] For further information see Pindar. *Ol*. 8.53: *Nem*. 4.93; 5.47; *Isth*. 4.71 in Kyle *Athletics of the Ancient Athens,* 142.

[62] Yallouris, ed., *The Eternal Olympics: The Art and History of Sport*, 118.

[63] Kyle, *Athletics of the Ancient Athens*, 142.

[64] Robinson, *Sources for the History of Greek Athletics*, 212. For a biography of Philostratus's life see: Jona Lendering, "Philostratus," http://www.livius.org/phi-php/philostratus/philostratus.htm. (accessed

which scholars believe was published around A.D. 220, Philostratus writes extensively about various subjects relating to athletics and physical training including: the origins of different Olympic events; the degenerative nature of modern athletics; the correct training of athletes, including how to treat athletes when they overate, drank too much or had sexual intercourse; the physical signs of poor condition; the tetrad system; equipment, clothing and the relative merits of sunbathing.[65]

Philostratus began with a discussion of the "Science of Gymnastics," for which he held the highest esteem. "As for gymnastics we designate it as a science equal in ranks to any other….thus the purging of humours, removing superfluous matter, rendering the hard flexible and fattening, modifying or warming any part of the body whatsoever, belong to the science of the gymnast."[66] The trainer then, like the doctor, required knowledge of diet and the effects of different types of food on the body. He also required a fundamental knowledge of anatomy and the effects of different kinds of exercise. Details of exercise prescription included recommendations of the best type of athletics to undertake, the type and number of exercises that were needed for individual athletes, how to increase muscle mass (particularly advantageous in the "heavy events" where no weight categories existed), the rhythm and intensity of exercises, continuous and sporadic

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February 18, 2008). Robinson views Philostratus's reflections on the details of training and the tetrad system within *On Gymnastics,* as original, legitimate contributions. However, Philostratus's account of the history of the Olympic Games, the theorizing of the gradual introduction of the various contests and the elaborate explanation of each event can be considered no better or worse than his sources.

[65] Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*, 212-228.

[66] Philostratus, *Philostratus: Concerning Gymnastics by Thomas Woody*.

training, and the beneficial effects of training in the open air.[67] A familiarity with ideal physical body proportions for specific events and a rudimentary understanding of the influence of hereditary factors (genetics) such as the parental endowment of physical characteristics to their offspring and the likelihood of hereditary diseases were also evident.[68] The *gymnastes* were also required to judge the "human condition" and to distinguish between physical exhaustion caused by training, and psychological or mental exhaustion caused by factors such as depression and "bad humor."[69]

In the sport world described by Philostratus, *gymnastes* attempted to ascertain the bodily response to exercise, judge the satisfactory progression of training, and to detect signs of overwork by assessing the color and quality of the athlete's skin. They also diagnosed excessive cold or over-heating of the body during training, assessed optimal muscle tone and contusions in the muscle fibers and worked out muscular pain or local tiredness of the muscles through massage and other therapies in a concerted effort to enhance performance.[70] Considering that Philostratus was neither a scientist nor a trainer his appraisal still offers the most detailed and hopefully accurate account of training during the years of the ancient Olympic Games (776 B.C. to A.D. 393).

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[67] Yallouris, ed., *The Eternal Olympics: The Art and History of Sport*, 114; Gardiner, *Athletics of the Ancient World*, 89.
[68] Yallouris, ed., *The Eternal Olympics: The Art and History of Sport*, 118.
[69] Ibid., 116.
[70] Ibid.

NUTRITION, MASSAGE AND MANUAL THERAPY

Other writers in these early times offered athletes advice on nutrition as a vital component in the complete preparation of an athlete. Epictetus, a Stoic philosopher in the second century A.D., warned would-be Olympic champions that they should employ a strict and plain diet and that it was necessary to "eat according to regulations….keep away from desserts and to exercise on a fixed schedule at definite hours."[71] Despite the potential benefits of a controlled diet, by the second century A.D. extreme attention to dietary intake to gain a competitive edge bordered on the farcical.[72] For example, Philostratus states how trainers argued over the relative merits of deep-sea versus in-shore fish based on what type of seaweed they would likely to have eaten. Doctors also classified pork depending on how and where pigs were raised. Pigs raised near rivers were avoided as they may have eaten crabs. The only pork suitable for an athlete's diet was from pigs fed on acorns and cornel berries.[73] Consequently, Philostratus derided the nature and nutritional practices of modern athletes—a practice he felt had turned them into "gluttons with bottomless stomachs."[74]

During the fifth century B.C. when the science of medical gymnastics arose, *paidotribes* and *gymnastes* are credited with the invention and introduction of medical massage.[75] *Aleiptes*, or "oilers," were responsible for anointing the athletes with oil

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[71] For further information see Epictetus, *Discourses* 15.2-5 in Sweet *Sport and Recreation in Ancient Greece: A Sourcebook with Translations,* 114.
[72] Harris, *Greek Athletes and Athletics*, 172.
[73] The cornel berry (cornelian cherry) refers to a European shrub with clusters of small greenish flowers, followed by very acidic but edible drupes resembling cherries.
[74] Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*, 223.
[75] Gardiner, *Athletics of the Ancient World*, 90.

before and after exercise in special rooms dedicated to this practice.[76] This relatively simple task developed into a highly skilled art of manual therapy that became an integral part of the overall training of athletes. The trainers used massage to treat injury, aid the recovery process and to "soften any part of the body that became hard."[77] Hence the *aleiptes* became known as *iatraleiptes* or healer-anointer. As can be seen, the integration of a carefully manipulated diet, massage and prescribed exercise by the *gymnastes* and the *aleiptes* aimed to produce the optimum physical condition required for athletic success.[78]

THE TRAINING PROGRAM

Preparation for an athletic event primarily involved practice of the event, rather than the use of any specialized exercises.[79] This was especially true after the rise of professionalism when would-be champions devoted themselves from a very early age to the rigors of training. Athletes soon found it necessary to specialize in a particular event, as different events required different methods of application and training.[80] The increased level of specialization amongst athletes was complimented by an increased level of coaching specialization. Philostratus acknowledged the need for coaching specialization by noting, "But no one would announce that he knew the entire field of athletics. For the

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[76] Ibid., 78.
[77] Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*, 219.
[78] Gardiner, *Athletics of the Ancient World*, 89.
[79] Yallouris, ed., *The Eternal Olympics: The Art and History of Sport*, 114.
[80] Gardiner, *Athletics of the Ancient World*, 101.

man who knows running events does not know about wrestling or the pankration, nor will the expert in the heavy events be competent in other fields."[81]

Figure 6. A powerful illustration of ancient Greek sprinters demonstrating the high knee lift and increased muscularity, typical of athletes in this event.[82]

Primarily focusing on their own events, Greek athletes also used a wide variety of general physical preparatory exercises in addition to specific preparation exercises that approximated their chosen event. However, before we examine the precise categorization and specific examples of training exercises it is important to understand the contemporary criterion of exercise. Galen, the ancient Greek physician authored a number of medical historical texts—the most pertinent to training and exercise being *Hygiena*, which was

[81] Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*, 219.
[82] Neil Duncanson, *The Fastest Men on Earth* (London: Willow Books, 1988), 11.

divided into six books.[83] Book Two, entitled *Exercise and Massage*, contained the details of the "Purpose, Time and Methods of Exercise and Massage," and included his criterion for exercise: "To me it does not seem that all movement is exercise, but only when it is vigorous…The criterion of vigorousness is change of respiration…if anyone is compelled by any movement to breathe more or less faster that movement becomes exercise for him. This therefore is what is commonly called exercise or gymnastics."[84]

In Galen's treatise on the *Preservation of Health,* the author expands upon his conception of exercise by talking extensively on the exercises best suited to youths aged between fourteen and twenty.[85] He distinguished between exercises for the different parts of the body including the hips, hands, legs, whole back, chest and lungs. Walking and running especially targeted the legs, while sparring and shadow-boxing concentrated on the hands; bending down and straightening up continuously utilized the hips as did picking up weighted objects from the ground.[86] Specifically, Galen referred to three main types of exercise.

The first category called vigorous exercises were exercises "performed with strength but without speed."[87] Exercises in this category included digging, picking up any kind of heavy load and either standing still with it or walking—particularly up a hill, and climbing a rope and hanging from a beam or rope as long as possible. Other examples included statically holding the arms up (with and without weights) whilst a partner

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[83] Berryman, "Exercise and the Medical Tradition," 14.
[84] Green, *A Translation of Galen's Hygiene (De Sanitae Tuenda)*, 53-54.
[85] Gardiner, *Athletics of the Ancient World*, 97.
[86] Ibid.
[87] Robinson, *Sources for the History of Greek Athletics*, 178.

resisted them in a downwards direction, attempting to break free from a wrestling hold, lifting a partner up, trying to pull a partner towards the ground with both hands clasped behind the partner's neck and a variety of wrestling exercises—all of which had the common denomination of developing strength. Cleanthis Paleologos, former Honorary Director of the National Physical Education Academy in Athens, Greece, categorizes these types of exercises as general preparation or "fatigue work," that also included hacking, ploughing, rowing, mowing, carrying heavy burdens and a variety of weight training-type exercises designed to develop and strengthen the arm muscles.[88] The emphasis upon the use of specific strength training exercises highlights a rudimentary understanding of the fundamental training principles of overload and progressive resistance which are needed to stimulate gains in strength. The overload principle in modern terms refers to the phenomenon that "for a training adaptation to occur, a physiological system must be exercised at a level beyond that to which it is presently accustomed," and the progressive overload principle refers to the phenomenon of "progressively placing greater than normal demands on the muscle."[89] These phenomena were practically demonstrated by the legendary wrestler, Milo of Croton who won six Olympic titles in wrestling, during the sixth century B.C.[90] Milo purportedly developed

[88] Paleologos, "Origin of the Modern Theory of Training," 26-29.
[89] Thomas R. Baechle and Roger W. Earle, eds., *Essentials of Strength and Conditioning* (Champaign, Ill.: Human Kinetics, 2000), 62,493.
[90] For further information see Pausanais 6.14.5 in Sweet *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*, 244.

his remarkable level of strength by "practicing weight lifting on most scientific principles with a young calf which he lifted and carried every day till it was fully grown."[91]

The second category of exercises classified as speed exercises developed "speed apart from strength and force."[92] Examples included running, shadow boxing, sparring, hitting the punch bag, players running back and forth with a small ball and a variety of leg and arm movements similar to those performed in physical drill training at the beginning of the twentieth century.[93] More detailed examples include: *Pitylysma* which consisted of standing on tiptoe, stretching one's arms upwards and then moving one arm quickly forward and the other arm back, rolling quickly on the ground (with or without partners) and isolating the legs by standing erect and repeatedly jumping up with a backward kick or sometimes bringing each leg forward alternately.[94]

The third and last category of exercises—violent exercises combined "strength and speed."[95] The exercises that were classified as "strong" or "vigorous" became violent by accelerating their speed. Digging, hurling the discus, and jumping continuously without rest intervals typified exercises in this category. Likewise, if any of the quick exercises were performed with weight—such as hurling any of the heavy weapons without pausing or moving about quickly in heavy armor, they were also considered violent. Galen acknowledged the strenuous nature of these exercises by stressing the importance of rest and recovery in between bouts of exertion. He recommended that, "of

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[91] Gardiner, *Greek Athletic Sports and Festivals*, 82-83.
[92] Robinson, *Sources for the History of Greek Athletics*, 180.
[93] Gardiner, *Greek Athletic Sports and Festivals*, 97.
[94] Robinson, *Sources for the History of Greek Athletics*, 181.
[95] Ibid.

course, even those who are taking some exercise of this violent sort should rest for a short time."[96] The categorization of three main types of exercise (strength, speed, and a combination of speed and strength) demonstrates an awareness of one of the most basic principles of training—specificity. This principle refers to the phenomenon that "a training effect is limited to the physiological systems used and overloaded during training."[97] The categorization of exercises into three main types implies that if the goal was to increase strength, the athlete must perform specific strength exercises since speed exercises alone would not provide sufficient stimulus to produce gains in strength. Galen also demonstrated a rudimentary awareness of the different bio-motor abilities of speed and strength and how they need to be combined in order to produce "violence" or in modern terms—power (the optimal combination of speed and strength that is a primary determinant of athletic success).[98] A practical example of speed-strength training was exhibited by the use of specialized jump training or "plyometrics," such as scissor jumps or *aphalmos* that were used to enhance the development of "elastic energy," leg strength, and power.[99]

In addition to general preparation exercises for speed, strength and power, Greek athletes also engaged in specific preparation exercises that directly mimicked their event. Examples of specific training exercises for the running events included: 1) *Anatrochasmos*—which involved running backwards; 2) *Peritrochasmos*—running in circles; 3) *Ecplethrisma*—running repeatedly back and forth the length of a plethron (a

[96] Ibid.
[97] Baechle and Earle, eds., *Essentials of Strength and Conditioning*, 493.
[98] David Sandler, *Sports Power* (Champaign, Ill.: Human Kinetics, 2005), ix.
[99] Yallouris, ed., *The Eternal Olympics: The Art and History of Sport*, 252.

distance of about 100 feet) decreasing the length each time until a single step was reached; and 4) Running in ever-decreasing circles until the center of the circle was reached.[100] Runners also used contrast methods of training to enhance performance. Running on sand increased the level of work and resistance so that afterwards, when the athletes ran on hard ground they had a sensation of minimal or reduced effort.[101]

Figure 7. An amphora (a kind of jar) depicting three long-distance runners.[102]

The training which was formerly called "Kataskevi" lasted almost the whole day and included a wide variety of exercises.[103] Consequently, Cleanthis Paleologos argued in a 1987 *Track and Field Quarterly Review* article entitled "Origin of the Modern Theory

[100] Gardiner, *Greek Athletic Sports and Festivals*, 97.
[101] Paleologos, "Origin of the Modern Theory of Training," 26-29.
[102] Image located at: http://www.bbc.co.uk/history/ancient/greeks/greek_olympics_gallery_03.shtml (accessed January 11, 2008). This 60cm-high amphora is housed in the British Museum. It was made in 333-332 BC in the Greek archonship of Nikokrates.
[103] Paleologos, "Origin of the Modern Theory of Training."

of Training," that the training of Greek athletes was not that different from present day athletes in that it lasted almost all day and required a complete sacrifice on behalf of the athlete.[104]

To illustrate the level of preparation required by athletes and to ensure only sufficiently conditioned athletes competed, Philostratus noted that prior to the Olympic Games, athletes prepared in the city of Elis for a period of one month.[105] Furthermore, they swore an oath as testimony to their level of preparedness—that they had "carefully trained for the space of ten months" prior to the games.[106] Coincidentally, this length of time is almost identical to the period recommended for the preparation of modern-day Olympic track and field athletes.

After the Roman conquest of Greece in 146 B.C. a strict method of repetitive training was devised that applied to all athletes.[107] It was called the tetrad, or four-day training cycle. Philostratus outlined the four-day variation in the training cycle in *On Gymnastics*:

> By the tetrad system we mean a cycle of four days, each one of which is devoted to a different activity. The first day prepares the athlete; the second is an all-out trial; the third is relaxation; and the fourth a medium-hard workout. The exercise of the first day, the one that prepares him, is made up of short, intense movements which stir up the athlete and prepare him for the hard workout to follow on the next day. The strenuous day (the second) is an all-out test of his

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[104] Ibid.

[105] Drees, *Olympia, Gods, Artists and Athletes*, 43. For further information see Philostratus the Elder, *Apollonius of Tyana*, V.43

[106] Ibid. For further information see Pausanias, V. 24, 9

[107] Drees, *Olympia, Gods, Artists and Athletes*, 116.

> potential. The third, the day of relaxation, so to speak, employs his energy in a moderate way, while on the day of the medium workout (the last day), the athlete practices breaking holds himself and preventing his opponent from breaking away.[108]

With reference to "breaking holds" and preventing opponents from "breaking away," the passage clearly relates to pankratiasts and wrestlers who formed the bulk of the class of professional athletes at the time.[109] Philostratus opposed the adoption of the system on the basis that it was continually repeated and too rigidly applied. He felt that while the *gymnastes* followed a fixed routine they ignored the intrinsic condition of the athlete they were training—such as the food he was eating and the level of mental strain (worry) and fatigue (exhaustion) he was experiencing.[110] He therefore recommended abandoning the system "which has virtually destroyed the whole field of athletics."[111] The umpires, or *Hellanododikai* ("Judges of the Greeks"), at Elis also opposed the four-day tetrad system during the one month's preliminary judging prior to Olympic competition. They used more traditional exercises and believed training should not be based on a fixed program of exercises, but on a program determined in accordance with the particular set of circumstances at the time.[112]

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[108] Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*, 229.
[109] Gardiner, *Greek Athletic Sports*,97.
[110] Robinson, *Sources for the History of Greek Athletics*, 230.
[111] Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*, 225.
[112] Yallouris, ed., *The Eternal Olympics: The Art and History of Sport*, 116. Drees notes that the one month of training at Elis must have been a relatively late innovation. The ten-month training period could only have been prescribed for professional athletes, and, although these were a common feature of Roman times, at the early Olympics the competitors had all been amateur. Furthermore, the training could have only taken place in Elis from 472 B.C. onwards, since that was the year in which the city was founded. For further information see Drees, *Olympia, Gods, Artists and Athletes*, 43.

Philostratus's distaste was highlighted by the death of Gerenus, (a wrestler from Naucratis in Egyptdes) an act he attributed to the tetrad system and the dogmatic application of hard training two days after celebrating his Olympic victory. Gerenus celebrated his victory with friends by drinking and overindulging in "fancy food" which left him short on sleep.[113] Philostratratus highlights that as a consequence of such an unaccustomed lifestyle and despite complaining to his *gymnastes* that his stomach was upset, the *gymnastes* insisted on Gerenus not breaking and upsetting the tetrad system. As a result—he brought about his pupil's death in the middle of the workout by "assigning the kind of exercise which he should have had sense to avoid even if his pupil had not told him of his condition."[114]

Unfortunately, Philostratus's account of the tetrad system does not provide us with information regarding the volume of the training load—one of the key variables related to a periodized approach to training. Also, according to Philostratus, (who it is important to bear in mind was an orator and not a *paidotribe* or *gymnastes*), the system was not universally accepted and was abandoned by the *Hellanododika* during the one month preparation at Elis, prior to the Olympic Games. Despite the rigidity of application, the *gymnastes'* cyclical manipulation of daily training intensity demonstrates a rudimentary understanding of the accumulative aspects of stress and the need to vary intensity levels on a daily basis. It also demonstrates a knowledge (at least in the short

[113] Harris, *Greek Athletes and Athletics*, 175.
[114] Sweet, *Sport and Recreation in Ancient Greece: A Sourcebook with Translations*, 228.

term) of the stimuli necessary to produce ongoing improvement while at the same time avoiding the pitfalls of overtraining by not training at high intensity levels all of the time.

The increased level of sophistication of the training process is highlighted by Allen Guttman, sport historian and Professor of English and American Studies at Amherst College, Massachusetts, who notes that the Greeks did more than practice—they trained. This is an important distinction as it implies rationalization of the whole training process necessary to ensure improved performance.[115] However, despite the increased level of sophistication and the daily manipulation of intensity—one of the key requirements for a training program to be considered "periodized," the tetrad system remains distinctly remedial when compared to what has evolved into the modern-day concepts of training cycles. Modern training theory, and especially the new science of periodization, has developed (at least at its most sophisticated level of application) into a highly complex attempt to gain control of the adaptive response to training. Utilizing the various branches of sport science, it aims to optimally integrate all five bio-motor abilities (speed, strength, skill, stamina, suppleness) with the aim of maximizing performance and peaking at the right moment in time.[116]

With the decline of the Olympic Games and the subsequent fall of the Roman Empire in A.D. 476, organized athletic competitions like the ancient Olympics and

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[115] Allen Guttman, *From Ritual to Record*, 43.
[116] Bompa, *Theory and Methodology of Training: The Key to Athletic Performance*, 1.

interest in physical training to enhance human performance, entered its own "Dark Age" in Western Europe. As Europe evolved into a series of isolated feudal states during the period A.D. 500-1400 the ability to read Greek declined, many of the ancient texts were lost, and the Catholic Church's interest in denigrating the body and its physicality meant that almost no one in Western Europe paid much attention to the idea of athletic training. As will be seen however, once Greek ideas and texts re-emerged, first in the Renaissance, and then again in the Enlightenment, they served as the basis for a new and far more sophisticated approach to training for athletics and launched an era of unabated enthusiasm for athletics itself which continues to the modern era.

CHAPTER TWO

OUT OF THE DARK—TOWARDS THE LIGHT: ATHLETIC TRAINING FROM THE DARK AGES TO WORLD WAR I

The Dark Ages (A.D. 476-1000) have traditionally been characterized as a vacuum of physical, cultural, and intellectual development. With isolated exceptions Greek was unknown in Western Europe, yet Greek was still the key language for all higher learning, especially in medicine.[1] It was not until the Middle Ages (A.D. 900-1400) that physical preparation became valued as an important prerequisite for survival. This revival began when knights of the feudal era needed to train in disciplines such as riding, swimming, climbing, vaulting, fencing, wrestling, archery, jousting and tourneys in order to defend and expand their territories.[2]

The cultural and social interjection of the crusades (1096-1270) laid the foundation for the Renaissance (1400-1600) and a reawakening of minds. Medical historian Jack Berryman in his treatise, "Exercise and the Medical Tradition from Hippocrates through Antebellum America," highlights how the "regimen of non-naturals" flourished as part of the revival of Galenic medicine—where exercise once again was viewed as an essential component for the complete development of "self."[3]

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[1] Withington, *Medical History from the Earliest Times: A Popular History of the Healing Art*, 176.

[2] Lance C. Dalleck and Len Kravitz, "The History of Fitness," The University of New Mexico, http://www.unm.edu/~lkravitz/Article%20folder/history/html (accessed October 10, 2005). This paper was presented by Dr. Len Kravitz, Ph.D. at the Southwest American College of Sports Medicine Chapter 22nd annual meeting in Las Vegas, Nevada in November 2002.

[3] Berryman, "Exercise and the Medical Tradition," 16.

Figure 8. Mercurialis (National Library of Medicine)

Hieronymus Mercurialis (1530-1606), a physician born in Forli, Italy, epitomized the intellectual revival of the Renaissance period.[4] His book *De Arte Gymnastica Aput Ancientes* published in 1569, credited as one of the oldest books on physical culture and sports medicine, formed the foundation for much of the physical culture and related literature that followed.[5] The text comprised more than 110,000 words and drew upon various sources, including the works of Galen, Hippocrates, Philostratus and Vegetius

4 McIntosh, "Hieronymus Mercurialis 'De Arte Gymnastica': Classification and Dogma in Physical Education in the Sixteenth Century," 73-84; Mercurialis, *De Arte Gymnastica Aput Ancientes*.
5 Terry Todd, "Fitness Collection Receives Oldest Known Book on Physical Culture and Sports Medicine," University of Texas at Austin, http://www.utexas.edu/education/news/artegymnastica.html (accessed January 19, 2005). In March of 2005 an original copy of *De Arte Gymnastica* was donated to the Todd-McLean Physical Culture Collection at the University of Texas at Austin by strength historian David Webster , O.B.E.

(who wrote on military training in the fourth century A.D.) as well as poets and authors of philosophical, historical, educational and political books.[6] Mercurialis reinforced the validity of the ancient writings but also offered his own improved recommendations. For example, he extended Galen's definition of exercise to include its relation to health: "Exercise with which medicine ought to deal is properly vigorous voluntary movement of the human body with a change in the rate of breathing done either to protect health or to develop fitness."[7] Mercurialis classified gymnastics into two main types—preventative and therapeutic and believed that exercise should be tailored to each person, dependant upon their constitution and fitness level.[8]

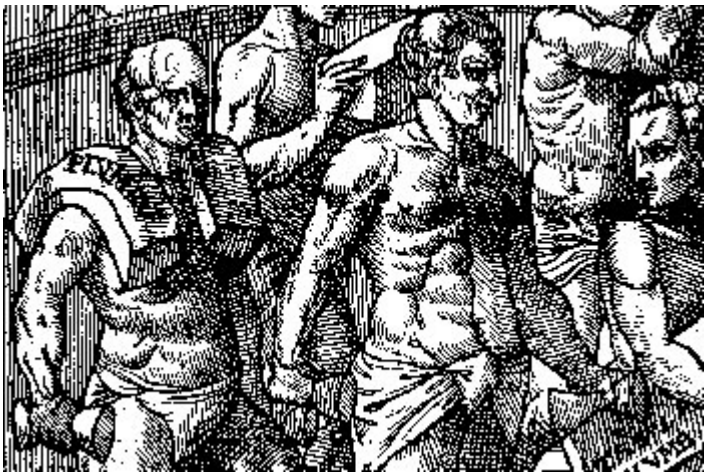

Figure 9. *De Arte Gymnastica* illustration of men training with dumbbells and weights.

[6] McIntosh, "Hieronymus Mercurialis 'De Arte Gymnastica': Classification and Dogma in Physical Education in the Sixteenth Century," 74.

[7] Ibid., 77.

[8] L.H. Joseph, "Physical Education in the Early Middle Ages"; "Gymnastics During the Renaissance as a Part of the Humanistic Educational Program"; "Medical Gymnastics in the Sixteenth and Seventeenth Centuries;" and "Gymnastics in the Pre-Revolutionary Eighteenth Century," *Ciba Symposia* 10 (March-April 1949). Jan Todd notes in "'As Men Do Walk a Mile, Women Should Talk an Hour....Tis Their Exercise,' and Other Pre-Enlightenment Thought on Women and Purposive Training," *Iron Game History* 7 (2002): 56-70 that Joseph's work remains the best overview of therapeutic exercise up to the Enlightenment period.

Writing in a time when there was little in the way of organized athletics, Mercurialis warns his readers that training simply for the sake of training—as say a modern bodybuilder might do—was not a worthy aim for gymnastics. Athletic training for entertainment was viewed as a perversion of true gymnastics and harmful to health. It made the senses dull, torpid, sluggish, and athletes were likened to the "thick" columns of the gymnasium by Mercurialis.[9] In contrast, military gymnastics used in preparation for war, and pure gymnastics used to preserve and promote health, were both considered legitimate aims. Merculiaris's text represents a watershed in the field of physical culture and exercise training. He was one of the first clinicians to resurrect the idea that exercise can be helpful or harmful depending on its use, duration, and intensity, and he stimulated an ongoing interest in therapeutic exercise and the relationship between physical education and health that continues today.[10]

The resurgence of physical educators who advocated the beneficial role of exercise continued in Continental Europe following the Renaissance and as physical education programs expanded, gymnastics enjoyed immense popularity. By the nineteenth century exercise pioneers such as Johann Guts Muths and Friedrich Jahn (Germany), Per Henrik Ling (Sweden), Frank Nachtegall (Denmark), and Archibald Maclaren (England) were all advocates of various forms of gymnastics and their interest in and advocacy of physical training created a fitness movement in Western Europe that also impacted sporting practices in the United States.[11]

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[9] Ibid., 82.
[10] Ibid., 83.
[11] Dalleck and Kravitz, "The History of Fitness."

AMERICAN INVOLVEMENT IN ATHLETICS (1700-1885)

During the period between 1700 and 1776, Colonial America remained underdeveloped, characterized by much unexplored land and wilderness. Many early Americans were by necessity farmers and agricultural workers—their lives dictated by the demands of their crops and livestock. Colonial life provided ample physical activity and was recognizably too hard to allow for much in the way of sport and leisure.[12]

In the first sixty or so years after the American Revolution, the United States experienced rapid growth. While a number of commercial and social centers such as Boston, New York, Philadelphia, Baltimore and Charleston existed, the country remained largely rural in nature.[13] Sport and sport-related activities reflected the diversity of the period and provided recreation, amusement, and entertainment to an emerging nation. Various forms of dance were popular, as was horse racing which established itself as the "first modern sport in America."[14] Men patronized cockfighting and "bare-knuckle" boxing matches which tended to attract the less savory elements of society. Starting in the 1820s and reaching a peak in the 1840s and 1850s pedestrianism—the sport of professional running and walking, became very popular and attracted numerous spectators to towns, villages and fairs. It remained popular up until the early 1880s when amateur track and field began to replace the affectionately called professional "peds."[15]

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[12] Struna, *People of Prowess: Sport, Leisure, and Labor in Early Anglo-America*, 5-6.
[13] Spears and Swanson, *History of Sport and Physical Activity in the United States*, 90.
[14] Melvin L. Adelman, "The First Modern Sport in America: Harness Racing in New York City 1825-1870," *Journal of Sport History* 8, no. 1 (1981): 5-32.
[15] Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 65.

The period between 1840 and 1885 was characterized by marked technological improvements in transportation, communication, manufacturing, and urbanization. This, together with a vast increase in population changed towns into cities and created the environment which transformed games into organized sport.[16] The discovery of electricity along with Morse's system of telegraphy in 1844 meant that news (including the results of sporting events) could be transmitted instantaneously across a growing web of telegraph lines. By the late 1850s, railways had improved and could be used for reliable transportation to and from sporting events. Teams such as the Cincinnati Red Stockings, the first open, all-salaried team, traveled from Maine to California in 1869 using the railroad to barnstorm and create interest in the game.[17] Life, especially in the cities, became more compartmentalized—time for work, time at home and free time where Americans sought spectator sport and various forms of physical activity as a means of recreation and "letting off steam."[18] In less than fifty years (1840-1885) sport was transformed from an informal, social pastime to an organized component of American life. Some of the significant changes in sport history during this time period included the beginning of professional team sport (baseball), the first intercollegiate sporting events for men (rowing, baseball, football, and track and field), the formation of

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[16] John Rickards Betts, "The Technological Revolution and the Rise of Sports 1850-1900," in *The American Sporting Experience: A Historical Anthology of Sport in America*, ed. Steven A. Reiss (West Point, New York: Leisure Press, 1984), 231-256; Reiss, *Sport in Industrial America 1850-1920*, 11-42. See Chapter One: Urbanization, the Technological Revolution and the Rise of Sport.

[17] Reiss, *Sport in Industrial America 1850-1920*, 153; Reiss, *The American Sporting Experience: A Historical Anthology of Sport in America*, 143.

[18] Ibid., Spears and Swanson, *History of Sport and Physical Activity in the United States*, 95.

various formal and voluntary sporting associations (New York Athletic Club, YMCA, Turner Societies) and the promotion of sport to improve health.[19]

Intrinsically linked to the urbanization and industrialization that occurred during the nineteenth century, sport historian Allen Guttmann summarized the evolution of sport during this period (and beyond) as a transformation from "ritual to record."[20] Guttmann's seminal work described how a new era of "modern" sport evolved that was in sharp contrast to primitive, ancient and medieval sports. The new era had seven distinguishing characteristics. Firstly, modern sport was *secular* in nature, partly pursued for its own sake and partly for other equally non-religious goals.[21] Secondly, and particularly over the course of the twentieth century, modern sport assumed *equality* where athletes were no longer denied opportunity on the basis of class, gender and race. The third trait was *specialization.* To be successful, athletes were forced to a) concentrate on specific sports and b) focus on a specific role or position within their chosen sport. The fourth trait was *rationalization.* A transition from play (or practice) to training took place that rationalized training as a prerequisite for improvement and superior results. This inevitably led to increased sophistication of the training process as specific time was devoted to planned training—one of the key elements of a periodized approach to training. The remaining traits were *bureaucratization, quantification* and *record keeping. Bureaucratization* referred to the formation of organizations that were responsible for

[19] Reiss, *Sport in Industrial America 1850-1920*, 1-10; John Rickards Betts, "Mind and Body in Early American Thought," in *The American Sporting Experience: A Historical Anthology of Sport in America*, ed. Steven A. Reiss (New York: Leisure Press, 1984), 61-79.
[20] Guttmann, *From Ritual to Record: The Nature of Modern Sports*.
[21] Ibid., 26.

keeping records and implementing rules and regulations. *Quantification* referred to the tendency (mirrored in wider society) to "transform almost every athletic feat into one that can be quantified and measured."[22] The final trait was keeping *records* where a combination of the impulse to quantify was coupled with the desire to win and be the best which resulted in the notion of being a record holder. Indeed, the pursuit of records replaced the need to gain favor with the Gods, and in doing so provided its own "uniquely modern form of immortality."[23]

Sport historian Melvin Adelman drew partly upon the analytical framework of Guttmann in his appraisal of the rise of modern athletics. Moreover, he refined Guttmann's work by identifying 1820 to 1870 as the key period in which the transformation of American athletics from premodern to modern took place. Adelman isolated six defining characteristics of modern sport. Organization, rules, role differentiation and records were similar in nature to Guttmann's bureaucratization, specialization and records. However, Adelman also identified the increasing role of public information (reports in newspapers, national sports journals, specialized magazines and guidebooks) and the transition from local to national and international competition as two additional characteristics of modern sport.[24]

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[22] Ibid., 48.
[23] Ibid., 55.
[24] Adelman, *A Sporting Time: New York City and the Rise of Modern Athletics, 1820-1870*, 6.

ORIGINS OF ORGANIZED TRACK AND FIELD

The origins of organized track and field in America can be traced to various ethnic communities. In the 1840s and 1850s the Turners, who originated in Germany, created active athletic, social and cultural societies throughout the country based on the tradition of German Turnvereins (Athletic Clubs).[25] These social centers promoted exercise in schools in the form of marching, free exercises with wands, gymnastic apparatus work, organized games, dance, and track and field. The Scottish community contributed by initiating their own Caledonian Games, based on the tradition of Scotland's Highland Games. For historian Benjamin Rader, the Caledonian Games represented the "single most important promoters of track and field in the country" from the 1850s to the mid-1870s.[26] Events competed in Caledonian Games held in the United States included: throwing the hammer, putting the stone, the standing high jump, the running long jump, the running high jump, hop, step and jump, vaulting with a pole, tossing the caber, walking match (eight times round one mile) and the short race.[27]

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[25] Rader, "The Quest for Subcommunities and the Rise of American Sport," 359-361; Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 57-58.
[26] Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 56.
[27] Redmond, *The Caledonian Games in Nineteenth-Century America*, 51.

Figure 10. "The Great International Caledonian Games: New York, July 1, 1867." New York: Kelly & Whitehill, ca. 1868. Prints and Photographs Division, Library of Congress.

In 1905 Samuel Crowther and Arthur Ruhl published *Rowing and Track Athletics* that included a separate section on the history of track in America. Although the book was co-authored, Ruhl was responsible for all the information on track and field and included chapters on 1) The Beginnings of Modern Track Athletics, 2) The Organization of (Athletic) Clubs, and 3) Track Athletics in Colleges, along with technical chapters on sprinting, the distances, and the throwing events.[28] Ruhl noted that in England athletes ran and had organized track meets many years before track seriously took hold in

[28] Crowther and Ruhl, *Rowing and Track Athletics*.

America. Races were common events in county fairs and various festivals in England, Scotland and throughout Europe in the eighteenth and early nineteenth centuries**.** However, the men who participated in these early "folk" contests did not generally do much training prior to the event. However, early in the 1850s athletic clubs were formed at Oxford and Cambridge for the purpose of promoting running. By the 1860s, interest in running had increased to the point at which intercollegiate competition seemed desirable. Although there were undoubtedly some earlier races without official sanction, the first intercollegiate contest worthy of note, took place between Oxford and Cambridge universities when they competed at Christ Church field in 1864.[29]

In America during this period, except for the men who participated in the Caledonian Games and the occasional footrace held at a Turnfest or athletic festival organized by the German Turner society, most runners who competed were professionals and came from working class backgrounds. These professionals competed in races generally sponsored by tavern owners or other sporting entrepreneurs who saw in track a chance to make money by managing the gambling associated with a professional race. Professional racing in this era was not at all organized—there were no consistent distances tested, for example—rather sports promoters just set up races that fit the terrain in their area. Some races were lengthy endurance events in which men vied to see who could cover the most ground in twenty-four hours. Other races however, were based on running the length of a particular street or from one signpost outside a city to the next marker. Although long distance events were more common—and provided a longer

[29] Smith, *Sports and Freedom: The Rise of Big-Time College Athletics*, 101.

window for the placing of bets—a few races, comparable to our modern sprint events, were also held. The lack of organization and accusations of fraud with associated gambling eventually damaged the sport's credibility and contributed to the rise of amateur track and field as an alternative.[30]

During the middle decades of the nineteenth century there was not any particular system of training used by a majority of track athletes. Ruhl, in a discussion of the sprinter, George the "American Wonder" Seward, describes this as "an age when training was only guesswork and established records unknown."[31] However, as historian Joseph Turrini points out, by the late 1860s a new amateur philosophy of athletic competition began to emerge.[32] Bolstered by the Muscular Christianity movement of the mid-nineteenth century, the idea of competing in sport was increasingly seen as a desirable, character building experience. The birth of the YMCA and dozens of other athletic clubs can be traced to this sentiment which found particular favor with upper class men who began to view participation in sport—but only if it was amateur sport—as part of a young man's passage to manhood. [33]

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[30] Edward S. Sears, *Running through the Ages* (Jefferson, NC: McFarland & Co., 2001), 92-93; Ted Vincent, *The Rise and Fall of American Sport* (Lincoln: University of Nebraska Press, 1981), 43-44.
[31] Crowther and Ruhl, *Rowing and Track Athletics*, 253.
[32] Turrini, "Running for Dollars: An Economic and Social History of Track and Field in the United States, 1820-2000," 46.
[33] Muscular Christianity referred to a "form of social gospel that affirmed the compatibility of the robust physical life with a life of Christian morality and service and indeed contended that bodily strength built character and righteousness and usefulness for God's (and the nation's) work." James Whorton, *Crusaders for Fitness: The History of American Health Reformers* (Princeton: Princeton University Press, 1982), 271. For more information about the Muscular Christianity movement and its pervasiveness in society see Harvey Green, *Fit for America: Health, Fitness, Sport, and American Society* (New York: Pantheon Books, 1986), 181-215; Donald E. Hall, *Muscular Christianity: Embodying the Victorian Age* (Cambridge: Cambridge University Press, 1994); Clifford Putney, *Muscular Christianity: Manhood and Sports in Protestant America, 1880-1920* (Cambridge: Harvard University Press, 2001).

A pivotal moment in the history of amateur track and field was the formation of the New York Athletic Club (NYAC) founded in 1866 by three affluent sports enthusiasts.[34] Ruhl notes that the club's early games were considered rudimentary even by the turn of the twentieth century—as exemplified by the sprint races that were started with the tap of a drum.[35] Despite this, they stirred up a lot of interest and club membership rapidly increased. Two years later in 1868, the NYAC held and sponsored the first open track and field meet against the New York Caledonian Club, hailed as "an international match—America against Scotland."[36] In 1871 the NYAC built the first cinder path in America. The spring games of that year included five events—the 100-yard dash, the one-half mile, one-mile and three-mile runs, and the three-mile walk.[37] To illustrate the rudimentary level of performance at the time, the mile was won in a time of 5:25, almost two minutes slower than the current world record of 3:43.13.[38] Popularity increased and the first American championships took place at the NYAC in 1876. The success of the NYAC was the impetus for the formation of other clubs modeled along similar lines in the metropolis. A similar phenomenon occurred in the west but it wasn't until 1877 that amateur athletics really began on the Pacific coast.[39]

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[34] Richard Wettan and Joe Willis, "Social Stratification in the New York Athletic Club: A Preliminary Analysis of the Impact of the Club on Amateur Sport in Late Nineteenth Century America.," *Canadian Journal of History of Sport* 7, no. 1 (1976): 44.
[35] Crowther and Ruhl, *Rowing and Track Athletics*, 259.
[36] Frederick W. Janssen, *History of Amateur Athletics* (New York: 1885), 126.
[37] Crowther and Ruhl, *Rowing and Track Athletics*, 259.
[38] Pierre de Coubertin, "Official History of the First Olympic Games," *Olympic Review*, no. 152-153 (June-July 1980).
[39] Crowther and Ruhl, *Rowing and Track Athletics*, 262.

Track and field historian Roberto Quercetani in *Athletics: A History of Modern Track and Field Athletics (1820-2000)* suggests that modern athletics truly began when it became possible to ensure generally reliable, if not entirely "scientific," verdicts in timing races and measuring field event performances.[40] In the mid-eighteenth century races were timed to the second. However, by 1880 stopwatches were manufactured that could record time to within one quarter of a second. Timing with such precision was particularly advantageous for short distance events and for close finishes and serves a prime example of what Guttmann refers to as the quantification of modern sport.[41]

Collegiate track and field began in the 1860s when American students (mimicking their British counterparts) began to devote a special day to running, jumping and throwing events.[42] In 1869 the Columbia College Athletic Association held its first meet patterned on a combination of running events found at the Oxford-Cambridge university meet and field events derived from the Caledonian Games that were popular in New York City.[43] The meets that year included the 100 and 150-yard dashes, a 200-yard hurdle race, a mile walk, the standing long jump, high jump, and running long jump. In 1874 the first intercollegiate track meet was held. Undergraduates from Harvard University competed in a meet at Saratoga, New York, an event held in conjunction with the Intercollegiate Rowing Association Championships. The *Harvard Advocate* heralded the arrival of intercollegiate track by announcing "at least we have the various foot contests so well

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[40] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 12.
[41] Henning Eichberg, "Stopwatch, Horizontal Bar, Gymnasium: The Technologizing of Sports in the 18th and Early 19th Centuries," *Journal of the Philosophy of Sport* IX (1982): 43-59.
[42] Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 100.
[43] Smith, *Sports and Freedom: The Rise of Big-Time College Athletics*, 103.

known in the British Universities."[44] There were five events at the first meet in 1874—the mile, the 100-yard dash, the three-mile run, the 120-yard hurdles, and the seven-mile walk. In 1876 eleven institutions participated in collegiate track and field athletics and in the same year the Intercollegiate Association of Amateur Athletics of America (IC4A) was established. Thus, by 1885 track and field had firmly taken its place among football, baseball, and rowing as the fourth major sport contested on college campuses.[45]

EARLY NINETEENTH CENTURY TRAINING

Roberta Park notes in "Athletes and their Training in Britain and America, 1800-1914," how "American ideas and practices have been deeply, if selectively influenced by British and especially English development of sport."[46] In this chapter and the others in this dissertation, therefore, the author includes (where appropriate) details of British and other international training methods that influenced and in many cases revolutionized the training of runners throughout the world.

Walter Thom's *Pedestrianism* published in Aberdeen, Scotland, in 1813 is often credited as the first modern (post-Renaissance) book specifically devoted to athletes and their training.[47] However, *Pedestrianism* was neither an original or sustained account of training in the nineteenth century. Sir John Sinclair's massive, four volume *Code of Health and Longevity; Concise View of the Principles Calculated for the Preservation of*

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[44] Betts, *America's Sporting Heritage*, 103; Coubertin, "Official History of the First Olympic Games."
[45] Smith, *Sports and Freedom: The Rise of Big-Time College Athletics*, 99.
[46] Park, "Athletes and Their Training in Britain and America, 1800-1914," 70.
[47] Thom, *Pedestrianism*.

Health and the Attainment of Long Life (1807) had already discussed training for pedestrianism and pugilism.[48]

Figure 11. Sir John Sinclair.[49]

Sinclair's extensive work was essentially a subsection of a larger study of health and longevity that utilized responses from questionnaires that were posed to leading trainers in the late eighteenth century. Trainers were responsible for training (educating, coaching, exercising) persons or animals with the aim of enhancing performance. Sinclair's inquiries revealed that in the early nineteenth century there was little difference

[48] Sinclair, *The Code of Health and Longevity*.
[49] Image located at: http://www.electricscotland.com/history/other/sinclair_john.htm (accessed December 12, 2007)

in the training of horses, fighting cocks, greyhounds, pugilists (boxers), and runners. All were subjected to the relentless rigors of sweating, purging and bleeding that reflected the medical and sporting practices of the time.[50] Adherence to correct diet, exercise, and evacuations—along with cleanliness and adequate sleep—formed the basis for both the hygienic practices and the training regimes of athletes.

To gather information on training, Sinclair sent letters to the leading trainers of pedestrians, boxers, race horses and other animal athletes such as dogs and cocks. However, trainers responding to Sinclair's questionnaire were often unforthcoming and limited their information on specific training methods pursuant to their desire to earn a livelihood, and stay ahead of competition. Furthermore, as Park notes, trainers were usually poorly educated, their theories derived from observation, experience and word-of-mouth using the "distillations of practices used in training racehorses and gamecocks."[51] Incorporating what were largely classical conceptions of the body, nineteenth century training regimens initially drew much of their inspiration and application from the second century A.D. physician Galen and other ancient authorities.[52]

Sinclair's "Inquiries Into Athletic Exercises" yielded a wealth of information pertaining to 1) the ideal form and size of an individual, 2) the proper age to begin training, 3) the time required to achieve fitness, 4) the best medicines for athletes when needed, 5) the necessity of pure air, 6) the quantity of liquid intake for an athlete, 7) how much solid food should an athlete eat, 8) the exercises to be undertaken, 9) the amount of

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[50] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, xxxv.
[51] Park, "Athletes and Their Training in Britain and America, 1800-1914," 61.
[52] Ibid., 59.

sleep necessary, 10) miscellaneous articles, 11) diseases which training may cause, 12) the effects of training upon the body, 13) the effect of training on the mind, 14) the duration of the effects of training, and 15) how to utilize such advice.[53]

For Sinclair, eighteen was the earliest age in which an individual should begin training for a running or boxing match and two to three months was the time frame necessary to "bring a man into good plight." Three months was required if a man was considered "fleshy" or overweight.[54] Classical theories of *alimentation* (nourishment) advocated an initial preparation of the body to receive food. Purging, vomiting and bleeding (often omitted for athletes requiring strength) were the standard means to help rid the body of noxious material.[55] The initial task of the trainer therefore, was to attend to the state of the athlete's bowels. This was achieved by administering an emetic and then a series of three "physics" or medicines (preferably Glauber's salts) that were spread over a four-day period. The combination was supposed to "clear any man of all the noxious matter he may have in his stomach and intestines."[56]

After the physicking, regular exercise began. Sinclair declared that trained men should begin their exercises early in the morning, beginning at five o'clock in the summer and half past six o'clock in the winter or as soon as it was light. The object of the exercise was to produce profuse sweating sufficient to "take off the superfluities of flesh

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[53] Sinclair, *The Code of Health and Longevity*, 2-23.
[54] Ibid., 3.
[55] Park, "Athletes and Their Training in Britain and America, 1800-1914," 63.
[56] Sinclair, *The Code of Health and Longevity*, 4.

and fat." This action was thought to reduce the quantity of blood by making it thinner thereby enhancing an athlete's strength and "wind" (cardio-respiratory fitness).[57]

Athletes training for the "foot-race" ran for three miles twice a day. Sweating to decrease excess weight was further encouraged by placing the athlete between feather beds and getting them to drink warm drinks. This was performed three times every couple of days followed by rubbing with a flannel and staying indoors until cool. After the runs, moderately-active exercise such as cricket and quoits was encouraged.[58]

Physiologically the object of training was to improve the respiratory capacity, or "wind," of the athlete. Training improved the ability to inspire, to hold the breath longer and to recover it sooner after a bout of exercise. A man was said to have good "wind" if his power of respiration was maintained during a run or boxing bout. In terms of recovery Sinclair stressed the importance of rest, going to bed early and getting a necessary eight hours of sleep each night. In justifying these practices, he referred to the ancient athletes who "were permitted to sleep as many hours as they chose."[59]

Linked to the classical conception that skin condition reflects the physical health of an athlete Sinclair believed that there was no part of the body which training has a greater effect on than the skin, and as a result, the skin becomes clear, smooth and well-colored. According to Sinclair, training also had a positive influence upon the mind by improving the attention span, heightening perceptual acuity and providing a general mental outlook that was brighter and preserved later into life. Alluding to the possible

[57] Ibid., 11-12.
[58] Ibid.
[59] Ibid., 13.

effects of overtraining, Sinclair felt that any loss of muscle mass was deemed a signal to decrease the intensity of training.[60]

Sinclair's investigations revealed general agreement on training methods that focused mainly on preparation for wager-based, endurance-type events. Sinclair concluded his study by referring to the prophylactic qualities of exercise. He felt that by participating in boxing, fencing and other athletic exercises "there is every reason to believe that…a foundation of health and strength may be laid in youth that will be found of infinite consequence in every future period of life."[61]

Walter Thom's *Pedestrianism* (1813) echoed the training methods advocated by Sinclair while extolling the physical virtues of Captain Barclay Allardice, the sixth Laird of Ury, a notable Scottish walker of the early nineteenth century.[62] Barclay's most famous feat of human endurance entailed walking 1,000 miles in 1,000 hours for a prize of 1,000 guineas. Captain Barclay wrote a chapter entitled "On Training" in *Pedestrianism* which offered personal advice on preparing for pedestrian events. Pedestrianism, or walking races, as they were then termed, predated amateur athletics by at least two hundred years and took the form of four different types: match racing, challenges involving time and distance, handicapped races and handicapped races that were incorporated into rural games such as the Highland or Lakeland Games.[63]

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[60] Ibid., 12.
[61] Ibid., 23.
[62] Thom, *Pedestrianism*.
[63] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, xxxi.

Figure 12. Captain Barclay from the inside cover of Walter Thom's *Pedestrianism* (1813).

Barclay recommended a course of physicking prior to a gradual increase in intensity of exercise in the lead up to competition. To prepare the athlete for a "match," a total of twenty to twenty-four miles per day were recommended. Specifically the athlete should:

> . . . rise at five in the morning, run half a mile at the top of his speed up-hill and then walk six miles at a moderate pace, coming in about seven to breakfast, which should consist of beef-steaks or mutton chops under-done, with stale bread and old beer. After breakfast he must again walk six miles at a moderate pace and at twelve lie down in bed without his clothes for half an hour. On getting up he must walk four miles, and return by four to dinner, which should also be beef-steaks or mutton-chops, with bread and beer as at breakfast. Immediately after dinner he must resume his exercise by running half a mile at the top of his speed and walking six miles at a moderate pace. He takes no more exercise for that day but retires to bed about eight and next morning proceeds in the same manner.[64]

This routine was recommended for a period of three to four weeks without a hint of variation or even a day off. After four weeks the athlete undertook a weekly sweat that consisted of a four-mile run (done as quickly as possible) followed by the administration of a "sweating liquor." This concoction consisted of one ounce of caraway-seed, one ounce of licorice root, half an ounce of coriander seed and half an ounce of sugar candy mixed with two bottles of cider boiled down to half of the volume. The runner was then put to bed and wrapped in six to eight pairs of blankets for twenty-five to thirty minutes. He then walked gently for two miles and returned for breakfast which consisted of a

[64] Thom, *Pedestrianism*, 229-230.

roasted fowl. At the end of two to three months training the athlete was deemed to be in peak physical condition, and ready for competition.[65]

Barclay's training focused on what today would be termed ultra-endurance walking. His grueling program was clearly effective in allowing him to average one mile per hour over the course of one thousand hours. However, competitive race walkers and ultra-endurance walkers nowadays use much greater variation in the volume and intensity of their training in an effort to enhance performance. For example, many of today's walkers raise the intensity of their training by incorporating "intervals" (which will be covered in greater detail in Chapter Three) that alternate specific periods of work with rest.[66] Indeed, in 2003 six individuals (including Sharon Gayter—Great Britain's top female twenty-four-hour runner) raised money for charity by replicating Barclay's feat and walking (or running) a mile every hour for 1,000 miles. Not content with this accomplishment, at the end of 1,000 miles each volunteer competed in and finished the 2003 London Marathon.[67]

In relation to fluid replacement, both Sinclair and Thom were adamant concerning the restriction of fluids necessary to acquire strength. For Sinclair "there is no circumstance that seems to be more essential in training up persons to the acquisition of

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[65] Ibid., 231.

[66] Jeff Salvage et al., "Racewalking," in *USA Track and Field Coaching Manual*, ed. Joseph L. Rogers (Champaign, Ill.: Human Kinetics, 2000), 281-286. Additional information taken from The Athletics Congress, Coaching Education: Endurance Events course notes written by Jim Crakes, Lou Duesing, Joe Vigil, Gary Wilson and Fred Wilt from the personal collection of Coach Dan Pfaff. No date given.

[67] Richard A. Swanson and John D. Massengale, "Exercise and Sport Science in Twentieth Century America," in *The History of Exercise and Sport Science*, ed. Richard A. Swanson and John D. Massengale (Champaign, Ill.: Human Kinetics, 1997).

strength than to permit them to take only a small quantity of liquid food."[68] Sinclair noted that although the ancient Greeks had allowed the drinking of water "in modern times water alone is never given during training."[69] Too much liquid was thought to swell the belly and be bad for the wind. It was also thought to take up too much space (better used for solid food) and encouraged the acquisition of "soft unhealthy flesh."[70]

The training methods advocated by Captain Barclay, although firmly rejected by amateurs and scholars in the second half of the nineteenth century, survived well into the twentieth century—as reflected by the teachings of renowned track and field coaches such as Samuel Mussabini, author of *The Complete Athletic Trainer* (1913) and portrayed in the 1981 Oscar winning film *Chariots of Fire*.[71] Furthermore, as Tom McNab, Peter Lovesy and Andrew Huxtable highlight in their appraisal of track and field literature, Barclay's influence lasted well into the twentieth century and can best be ascribed to his personal success as a match-racer and to the training of the pugilist Thomas Cribb (the English bare-knuckle champion from 1809 to 1822) rather than to any originality or efficacy of his method.[72]

THE EMERGENCE OF SCIENTIFIC TRAINING

By the last quarter of the nineteenth century attitudes regarding athletics and training had undergone significant changes. The traditional methods employed by

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[68] Sinclair, *The Code of Health and Longevity*, 6.
[69] Ibid.
[70] Ibid., 7.
[71] Samuel A. Mussabini, *The Complete Athletic Trainer* (London: Methuen, 1913).
[72] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, xxxvi.

Captain Barclay and the professional trainers who copied his methods were increasingly challenged by a university-based amateur movement and the advancing role of physical education as an academic discipline and science.

In 1855, William H. Byford of the Chicago Medical College published a seminal paper on the physiology of exercise and in the 1860s chemist Justus Von Liebig and physiologists such as Claude Bernard advanced new concepts regarding the role of metabolism.[73] David Martin, Professor of Physiology at Georgia State University, Atlanta, notes in "Physiology—Its Role in Explaining Athletic Performance," that Claude Bernard's notion of homeostsasis (the maintenance of the body's internal environment) was the first fundamental concept that identified physiology as a discipline.[74]

In 1863, Charles Westhall, a professional walker, compared the "old method" (i.e. physicking and sweating) with the "new rules of training." Westhall advised beginning with more "gentle purgative medicines" to clear the stomach and bowels. He also advocated a more specific approach to training, adjusting both the intensity and duration of exercise, and tailoring the exercise to the individual—"the same amount of work and strict regimen is not requisite for a sharp burst of a hundred yards or so, that is required…in preparation for the more arduous struggle of a mile's duration."[75]

In 1865, Archibald Maclaren, proprietor of a private gymnasium in Oxford, England, published *A System of Physical Education* and in 1866 *Training in Theory and*

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[73] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 368.
[74] David E. Martin, "Physiology: Its Role in Explaining Athletic Performance," *New Studies in Athletics* 10, no. 1 (1995): 9-12.
[75] Charles Westhall, *The Modern Method of Training for Running, Walking, Rowing, and Boxing, Including Hints on Exercise, Diet, Clothing, and Advice to Trainers*, 7th ed. (London: Ward, Lock and Tyler, 1963), 21-43.

Practice.[76] Maclaren had studied medicine in Paris and was widely recognized as an authority on the "scientific study" of physical education. In his books Maclaren questioned almost every training system in vogue. In particular, he questioned the use of purgatives at the commencement of training and declared all medicines to be "virtually poisons since they were calculated to change normal functions." Maclaren deemed it remarkable that men were able to stand up to continual purging, vomiting, forced "sweatings," restricted liquid and eating semi-raw flesh. It was these practices he felt, and not exercise, which caused the athlete to "fall to pieces." In the preface to the second edition of *Training in Theory and Practice* (1874) Maclaren asserted that "The mischievous habit of amateur physicking is being abandoned, and the dangerous custom of forced perspiration, undertaken to exorcise the demons of 'internal fat' and 'loose flesh,' may be said to be discarded."[77] Furthermore, exercising while wearing layers of heavy clothing Maclaren affirmed could reduce weight through perspiration, but it did not affect fatty tissue. Directly linked to the practice of forced sweating was Maclaren's vehement objection of the long-standing belief that athletes should be denied water. He argued just the opposite—they should be allowed to drink as much of it as they wished in order to replace the fluid lost in perspiration and expiration.[78] Despite Westhall's and Maclaren's recommendations and the fact that the term "scientific training" appeared with increasing regularity from 1870 onwards, most training methods at the end of the

[76] Maclaren, *A System of Physical Education, Theoretical and Practical*; Maclaren, *Training in Theory and Practice*.
[77] Archibald Malaren, *Training in Theory and Practice*, 2nd ed. (London: Macmilan and Co., 1874), iii-iv.
[78] Maclaren, *Training in Theory and Practice*, 74-79.

nineteenth century continued to rely heavily upon the accumulated experience and folklore of successful athletes and trainers.[79]

THE ORGANIZATION OF SPORT AND PHYSICAL ACTIVITY (1885-1917)

The period between 1885 and 1917 is regarded by Betty Spears and Richard Swanson, authors of *History of Sport and Physical Education in the United States*, as an era in which sport and physical activity proliferated and became increasingly "organized."[80] The United States experienced continued growth in the cities, mass immigration, increased industrialization, improved transportation and a widening in the gap between the wealthy and the poor.[81] "The "Gilded Age" saw industrialization and technology transform every aspect of people's lives. Greater free time and the need to escape the monotony of factory work meant playing and watching sport took on a much greater role in relieving the strains of everyday life.[82]

As the country grew in the 1880s, so did the need for public education. Curriculums expanded to include sciences, art, manual training, cooking, sewing, commercial skills and physical education.[83] In 1885 William G. Anderson organized the

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[79] Park, "Athletes and Their Training in Britain and America, 1800-1914," 70.
[80] Spears and Swanson, *History of Sport and Physical Activity in the United States*, 151.
[81] Ibid., 189.
[82] Douglas A. Noverr and Lawrence E. Ziewacz, *The Games They Played: Sports in American History, 1865-1980* (Chicago: Nelson Hall, 1983), 38; David K. Wiggins, ed., *Sport in America: From Wicked Amusement to National Obsession* (Champaign, Ill.: Human Kinetics, 1995), 117-119. Note: The term Gilded Age comes from a novel of the same name published in 1874 by Mark Twain and Charles Dudley Warner which though fictional was a critical examination of politics and competition in the United States during the nineteenth century. Mark Twain and Chares Dudley Warner. *The Gilded Age: A Novel* (London: G. Routledge, 1874).
[83] Mabel Lee, *A History of Physical Education and Sports* (New York: Wiley, 1983), 79-86. See Chapter Six: Organized Physical Education in the Latter Nineteenth Century.

American Association for the Advancement of Physical Education (AAAPE), instrumental in the professionalization of physical education.[84] Physical education programs for men and women varied considerably but the general trend between 1885 and 1917 was a decrease in gymnastics and formal exercise systems and an increase in organized sport.[85]

By 1880 intercollegiate sport formed a vital part of college life on most college campuses in the East and in a growing number in the South.[86] Concern in 1905 over the number of injuries in football and excessive class absences due to playing sport resulted in the formation of the Intercollegiate Athletic Association of the United States (IAAUS). The association which changed its name in 1910 to the National Collegiate Athletic Association (NCAA) sought to oversee management and raised ethical standards in college athletics. Once academic institutions had formally adopted intercollegiate athletics for men, a need for coaches, athletic directors and other administrators arose, reinforcing the shift in emphasis away from gymnastics and towards organized sport.[87]

In summary, by the beginning of World War I sport had become institutionalized in American life as a major entertainment industry (both in the professional and amateur sectors), a means of promoting good health and moral values, and as an acceptable way to spend leisure time. In this new era organized sports began to achieve as Benjamin

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[84] Roberta J. Park, "Science, Service and the Professionalization of Physical Education: 1885-1905," *The International Journal of the History of Sport* 24, no. 12 (December 2007): 1674-1700.
[85] Swanson and Massengale, "Exercise and Sport Science in Twentieth Century America," 2-3.
[86] Betts, *America's Sporting Heritage*, 101-104.
[87] Wiggins, ed., *Sport in America: From Wicked Amusement to National Obsession*, 117-119.

Rader notes, an "institutional permanency and prominence in American life in some ways equal to that of business, politics, ethnicity, race or religion."[88]

THE GROWTH OF TRACK AND FIELD

Track and Field grew steadily during this period and thrilling dual meets took place in the East among Harvard, Princeton, Yale, Pennsylvania and Columbia.[89] The Amateur Athletic Union (AAU) was founded in 1888 to establish standards and uniformity in amateur sport and in 1895 the University of Pennsylvania established the Pennsylvania Relays—the oldest and largest annual track and field event in the United States.[90]

The year 1896 saw the inauguration of the modern Olympic Games, the inspiration and brainchild of Baron Pierre de Coubertin—a French pedagogue and founding member of the International Olympic Committee (IOC), who served as its president from 1896 to 1925.[91] Although the IOC does not officially recognize national medal tables, American track and field athletes dominated the 1896 Athens Olympics, winning nine out of twelve events. Thomas Burke of Boston doubled, winning the 100 meters in a time of 12.0 and the 400 meters in 54.2.[92] Despite placing second in the overall medal tally during the unofficial 1906 Athens Olympics and the 1908 London

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[88] Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 114.
[89] Crowther and Ruhl, *Rowing and Track Athletics*, 266-282.
[90] Turrini, "Running for Dollars: An Economic and Social History of Track and Field in the United States, 1820-2000", 23-24; Whorton, *Crusaders for Fitness: The History of American Health Reformers*.
[91] Coubertin, "Official History of the First Olympic Games," 324-340. Coubertin analyzes the birth of the Olympic Games and proposes that the idea for their revival in 1896 was the logical culmination of a great movement in which physical exercise became popular everywhere during the 19th century.
[92] Wallechinsky, *The Complete Book of the Olympics*, 1.

Olympics, the United States continued their dominance in track and field—convincingly winning more gold medals than any other nation in each of the successive Olympics from 1900 until 1912.[93]

In the Stockholm Olympics of 1912, the United States claimed fifty percent of the gold medal tally by winning sixteen of the thirty-two track and field events. The Olympics that year showcased the outstanding performance of Native American, Jim Thorpe who won both the pentathlon and decathlon by hefty margins, setting world records in both events. However, a year later he was removed from the Olympic roll of honor after it was revealed that he had earlier broken the Olympic amateur charter by receiving payment for playing minor league baseball. Thorpe, an athletic all-rounder of Native American, French and Irish descent went on to play both professional baseball and football and is often considered the greatest athlete in history.[94]

[93] Wallechinsky, *The Complete Book of the Olympics*, xiv.
[94] Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 203; Peter Levine, *A.G. Spalding and the Rise of Baseball* (New York: Oxford University Press, 1985).

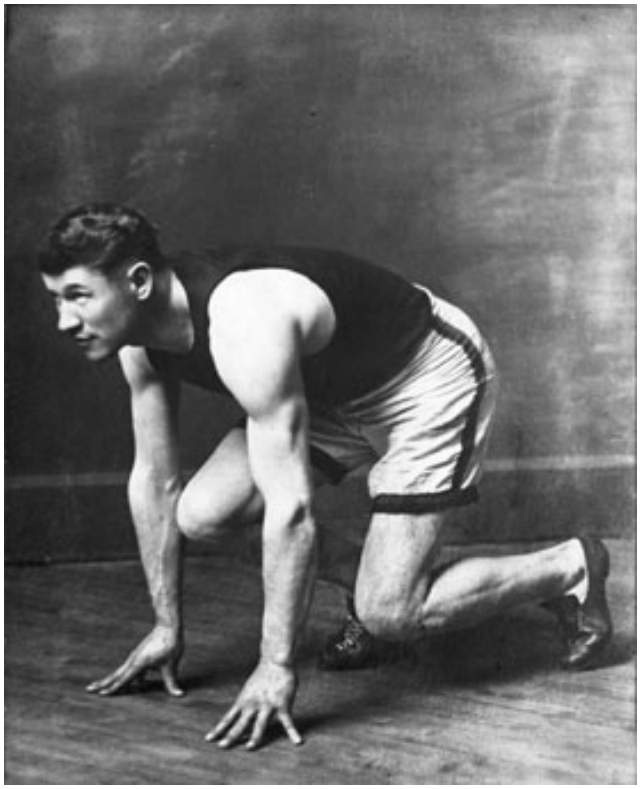

Figure 13. Jim Thorpe.[95]

THE COACHES AND THEIR LITERATURE

In 1885 Albert G. Spalding, one of the earliest stars of professional baseball, who proceeded to manage and eventually own the Chicago White Stockings, established the *Spalding Library of American Sports*.[96] The "Library" which started as a thirteen volume series in 1885 aimed to provide up-to-date information on training methods, techniques and records, as well as to advertise Spalding's expanding athletic equipment business. The Library was later reorganized as the Spalding's Athletic Library and contained over

[95] Image located at: http://home.epix.net/~landis/thorpe.html (accessed June 10, 2007)

[96] James C. Schneider, "Review of A. G. Spalding and the Rise of Baseball: The Promise of American Sport by Peter Levine," *Journal of Sport History* 3 (1985): 275-277. Note: Earlier, in 1876, Spalding and his brother Walter founded the Spalding sporting goods firm which secured their fortune and preserved their family name to this day.

three hundred separate publications on sport and physical activity.[97] The 1898 handbook of the Western Intercollegiate Athletic Association entitled *How to Train* provided a pertinent example of a Spalding publication.[98] The handbook was produced in response to "constant enquiries which have come to the Secretary of the Western Intercollegiate Amateur Athletic Association which have shown a need of some definite reliable information concerning the best methods of training for the separate events."[99] Ed W. "Dad" Moulton, Head Track and Football Coach at the University of Minnesota was responsible for the chapter on "General Training." He offered the following advice, "it is quite impossible to lay down any hard and fast rules to train by, as no two men need exactly the same amount of work, nor do we coach them alike, on account of disposition, build and ability to learn."[100] However, Coach Moulton provided some general advice on the importance of avoiding overtraining, or "overwork" as it was then called, by making training pleasurable—"rather train too little than too much."[101] His advice on training is sensible and bears remarkable resemblance to the advice given by Epictetus, nearly two thousand years ago in that Moulton cautioned, "One must sleep, eat and exercise according to a schedule." Moulton recommended a combination of old and new school measures. Instead of rising at dawn he proposed rising at 7:00 or 7:30 A.M. and

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[97] Levine, *A.G. Spalding and the Rise of Baseball*, 82. Ben Lisle, "A.G.Spalding," American Studies at the University of Virginia, http://xroads.virginia.edu/~HYPER/INCORP/baseball/spalding.html (accessed May 22, 2005).
[98] *How to Train: Handbook of the Western Intercollegiate Athletic Association*, (New York: American Sports Publishing Co., 1898).
[99] Ibid., 50.
[100] Ed W. Moulton, "General Training," in *How to Train: Handbook of the Western Intercollegiate Athletic Association* (New York: American Sports Publishing Co., 1898), 51.
[101] Ibid.

postponing exercise until after breakfast. With regards to sprinting, Moulton wrote, **"**The sprinter should jog at least two weeks before going on the mark to practice starting, and never go to the mark without a warm-up…the sprinter requires the finest training of all and is most liable to change in his trials—or go stale quick. Care should be used not to overwork…from four to seven shots [efforts] from the mark per day, with a 20 yard spin [run] each time and a rest between and one trial per week is quite enough."[102]

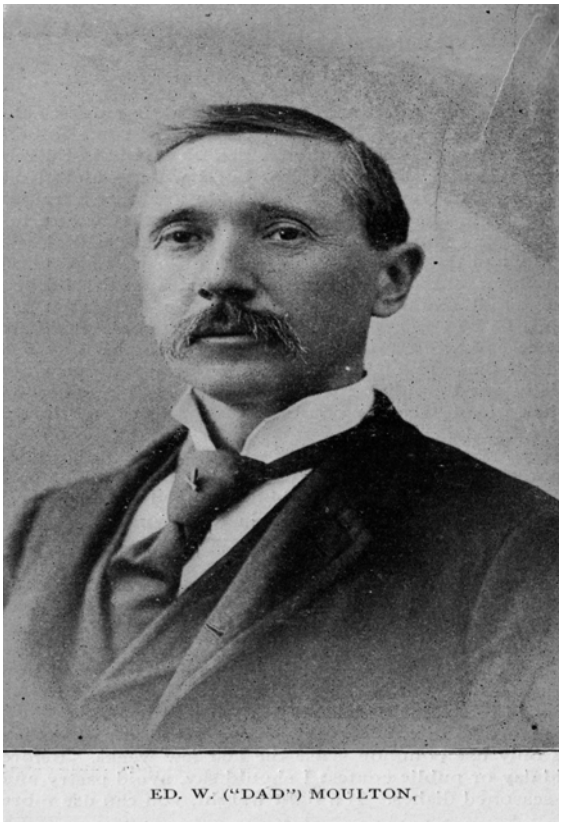

Figure 14. Ed. W, "Dad" Moulton.

[102] Ibid., 53.

Besides Moulton, Spalding recruited a number of other physical educators, athletes and coaches to write for and give status to his publications. One such example was renowned track and field coach Michael Murphy (1861-1913). Born on 28 February 1861, in Worcester County, Massachusetts, Murphy coached at Yale University prior to moving to the University of Pennsylvania where he became head track coach. His Yale and Pennsylvania teams won fifteen Intercollegiate Association of Amateur Athletes of America (IC4A) titles and as coach of the New York Athletic Club claimed ten national AAU team titles. He was the unofficial United States head coach at the 1900 Olympic Games where the US team finished first in the unofficial medal table. He also coached the 1908 and 1912 Olympic teams which finished second and first respectively.[103]

With over thirty years of experience in track and field and an inherent ability to assimilate science with coaching, Murphy was lauded by several sources (including Spalding's *Athletic Library*) as "the foremost authority in the world on all kinds of athletic training."[104] Murphy, a former competitive track athlete stated "when I was a sprinter every fellow trained himself."[105] Trying to avoid and learn from the mistakes of others he then spent the next twenty-five years studying all aspects of track and field athletics. "I wanted to know what kind of food was best for the athlete, how much work he should do to get the maximum speed if he were a runner, and how to add a few inches to his jumps or weight throwing."[106] In his relentless search for knowledge Murphy

[103] USA Track and Field, "USA Track and Field Hall of Fame: Michael Murphy," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=117 (accessed November 22, 2005).
[104] Park, "Athletes and Their Training in Britain and America, 1800-1914," 93.
[105] Murphy, *Introduction to Athletic Training*, vii.
[106] Ibid.

enrolled in a two-year medical course at the University of Pennsylvania after which it was rumored that he understood the human body as well as any physician.[107]

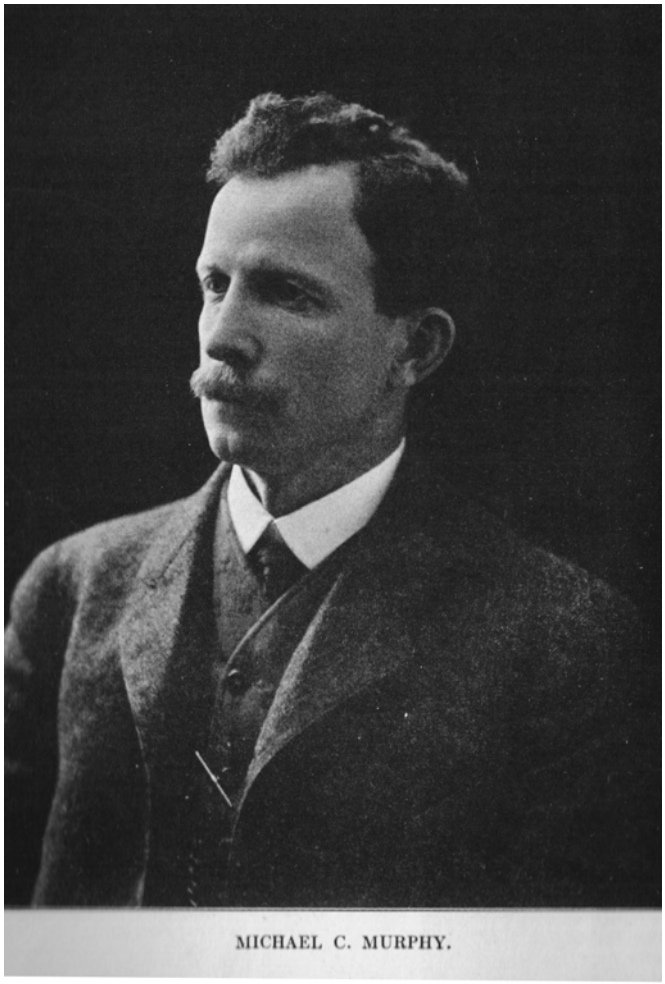

Figure 15. Michael Murphy from *Introduction to Athletic Training* (1813).

Technically, Murphy was particularly knowledgeable in the sprints and is credited with the invention of the crouch start first introduced in 1887 by Charles H. Sherrill at

[107] Park, "Athletes and Their Training in Britain and America, 1800-1914," 93.

Yale.[108] Murphy's specific recommendations for physical conditioning were simple, and resembled the non-naturals proposed by Galen in the second century A.D. He emphasized cleanliness, deep-breathing, adequate sleep (at least eight hours), bathing, massage and simple calisthenics. Eight to ten weeks of training was deemed sufficient preparation for any event and "no person should train severely for a longer period than this."[109]

A practical example of one of Murphy's training programs is provided by his chapter on "The One-Mile and Two-Mile Runs."[110] Murphy believed the best preparation for the mile consisted of cross-country running in the fall and winter periods. Mileage was controlled, starting with short runs and progressing to three or more miles. If an athlete was unable to spare the necessary time for preliminary cross-country training Murphy advised starting gradually with easy runs interspersed with walking for recovery. After two weeks the pace was increased and a half-mile effort in approximately 2:20 was recommended. At about the third or fourth week some longer runs were introduced—as much as two miles or more, twice a week that gave the "necessary endurance and confidence...to run the full mile."[111] Finally, in addition to the longer runs, Murphy advocated the inclusion of a few quarter-mile runs at full speed and perhaps one time-trial per week over the full mile.

Analysis of Murphy's program reveals very general instructions pertaining to the progression of training volume and intensity. Murphy's mileage recommendations are conservative and can be considered extremely "light" compared to modern day, year-

[108] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, 99.
[109] Murphy, *Introduction to Athletic Training*, xx.
[110] Ibid., 60.
[111] Ibid., 65.

round distance training practices that advocate up to one hundred (or more) miles per week.[112] Murphy's suggestions also reflect the amateur status of athletics at the time, and the commonly held view that "overexertion" was the athlete's greatest danger.

In 1914, Paul Withington, a physician and former rower and wrestler at Harvard University edited a non-Spalding publication—the *Book of Athletics.*[113] Withington updated Norman Bingham's 1895 *Book of Athletics and Out-of-Door Sports* which he felt had become obsolete because of the tremendous spread of knowledge and increased participation in sport in the preceding twenty years. Like Sinclair, a century earlier, Withington turned to those involved in sport and asked them to share their methods. He included articles written by players, captains, coaches, and athletic trainers about training regimens and techniques for thirteen sports. Withington himself contributed the chapters on football and track. The book was particularly aimed towards young developing athletes at the high school and collegiate level. For Withington, "there is probably no factor in connection with athletic events which has been so wrongly interpreted as that of training."[114] Withington's conception of training was simple—it "merely meant getting the body and mind, which is fully as important in all contests as the body, into the best possible condition to undergo the strain of competition."[115]

Like his predecessors Withington warned of the dangers of excessive hard exercise. He felt it took "very little extra work to get a young active boy into good physical shape" and once conditioned, "very little work is required to keep him there,

[112] Lydiard and Gilmour, *Run to the Top*, 22.
[113] Paul Withington, *The Book of Athletics* (Boston: Lothrop, Lee and Shephard and Co., 1914).
[114] Ibid., 11.
[115] Ibid., 12.

whereas a great amount is sure to send them to the line stale."[116] All in all, Withington felt that "an hour a day of fairly active work" of any sort was enough to get an athlete into shape and "never should the day's work be so long as to leave the athlete exhausted."[117] Withington's advice, like Coach Moulton's before him, encapsulated the basic ingredients of training where "the rules of training we find sane and simple. Regular hours of work and sleep, good, plain food, a minimum of excitement and unusual strain and a moderate amount of well directed exercise."[118]

Keene Fitzpatrick, trainer for Princeton University and former trainer at the University of Michigan, was responsible for the chapter on distance running. His approach to training was conservative, advising against any type of distance running until boys reached the age of sixteen, for fear of overexertion and injuring their hearts and lungs.[119] He recommended a steady, individualistic approach to running, starting with cross-country walking and then gradually introducing periods of running until the athlete was able to comfortably complete the distance (or a little over) of their chosen event. Once the athlete achieved this milestone it was time to switch focus to speed training. However, "The time for doing this all depends on the man," Fitzpatrick wrote, for "he knows best."[120]

With such an individualistic approach, and a lack of specific training advice it is difficult to analyze Fitzpatrick's program. The speed, volume and intensity of training all

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[116] Ibid.
[117] Ibid., 13.
[118] Ibid., 16.
[119] Ibid., 178.
[120] Ibid., 184.

increase in preparation for an event, but Fitzpatrick's training program clearly lacks a systematic approach to training. This is reflected by his statement that "A trainer may have a squad of a dozen milers. Should he give them but one set of rules, it is likely that not more than one of the twelve would derive any great benefit from following them."[121] Despite these limitations, Fitzpatrick offered insightful advice regarding the need for rest that bears remarkable resemblance to the "hard-easy" approach to training recommended by legendary University of Oregon coach and co-founder of Nike Corporation, William Bowerman in the 1960s. Fitzpatrick wrote, "Even when you are feeling in the best of condition do not exert yourself day after day. Run your distance two or three times each week, then take things easier for a day or two."[122]

Across the Atlantic, Frederick Annesley Michael Webster, author of *Olympian Field Events* (1913), ascribed the international success of American athletes to inter-collegiate competitions and a lack of professional coaches in England. Webster's prescription for improvement included "the use of scientific methods which are used by athletes of other nations."[123] Although Webster outlined the technical preparation required for each field event (including the tug-of-war) he failed to include any information or chapters specifically related to training and conditioning.

Tom McNab (former British Olympic Coach, 1972-1976), Peter Lovesy and Andrew Huxtable, authors of *An Athletics Compendium: An Annotated Guide to the UK Literature of Track and Field*, highlight the problems facing authors of track and field

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[121] Ibid., 177.
[122] Ibid., 185.
[123] Frederick Annesley Michael Webster, *Olympian Field Events: Their History and Practice* (London: George Newnes, 1913), 5.

manuals during the late nineteenth and early twentieth century. Athletics is not an individual sport; rather it is a series of sports which happen to occur in the same arena. Therefore, although requested by publishers, few authors were able to do justice and offer the expertise and advice relating to all track and field events.[124]

Some authors such as Samuel Mussabini in *The Complete Athletic Trainer* (1913) acknowledged their relative lack of expertise in certain events.[125] The most successful British coach of the first half of the twentieth century, Mussabini coached Albert V. Hill to two gold medals (800 and 1,500 meters) in the 1920 Olympic Games and helped Harold Abrahams win the 100 meters in the 1924 Games. Despite these achievements and Archibald Maclaren's earlier recommendations against the use of physicking, Mussabini's approach to training was rooted firmly in the nineteenth century. He believed that "the trainer's medical knowledge will enable him to give his charge some good clearing physic and later keep him in regular habits and stomach cleanliness."[126] Indeed, even as late as 1924 in *Track and Field Athletics,* Mussabini included a detailed recipe for "Black Jack," a laxative designed to clear the most sluggish of bowels.[127]

From a technical viewpoint, Mussabini conceded that during sprinting the forces are so rapid that "they are most difficult to follow."[128] This may explain his misguided advice that sprinters should turn their hands inwards so the knuckle-joints face one another to allow the arms to swing across the body in a so-called "cross-arm" action.

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[124] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, xxxv-xxix.
[125] Mussabini, *The Complete Athletic Trainer*.
[126] Ibid., 137.
[127] Samuel Mussabini, *Track and Field Athletics: A Book How to Train* (London: Foulsham, 1924).
[128] Mussabini, *The Complete Athletic Trainer*, 14.

Mussabini offered the following particularly erroneous advice to the nervous athlete who continued to under-perform. "Before he goes out on the track give the nervous athlete a good brisk hand-rubbing…then hit him on the nape of the neck with a sponge saturated in the coldest water procurable. If these methods do not prove sufficiently soothing then (as a last resort) give him a wineglassful of a good port wine and brandy mixed or old ale. For a sprinter who is known to lack confidence and regularly fail to show his proper running, a tumbler of good champagne has often worked wonders."[129] With the combination of Mussabini's "cross arm" sprinting action and the consumption of alcohol prior to the race it is surprising that his athletes were able to stay in their designated lanes, let alone win their races! Although Mussabini clearly lacked technical knowledge and subscribed to archaic professional training methods he still had an excellent coaching record at the international level. This is because, as Tom McNab and colleagues note, the rigorous training methods geared towards professional match racing used by Mussabini at a time when amateur runners were "lightly conditioned" were bound to produce results.[130]

[129] Ibid., 151.
[130] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, xxxviii.

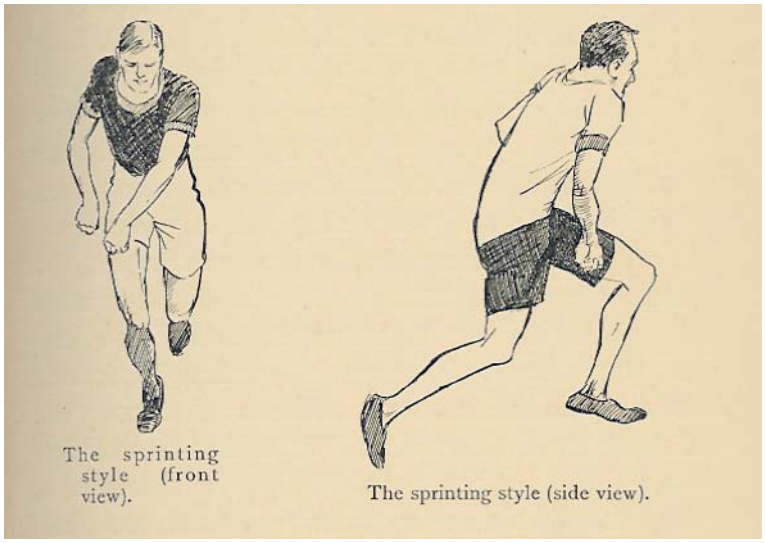

Figure 16. Illustrating the misguided "cross-arm" sprinting action advocated by Mussabini.

Kenneth Doherty, Olympic bronze medalist in the 1924 decathlon, esteemed coach at the University of Pennsylvania (1948-1961) and track and field instructional author, summarized the development of track knowledge between 1885 and 1920 in his 1976 *Track and Field Omnibook*.[131] The first chapter of Doherty's comprehensive five hundred-plus page text was specifically devoted to "The Development of Track Knowledge." According to Doherty, during the latter part of the eighteenth and early part of the nineteenth century, athletic training and the execution of track and field techniques were based on long-held fads, or folklore. Progress was more connected to trial and error than the application of a systematized approach to training. Exchange of training information was limited as athletes had very little knowledge of what was taking place outside their own sporting environment. What information there was tended to focus on

[131] Doherty, *Track and Field Omnibook*, 3-6.

the accomplishments of athletes rather than detailed, instructional features on how to train or improve technique. Doherty provides a telling example of how the lack of communication and dissemination of training knowledge manifested itself during this period. In 1912 George Horine of Stanford set a world record of 6'7" in the high jump using a technique that came to be known as the Western Roll. However, even a decade later, Horine's style was little known nationally. It wasn't until Harold Osborne of Illinois cleared 6'8" and won the 1924 Olympic title on the world stage that the style gained general acceptance. Osborne even claimed to be the originator of the style, unaware of Horine's innovation before him. [132]

In summary, the training advocated by coaches between 1885 and 1917 can be considered extremely light compared to today's year-round training regimes. Preparation for an event was short—lasting up to a maximum of eight to ten weeks. Training advice was general in nature, lacked detail, and coaches tended to be cautious in their exercise recommendations for fear of "overexertion." Technically, events were still evolving, particularly in the field events area and there was little sharing of knowledge in the track and field community. Even as late as the1920s Doherty notes that books on track and field were few in number, limited in content, and lacking the advertising means to make them available to coaches around the country.[133] It is not surprising therefore, that under these circumstances of restricted knowledge and light conditioning that performances were meager compared to today's standards.

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[132] Ibid.
[133] Ibid.

THE ATHLETES

In 1959, Fred Wilt, two-time Olympian (1948 and 1952) in the 10,000 meters and former editor of *Track Technique*, published *How They Train*.[134] Its purpose was to fill a void in track and field literature by disseminating empirical training knowledge "by describing the actual workout programs of great athletes from 1900 to the present time."[135] It included the training regimens and recollections of numerous world class runners ranging from Joe Binks, who established the world record in the mile in 1902, to 1950s world mile record holder, Herb Elliot of Australia. One criticism leveled at reporting training regimens is the tendency for athletes to exaggerate their accomplishments and provide the hardest workouts of the year as a general representation of their training. However, this is extremely unlikely during this period of "light conditioning." Nonetheless, this tendency should be borne in mind, particularly later in the twentieth century, when athletes could potentially gain an advantage of perceived invincibility over their opponents by reporting particularly impressive workouts**.**

Although information on individual athlete's training programs between 1885 and 1917 is relatively limited, Wilt's commendable text does provide a couple of telling examples of the structure of training at the turn of the twentieth century. In 1902, the Englishman Joe Binks established a world record time of 4:16.8 for the mile, which remained the British record for twenty years. Reflecting on his training during this period, the self-coached Binks observed, "I never did any warm up, just a couple of leg

[134] Wilt, *How They Train: Half Mile to Six Mile*.
[135] Ibid., 1.

stretches (short runs) across the arena…I trained only one evening per week, winter and summer, spending about thirty minutes on each workout. My training would not be understood today. It was always light."[136] In training for sprint races Binks ran five 60-to 110-yard sprints and then finished with a fast 220 or 300 yards. He trained the same for the mile as he did for an 880-yard race, doing several sprints, and then either 440 yards or 600 yards at varying paces—first part slow, middle part medium, and then finishing fast. Time trials or timed runs over a measured distance—used to simulate a race or provide feedback regarding progress—were never performed. When interviewed in the late 1950s, Binks expressed puzzlement at the intense training methods and competitive schedules then in vogue. "You will laugh at my 'slap dash' method of training," he wrote, "but I got a lot of fun out of it, which today's champions do not."[137]

John Paul Jones, born on 15 October 1890 attended Cornell University, where on 13 May 1913 he set the world record in the mile at Cambridge, Massachusetts, with a time of 4:14.4.[138] Jones's preparation for track included summer participation in games such as baseball and tennis. Fall and winter training consisted of cross country running where he won three IC4A titles from 1910 to 1912. He did not start training for track until the season opened, and he never performed any form of resistance training apart from one hundred or more push-ups each night. His training during the competitive season consisted of the following:

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[136] Ibid., 29.
[137] Ibid.
[138] John Paul Jones's mile time in 1913 was recognized as the first official one-mile world record by the International Amateur Athletic Federation (IAAF)—newly formed in 1912. For further information on Jones's world record see: Lawson, *World Record Breakers in Track and Field Athletics*, 86.

Sunday: Rest or jog 1-2 miles followed by several sprint starts and one 880 yard run without sprinting at the finish

Monday: 6-8 sprint starts. 300 at full speed then jog 1 mile

Tuesday: 4-6 sprint starts. Jog three miles, with 50 yards top speed at the end of each 880

Wednesday: 4-6 sprint starts. A 600 yard time all-out competitive trial followed by a 1-2 mile jog

Thursday: no details given regarding Thursday's workout [probable typo]

Friday: Rest

Saturday: Race.[139]

Analysis of Jones's competitive season program reveals reliance upon short, all-out speed training with limited over-distance work. Jones also performed a much greater volume of work than his predecessor Binks by participating in both fall and winter cross-country training and training five-to-six days per week. Despite these significant differences Jones was only able to lower Bink's mile record by 2.4 seconds. This relative lack of improvement may be attributed to Bink's being a particularly gifted athlete, but more likely is due to the room that was available for significantly greater improvements in the volume, intensity and density of training that occurred towards the middle of the twentieth century and onwards.

In March of 1899, the so-called "Father of Physical Culture," Bernarr MacFadden began publication of a magazine dedicated to health, fitness, and physical development

[139] Wilt, *How They Train: Half Mile to Six Mile*, 28-29.

which he called *Physical Culture*.[140] The 1903 October edition contained an article written by Ellery H. Clark, a twenty-eight year old practicing lawyer who won the 1897 and 1903 "All-Round Athlete of America," or decathlon as it is now termed. Clark acknowledged the popular view at the time that in order to excel an athlete should undertake a structured training program and practically devote several months to getting into "perfect physical trim."[141] This meant adherence to a rigid regime of exercise, diet, sleep, massage and sacrificing all other interests. However, despite this admission, Clark (who had returned to competitive athletics after a six year absence) stated that contrary to this belief "I paid absolutely no attention to strict training or dieting," preferring instead to train according to his own schedule based on relaxation and enjoyment.[142]

It is clear from the preceding accounts that structured, regular training was not an absolute prerequisite for athletic success. Because training levels were light compared to today's standards, athletes could remain competitive with relatively little training. Bink's acknowledgment of what he termed his 'slap dash' method of training also serves to highlight the increasing role of specialized training outlined by Guttmann as a distinguishing characteristic of modern sport that occurred increasingly from the middle of the twentieth century onwards.

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[140] Jan Todd, Joe Roark, and Terry Todd, "A Briefly Annotated Bibliography of English Language Serial Publications in the Field of Physical Culture," *Iron Game History* 1, no. 4 & 5 (March 1991): 25-40.
[141] Ellery H. Clark, "A Champion Athlete Talks of Physical Culture," *Physical Culture* X, no. 4 (October 1903): 338-341.
[142] Ibid.

THE SCIENCE OF ATHLETIC TRAINING (1885-1917)

The evolution from persistent reliance on traditional methods of training to the validation of training practices through the use of science is what Roberta Park refers to as the "embryonic science of athletic training."[143] In the last quarter of the nineteenth century, the training methods of Captain Barclay and the professional trainers who copied his methods were increasingly rejected. This is reflected by James Irvine Lupton and James Money Kyrle Lupton's publication—*Pedestrian's Record* (1890) that was largely concerned with the physiological aspects of athletic training and the advancement of athletic training by the application of science.[144] It also contained an extremely comprehensive list of amateur and professional British and American records**.** To assist with their tasks, the authors made specific reference to the contemporary scientific works of William Kirke, James Paget and Michael Foster (physiology), Jones Quains (anatomy) and William Thomas Brande (chemistry). The Lupton brothers recommended "due caution…by those about to place themselves under the restrictions and advice of a person unacquainted with the sciences, namely anatomy, physiology and pathology."[145] They dismissed Barclay's methods of physicking and excessive hard work and chastised the antiquated ideas that men should eat raw meat and withhold drink from parched lips. Indeed if such practices were "carried into effect," they were "calculated to send a man to the grave rather than the cinder-path."[146]

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[143] Park, "Athletes and Their Training in Britain and America, 1800-1914," 76.
[144] Lupton and Lupton, *The Pedestrian's Record*.
[145] Ibid., 23.
[146] Ibid., 89.

The Luptons acknowledged the basic ingredients necessary to excel in sport—regular sleep, food intake and rest.[147] They eloquently expressed the importance of rest and relaxation by stating, "The human body, a harp of a thousand cords, cannot without impunity always be strung to concert pitch. The harp strings must be loosened sometimes…Relaxation must succeed exertion, prolonged rest exhaustion."[148] However, the Luptons' technical advice remained rudimentary and reflected the amateur ethos that derided professionalism and its associated trappings such as gambling and the need for year-round training. For example, the arduous preparation recommended for walking was deemed potentially injurious to sprinters for whom "in fact a very limited amount of work is required."[149] Furthermore, in preparation for the mile, only one month of training was deemed sufficient to run the distance at race pace. Despite the *Pedestrian's Record's* shortcomings, the Luptons' advice represents a significant step towards more advanced training practices and the assimilation of science in sport.

In spite of the progressive ideas of Archibald Maclaren and the Lupton brothers' recommendations to assimilate science into athletics, the advice proposed did not transcend many of the traditional ideas that preceded them. For as Park notes, traditional views of the body have persevered in matters of health so why should we expect much difference with regards to athletic training? Furthermore, although "sports medicine" would emerge as an increasingly systematic discipline after 1920, information regarding the potential application of science in sport before World War I remained largely

[147] Ibid., 45.
[148] Ibid., 4.
[149] Ibid., 72.

confined to medical and physiological journals (e.g., *Boston Medical and Surgical Journal, American Journal of Medical Sciences* and the *American Journal of Physiology*) and not in manuals prepared by or for trainers or coaches.[150]

One of the primary reasons why athletes were discouraged from overexertion and overtraining was a condition dubbed the "athlete's heart." The post-Civil War growth in games and athletics raised activity beyond the expectancy and expertise of most physicians. Although a number of physicians such as the University of Pennsylvania's Dr. R. Tait McKenzie advocated participation in athletics to enhance health, another group of physicians was deeply concerned over the potentially adverse effects exercise and competition could have on the body.[151] They felt the quest for victory could cause athletes to overextend themselves, causing physical harm and damage to the muscles and vital organs. With a rudimentary knowledge of the long term effects of repeated stress to the heart, lungs and the nervous system, "it was only natural for physicians to err on the side of safety and suspect danger when a later, more experienced and sophisticated generation would see invigoration."[152]

The heart was the most obvious of vital organs whose function was clearly stressed (as exhibited by an increased heart rate) at the onset of exercise. Furthermore, victims of heart attacks were often afflicted when performing work or exercise. The concern over the affects of exercise coincided with a warning at the turn of the twentieth century by Alfred Stengel, an eminent cardiac expert, that the rate of heart disease had

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[150] Ibid., 94.
[151] James C. Wharton, "The Athlete's Heart: The Medical Debate over Athleticism 1870-1920," *Journal of Sport History* 9, no. 1 (Spring 1982): 33.
[152] Ibid., 36.

rose dramatically over the preceding fifty years.[153] Doctors opposed to excessive exercise made the observation that the heart of a trained person differed clinically to that of a normal person. The athlete's heart was hypertrophied (enlarged), beat less frequently, often exhibited murmurs, and was sometimes subject to arrhythmias (abnormal rhythms). As such the heart was considered pathological and given the label—the "athlete's heart."[154] By the early twentieth century, the idea that a hypertrophied heart was abnormal and caused by excessive exercise had become securely embedded in many physician's minds.[155]

However, a number of medical supporters of athleticism academically expressed their concerns. Citing a number of statistical studies that indicated the health benefits of sport and competition they challenged their counterparts to produce something more conclusive than anecdotal and hypothetical evidence. John Edward Morgan, a Manchester physician and Dr. E. H. Bradford both reported findings from Oxbridge and Harvard rowers respectively that heart disease, pulmonary and total mortality rates were comparable to, or lower than, the rates of the general population.[156] Despite growing evidence in favor of the beneficial effects of exercise, the stereotype of the "athlete's heart" and the need to avoid excessive exercise persisted. For example, a 1903 article in the *Journal of the American Medical Association* further reinforced the concept of the

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[153] Alfred Stengel, "A Review of the History of Cardiac Pathology with Especial Reference to Modern Conceptions of Myocardial Disease," *Philadelphia Medical Journal* 6 (1900): 698-706.
[154] Wharton, "The Athlete's Heart: The Medical Debate over Athleticism 1870-1920," 37.
[155] Robert Coughlin, "The Athletic Life in Relation to Degenerative Changes in the Cardiovascular System," *Medical Record* 77 (1910): 577.
[156] John Edward Morgan, *University Oars* (London: MacMilan, 1873), xv-xvi, and E.H. Bradford, "Health of Rowing Men," *The Sanitarian*, 5 (1877):529-536 in Wharton, "The Athlete's Heart: The Medical Debate over Athleticism 1870-1920," 43.

"athlete's heart" by reporting marathon running "unquestionably" caused heart damage.[157]

The debate continued until 1912 when R. Tait McKenzie stated "the hour has arrived for a complete reconsideration of the whole question of exercise in relation to the heart."[158] After reviewing the prevailing evidence he concluded that cardiac hypertrophy and irregularities in sound and rhythm were variations within the normal heart and not signs of pathology. Over the course of the next quarter of a century, McKenzie's position was further reinforced and the notion of the "athlete's heart" was eradicated. Instead, exercise would be extolled as a means of improving cardiac function and achieving a "functionally superior heart."[159] Given the lack of resolution within the medical community during this time period, it is not surprising that coaches would err on the side of caution and suggest moderation and limitation of exhaustive exercise. Given the lack of resolution within the medical community during this time period, it is not surprising that coaches would also err on the side of caution and suggest moderation and limitation of exhaustive exercise when prescribing training**.**

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[157] "The Dangers in Competitive Athletics," *Journal of the American Medical Association* 40 (1903): 992.
[158] Robert Tait McKenzie, "The Influence of Exercise on the Heart," *America of the Sciences*, no. 145 (1912): 69-74.
[159] Wharton, "The Athlete's Heart: The Medical Debate over Athleticism 1870-1920," 49.

CHAPTER THREE

ATHLETIC TRAINING BETWEEN THE WARS (1917-1945): THE ADVENT OF MODERATE TRAINING LOADS AND INNOVATIVE TRAINING METHODS

> Last Friday morning the Sunflower Schoolhouse in the southwest part of the county was burned and two boys received very severe burns. Floyd and Glenn Cunningham aged thirteen and seven years respectively with two other children, arrived a little before the teacher, Jesse W. Reeve, and undertook to build up the fire. Mistaking it for kerosene, they put some gasoline in the stove and an explosion followed, the burning gasoline from the bursted [sic] can striking them on the lower part of the body and legs; they at once ran to their home two miles away but the saturated clothing continued on fire and the burns were deep.[1]

Nine days after the fire, Floyd, the elder of the Cunningham brothers who had suffered burns that covered more than half of his body, lost his life. Glenn Cunningham was more fortunate and despite grave concerns, expressed his resolution to recover, "the doctors said I'd never walk, he couldn't convince me because I just *knew* I was going to be able to walk again."[2]

> Slowly I pushed my pain-wracked body upright in bed. Bracing myself I moved my right leg one inch toward the edge of the bed, then another inch, then the left limb the same way. Finally I got both badly burned legs over the edge and onto the floor. Sweat broke out on my body. My head was reeling. Then I reached for

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[1] *Hermes* 16 February 1917. The Hugoton Hermes was established by C.M. Davis and has served southwest Kansas since 1887**.** For further information see http://users.pld.com/hermes/master.html#MainLogo Hugoton Hermes (accessed December 12, 2006).

[2] Paul J. Kiell, *American Miler: The Life and Times of Glenn Cunningham* (New York: Breakaway Books, 2006), 47.

> the sturdy armchair by my bed. By grasping its arms I slowly pulled myself upright on the floor. Weakly I fell onto the chair seat. I rested for a moment, my breath coming in gasps. Using one arm of the chair as a crutch, once again I pulled myself to my feet and began to inch my way around the chair. Then I collapsed again. Oh God, how my legs hurt! 'A Cunningham never quits,' I'd heard my father say often to us as children. Pain, hard work, tough times, little money, we can stand anything.[3]

Seventeen years later, on Saturday, 16 June 1934, at Princeton University's Palmer Stadium, that same Glenn Cunningham, took on Bill Bonthron of Princeton and Gene Venzke of Pennsylvania in the Princeton Invitational Mile in front of 25,000 fans. Venzke led at the quarter-mile stage in a time of 61.7 seconds, but Cunningham forced his way into the lead at the half-way mark in 2:05.8. He held the lead at the three-quarter mile mark in 3:07.6 and went on to win by twenty yards in 4:06.8. It was a new world record—the fastest mile ever run, indoors or out. For the first time in nineteen years, the world record was again held by an American.[4]

Cunningham, whose story was made even more remarkable by his horrific injury, typified the type of training middle distance runners performed during the Twenties and Thirties. The simple eight-to-ten week preparatory period characteristic of training before World War I was replaced by both fall and winter training. The limited weekly

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[3] Cunningham, *Never Quit*, inset page.

[4] Lawson, *World Record Breakers in Track and Field Athletics*, 86-88; Kiell, *American Miler*, 191-193. The previous American owner of the world mile record was Norman Taber who on 16 July 1915 at Cambridge, USA won the mile in 4:12.6.

mileage of Joe Binks and John Paul Jones, described in Chapter Two, evolved into more moderate training levels in the region of fifteen miles per week.[5]

This increase in the training load—although moderate by modern standards—had a significant effect on the world mile record as it fell six seconds in the space of twenty years from 4:12.6 in 1917 to 4.06.4 in 1937. However, it was the introduction of innovative new training methods at the end of the 1930s that saw the mile world record plummet a further five seconds in eight years—from 4:06.4 in 1937 to 4:01.4 in 1945. A similar phenomenon occurred between WWI and WWII in the 800 and 1,500 meters as the world records dropped from 1:51.9 to 1:46.6 in the 800 meters and from 3:54.7 to 3:43.0 in the 1,500 meters.[6] It is impossible to claim, of course, that the world records in these events fell *only* because of these new training methods. Athletic performance is a complicated matter and on any given day psychological factors, nutritional preparation, proper sleep, pre-existing injuries, and, of course, simple human genetics will all play a role in the time achieved by an athlete in a race. However, changes in training methodologies, the author would argue, were responsible for the greatest portion of the rise in human performance.

The years between World War One and World War Two gave birth to some of the greatest innovations in track and field training—methods that continue to form the cornerstone of competitive track training programs today. It was an era particularly fascinated with the middle-distance events, and the quest for the four-minute mile was

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[5] Freeman, "Distance Training Methods, Past and Present: The Evolution of Distance Training and Racing, 1880-1975," 4-11.

[6] Lawson, *World Record Breakers in Track and Field Athletics*, 59-69.

born in this era. This chapter focuses on the preparation of athletes for these middle distance events since it was in preparation for these that coaches and athletes discovered the need to employ more scientific methods and rigorous training. It begins with an examination of the training philosophies and practices of three of the most successful track and field coaches (Clyde Littlefield, Brutus Hamilton and Dean Cromwell) of the first half of the twentieth century. It then explores the training regimens of five of the most celebrated athletes of the era (Paavo Nurmi, Glenn Cunningham, Jesse Owens, Gunder Hägg and Rudolph Harbig). Finally, the chapter traces the concomitant increase in exercise physiology and sport science related literature during this era. Although only in its infancy as an academic discipline, exercise science nonetheless played an important role in attempting to explain the phenomena of physical fitness and training for sport.

THE GROWTH OF SPORT, PHYSICAL EDUCATION AND TRACK AND FIELD (1917-1945)

Following World War I, America's focus turned towards prohibition, women's suffrage and the flapper or "jazz" age. America's favorite pastime was shaken by the news that eight members of the Chicago White Sox were involved in "fixing" the result of the 1919 baseball World Series.[7] After the scandal, which ultimately led to the reorganization of baseball, sport entered an era commonly regarded by historians as the "Golden Age" of sport.[8] This period reflected an economic and technological boom that

[7] Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 161-162.
[8] Reiss, *The American Sporting Experience: A Historical Anthology of Sport in America*, 218.

heralded the arrival of the "Roaring" Twenties. A shortened workday, new time-saving devices such as more efficient furnaces, electric stoves, vacuum cleaners and a better transport network in the form of trolleys, trains and more family cars created sufficient time and mobility to enjoy leisure pursuits and attend sporting events. The "Golden Age" heralded the arrival of the American sports hero. Almost every sport had its own hero including Jack Dempsey in boxing, Bobby Jones in golf, Bill Tilden in tennis, Red Grange in football and Babe Ruth in baseball.[9] Historian Benjamin Rader notes that the transformation of athlete to idol was based on more than sporting accomplishments alone. The same advertising skills and clever promotion that successfully sold automobiles, breakfast cereals and lipstick also sold athletes to an admiring public.[10]

While professional sport made rapid progress between the war years, amateur sports also grew exponentially. College football established itself as the number one attraction but other amateur sports such as golf, tennis, swimming, field hockey, track and field, polo, and rowing also thrived. The Depression which swept the country in the Thirties changed the role of sport in American society. The unfortunate reality of unemployment left millions with nothing to do and little money for travel and recreation. However, by the end of the Depression sport in all sectors of society had survived and in many cases prospered. Although elite sports such as tennis and golf were adversely affected by the depression, family sport, youth sport, and informal sport activities all increased in participation and popularity.[11] In summary, although sport in the period prior

[9] Ibid. Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 131.
[10] Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 131-132.
[11] Betts, *America's Sporting Heritage*, 286-287.

to World War I (1880-1917) made great inroads, it was the period after the war when sport became firmly woven into the fabric of American life. In fact, historian Benjamin Rader claims that organized sports achieved an "institutional permanency and prominence in American life in some ways equal to that of business, politics, ethnicity, race or religion."[12]

THE GROWTH OF TRACK AND FIELD

The Olympic Games represent the focal point of the track and field calendar and 1920 saw the re-introduction of the Games after an eight-year absence associated with World War I. The American team picked up where it left off, convincingly winning the 1920 Antwerp Olympics with forty-one gold medals, while Sweden—their closest rival earned only nineteen gold.[13] America was particularly dominant in the short sprints, winning a total of nine gold medals in these events. Charley Paddock claimed the accolade of the "World's Fastest Man" with his famous twelve foot flying leap through the tape in a time of 10.8 seconds.[14]

Track and field continued to grow in popularity, as witnessed by a crowd of 30,000 who turned out to see the 1924 US Olympic Trials held at the University of Michigan.[15] In the 1924 Paris Olympics the American track and field team once again dominated winning a total of twelve gold medals. Harold Osborn, a graduate of the

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[12] Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 114.
[13] Wallechinsky, *The Complete Book of the Olympics*, xiv.
[14] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 46. Quercetani notes that regardless of whether Paddock really gained anything by using such a tactic, he certainly "caught the eye" of the judges on the finish line.
[15] Spears and Swanson, *History of Sport and Physical Activity in the United States*, 210.

University of Illinois is the only athlete to this day to have coupled an Olympic victory in the decathlon, with a victory in an individual event by winning the high jump with a leap of 6' 6"—a world record that stood until 1936.[16]

A reversal in fortune occurred at the 1928 Amsterdam Olympics, however, where the American sprinters and runners combined to win only three gold medals. Although the United States easily won the most gold medals, (more than double their nearest rivals Germany) the failure of the track and field team, particularly the sprinters and veterans of the 1924 Olympics was viewed by sport historians, Douglas A. Noverr and Lawrence E. Ziewacz as a by-product of the late Twenties milieu. With the prosperity, consumerism and affluence of the "Roaring Twenties," Noverr and Ziewacz argue that America had lost its edge, the team was reportedly overconfident, pampered, and neglectful of the necessary training required to win.[17]

Track and field in the Thirties witnessed the emergence of numerous African-American stars, particularly in the sprints and jumping events. The most famous of these new cindermen was American Jesse Owens. Owens won an unprecedented four gold medals at the "Nazi" Olympics of 1936. He played a key role in destroying the myth of Aryan supremacy and his success and international celebrity caused many to question the discriminatory practices that blacks had struggled against for generations. Owens's success signaled that at least in one arena, African-Americans could dominate in a sport that was open to them.[18] Other important changes in the Olympic calendar also occurred

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[16] Camp, *Training for Sports*.
[17] Ziewacz, *The Games They Played: Sports in American History, 1865-1980*, 94.
[18] Ibid., 129.

during the inter-war years. In 1923 the Amateur Athletic Union (AAU) formally adopted track and field championships for women. Half a decade later in 1928, the International Association of Athletics Federations (IAAF) and International Olympic Committee (IOC) finally allowed women to compete in Olympic track and field events. However, it was not until 1960 that female athletes were allowed to compete in races longer than 200 meters as previously such "feats of endurance" were considered too dangerous.[19] Despite these positive steps for the Olympic movement, the Games themselves fell into disarray after Hitler invaded Poland in 1939. The Berlin Olympics were to be the last Games held for twelve years. When Europe finally emerged from World War II and the Games returned to London, in 1948, no one could again claim that the worlds of sport and politics were not inextricably linked.

[19] Wallechinsky, *The Complete Book of the Olympics*, xxiii. The transition to participation in sport regardless of gender or race during this period is an example of what sport historian Allen Guttmann refers to as "equality,"—one of the seven defining characteristic of modern sport.

Figure 17. Jesse Owens on top of the podium at the 1936 Berlin Olympics after winning the long jump. From left to right: Naoto Tajima (Japan), Jesse Owens (USA) and Carl Ludwig "Luz" Long (Germany) giving the Nazi salute.[20]

THE GROWTH OF PHYSICAL EDUCATION

In the period between the two World Wars sport, exercise, dance, and physical education (PE) became constitutive components of the education system in the United

[20] Image located at: http://images.google.com/imgres?imgurl=http://blog.pucp.edu.pe/media/540/20070518-JesseOwens%255B1%255D.jpg&imgrefurl=http://blog.pucp.edu.pe/category/1733/blogid/487&h=750&w=550&sz=56&hl=en&start=1&tbnid=NOV-h9iwT1LcgM:&tbnh=141&tbnw=103&prev=/images%3Fq%3DJesse%2BOwens%26gbv%3D2%26hl%3Den%26sa%3DG (accessed April 28, 2008).

States.[21] The rapid growth of public education with accompanying state laws that required the provision of physical education, created a need for physical education teachers. One-two-and three-year physical education courses were expanded and assimilated into four-year college or university programs. Robert Tait McKenzie renowned physician, sculptor and physical educator declared that graduate work would be essential for advancement of the profession. To this end, sport historian Earle F. Ziegler noted that "Between 1926 and 1949 some fifty-four colleges and universities began Master's degree programs in physical education."[22] In January of 1930 the American Physical Education Association (APEA) began publication of the *Journal of Health and Physical Education*—the major professional journal in the field of physical education that survives to this day as the *Journal of Health, Physical Education, Recreation and Dance* (JOHPERD). Later that same year the Association reflected a growing interest in research with the publication of *Research Quarterly.*[23] The journal reported the latest research in the art and science of physical education that added authority and credibility to a growing profession.

The greatest change in curricular content during this era was a shift away from health through gymnastics to a "sport for all" philosophy that emphasized the benefits of character and sportsmanship through sport.[24] According to Guy M. Lewis, Associate

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[21] Lee, *A History of Physical Education and Sports*, 173-178; Spears and Swanson, *History of Sport and Physical Activity in the United States*, 226.
[22] Earle F. Ziegler, ed., *A History of Physical Education and Sport in the United States and Canada* (Champaign, Ill.: Stipes Publishing Company, 1975), 279.
[23] Jan Todd, Joe Roark, and Terry Todd, "A Briefly Annotated Bibliography of English Language Serial Publications in the Field of Physical Culture," *Iron Game History* 1, no. 4 & 5 (March 1991): 25-40.
[24] Spears and Swanson, *History of Sport and Physical Activity in the United States*, 230.

Professor in the School of Physical Education at the University of Massachusetts, accommodation of varsity athletics was the key factor in the transformation of the profession. The status of competitive athletics established the location of physical education in high schools and colleges; facilities, equipment, and staff secured for varsity sports determined the content of the curricula and the nature of the programs.[25] Thus, the most important influence of the period was the growth and increased popularity of intercollegiate athletics.

THE COACHES AND RELATED LITERATURE

One person instrumental in defining American sport was Yale football coach, Walter Camp. Camp played in the first Yale-Harvard rugby game and served as Yale's first football coach from 1876 until 1910. He is particularly renowned for helping to conceive and implement the game of football which earned him the *sobriquet* "Father of Football."[26] In 1921, Camp published *Training for Sports,* a book that covered all aspects of athletic training with chapters on General Physical Conditioning, Training According to Age, Why Athletes Go Stale, Diet, Sleep, Exercise and The Storing of Energy. The book also contained specialized training information on football, baseball, rowing and track and field. Training for Camp was "essentially anything that implies preparation;

[25] Guy M. Lewis, "Adoption of the Sports Program, 1906-1939: The Role of Accommodation in the Transformation of Physical Education," *Quest* 12 (May 1969): 42.
[26] Smith, *Sports and Freedom: The Rise of Big-Time College Athletics*, 83-88; Camp, *Training for Sports*.

whether it be for physical effort as an athletic competition or military service in time of war, or merely for the ordinary conduct of life."[27]

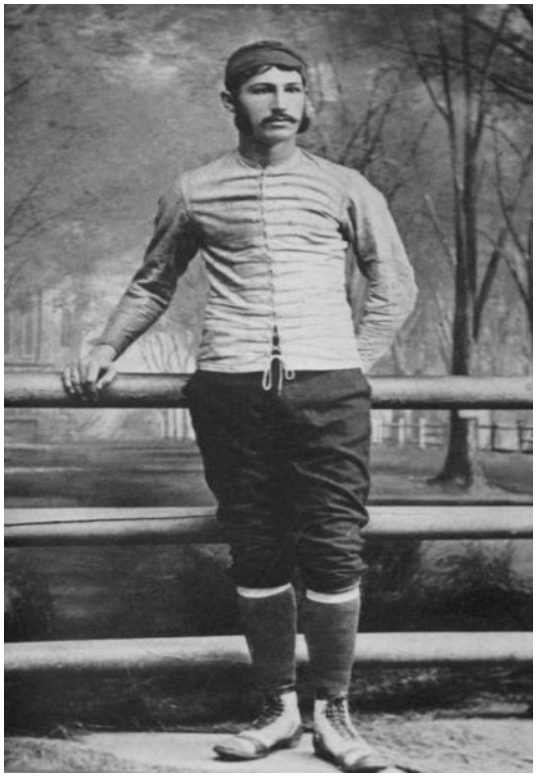

Figure 18. Walter Camp pictured as Yale's Captain 1878-1879.[28]

Camp argued that the athlete was most receptive to training between the ages of fifteen and twenty-five, when the hardest, most strenuous and most consistent physical work should be done. Camp was particularly concerned with the phenomenon of overtraining, or going "stale," as it was then termed. Of the two principle dangers that confronted athletes—overwork and underwork, the former was seen as a much greater

[27] Camp, *Training for Sports*, 3.
[28] Image located at: http://www.waltercamp.org/ (accessed September 12, 2007)

concern. This is reflected in Camp's recommendation that physical directors should pay careful attention and monitor the "work of men in relation to the capacity of the individual."[29] Camp also expressed concern regarding the use of time trials for runners that when repeated too often would "exhaust the capacity" of an individual come race time. Camp's contribution to the growth of American sport and his thoughts on training were considerable, as reflected by the 1929 *Annals of American Sport* that were entirely dedicated to his honor.[30]

The publishers of the Spalding Athletic Library (see Chapter Two) continued to produce quality track and field publications and in 1924 published *How to Hurdle* by Boyd Comstock of the University of Southern California. The book offered a particularly detailed account of hurdling and boasted "pictures...in a profusion that has never been attempted in any volume of athletic instruction."[31] Comstock, like Camp before him, was particularly concerned with the dangers of adopting an over-zealous training philosophy, based on his observation of the training of prize fighters of former years. The key to successful training was moderation. Comstock was therefore opposed to "killing" schedules where benefits could only be gained by running on "one's nerve" and drawing upon surplus energy. He felt that trainers who insisted upon continuing hard work when an athlete was tired only deferred the time scale and opportunity to get into "real condition." "Rest is the greatest tonic in the world for the tired athlete," Comstock

[29] Ibid., 24.
[30] John Allen Krout, *Annals of American Sport* (New York: United States Publishers Association, 1929).
[31] Boyd Comstock, *How to Hurdle* (New York: American Sports Publishing Company, 1924), 7.

advised, "and under no circumstances should a man force himself to undergo a tiresome practice when he feels he is not up to it."[32]

CLYDE LITTLEFIELD

> Winning was never the whole thing with me...Development of young men was important and rewarding. Personal honors are fine for a coach, but what really counts are the friends and the achievements made by the boys he has coached.[33]

Clyde Littlefield (1892-1981) was born on 6 October 1892 in Eldred, Philadelphia. In the fall of 1912, Littlefield enrolled at the University of Texas at Austin where he earned a dozen letters for varsity sport—football, basketball and track and field.[34] In 1920, after serving in World War I, Littlefield returned to the University of Texas where he was appointed head track, freshman football and freshman basketball coach. He subsequently served as the head football coach from 1927 to 1933 where he compiled a win-loss-tied record of 44-18-4, winning two Southwestern Conference titles in the process. However, it was in track and field that Littlefield sealed his legacy. When he retired as head track and field coach in 1961 after forty-one seasons, his teams had won twenty-five Southwest Conference championships, finishing second on fourteen occasions. His teams set four world records and five national records. Eleven of his

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[32] Ibid., 223.
[33] "History of the Clyde Littlefield Texas Relays," The University of Texas, www.texassports.com/mainpages/txr/structure/history.html (accessed April 17, 2005).
[34] Ibid.

athletes won individual NCAA honors**.** He served on the 1952 Olympic coaching staff and was co-founder of the Texas Relays which started in 1925.[35]

Figure 19. Clyde Littlefield, shown here (center) at the 1945 Texas Relays.[36]

In 1933, Littlefield wrote *Track and Field Athletics*.[37] Analysis of Littlefield's coaching philosophy and his detailed approach to training and competition reveals many of the reasons behind his longstanding success. "Track meets and contests are won in training days, getting ready for the actual competition," Littlefield declared. Furthermore, "Good generalship in track athletics lies in planning ahead for the contests which are to

[35] Ibid.
[36] Image located at: http://www.texassports.com/mainpages/txr/structure/history.html (accessed May 15, 2007).
[37] Littlefield, *Track and Field Athletics*.

come. Good track teams are not made in a hurry, and the slow gradual improvement is usually the best."[38] Littlefield likened the training and conditioning for track and field to building a house in that it should be well constructed. Also, the individual amount of work each athlete was capable of was subject to variation. For example, a stronger, more rugged man could stand extra work compared to a lighter, slender athlete who needed to take more care in his daily workout schedule. Moreover, for certain individuals, two light workout days prior to a competition was better preparation than the conventional one. Keeping with the contemporary theme of conservatively controlling workload—Littlefield felt that "it is better to underwork an athlete than to overwork him."[39]

Littlefield believed in a structured off-season. Ideally track athletes would participate in other sports such as football. However, if they did not partake in a fall sport, each athlete was required to regularly attend practice at least three times per week. All of the runners (except the sprinters) went out for cross country running or walking in the fall. Littlefield outlined a typical week's sprint training prior to the start of the competitive season:

> **Monday**: Warm-up exercises; form running; a few starts; a few wind sprints. As in sprint relays, pass baton a few times—light work
> **Tuesday**: Warm up; listen to gun a few times; run through distance at four-fifths speed with a finish and practice at the tape. Work a little on curve running if race is on a curve
> **Wednesday**: Hardest work of any day of the week; warm up; a few starts with two to three short dashes—30 or 40 yards; run through 120 yards with pick-up at

[38] Ibid., 12-13.
[39] Ibid., 17.

the finish; slower at start. If a 220 yard man run but 120 yards at a comfortable speed and sprint for finish

Thursday: Run a slow 300 yards or 150 yards at four-fifths speed; pass baton

Friday: Meeting; warm up or complete rest

Saturday: Competition under meet conditions.[40]

Littlefield's recommendations can be considered moderate compared to modern day collegiate sprint training practices. Littlefield's hardest day of the week entailed approximately six or seven runs with only one run over the full competitive distance. Modern day sprinters during the competitive season may perform as many as ten to twelve accelerations over distances ranging from ten to forty meters on a Monday and then come back two days later and perform six runs close to the athlete's competitive distance (for example a 100-meter sprinter would do runs of approximately eighty meters). In addition, modern day sprinters also participate in weight training up to six days a week in the off season and three times per week in season.[41] Furthermore**,** in contrast to the complete rest or a light warm up advocated by Littlefield for the pre-meet workout, modern day sprinters (in addition to a general warm up and cool down) may undertake three to five accelerations from the blocks at speeds approaching their

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[40] Ibid., 33.

[41] The information on training practices was derived from the time period when the author was employed as a Volunteer Track and Field Coach at the University of Texas from 2001 to 2003. There he worked under the close mentorship of Coach Dan Pfaff. Coach Pfaff was the coach of Donovan Bailey who set the world record (9.84 seconds) and won the Olympic 100 meters gold medal at the 1996 Atlanta Olympic Games. Coach Pfaff (as of August 2006) had tutored athletes who have combined to earn 154 NCAA All-America honors while also guiding 33 Olympians who went on to earn seven medals.
For a full biography See Dan Pfaff
http://www.gatorzone.com/trackfield/men/bios.php?year=2006&bio=pfaff.html (accessed August 10, 2006). As a volunteer to The University of Texas Track and Field team the author experienced first hand, the workouts of collegiate and professional track and field sprinters. Between July 2003 and February 2004 the author was also employed as an Assistant Track and Field coach to Dan Pfaff working with a group of elite professional sprinters.

maximum the day before a meet in addition to some explosive weight training. The rationale behind this practice is that it helps to "fire up" the nervous system to greater levels of arousal in preparation for the next day's event.[42]

Littlefield paid particular attention to detail and advised keeping records to evaluate progress and to "insure the success of the individual and the team." He felt that men were often haphazardly trained with a "win at all cost' mentality and therefore, **"**It is well to proceed along scientific lines as nearly as possible**."**[43] Detailed record keeping included estimation of skill levels, speed and individual knowledge of his men. Speed records were kept by recording the actual times achieved in races and knowledge of the athlete was determined by oral or written histories. He kept records on the physical condition of his athletes and recorded their weight and asked questions about their diet, bowel habits, sleeping patterns and mental status during rest periods. Monitoring the athlete's weight on a daily basis allowed the coach to assess the impact of his training methods and other factors in the athlete's life. Littlefield felt that if an athlete was getting the proper amount of sleep, an adequate diet and the correct amount of work his weight should remain the same throughout the training season. A loss of weight was a signal that something was wrong—possibly due to overwork. Other physiological markers Littlefield

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[42] Charlie Francis and Paul Patterson, *The Charlie Francis System* (Ottawa, Canada: TBLI Publications Inc., 1992), 29-30. Note: Charlie Francis was the coach to Ben Johnson when he temporarily broke the world record and won the gold medal in the 100 meters at the 1988 Seoul Olympics. Despite his admitted use of performance enhancing drugs with the athletes he coached, Francis is still considered an authority in the area of sprint training.

[43] Littlefield, *Track and Field Athletics*, 84.

monitored included the athlete's heart rate both before and after exercise. This helped him determine recovery rates and the general physical condition of the athlete.[44]

To help monitor an athlete's performance Littlefield composed percentage and measurement tables that could be converted into figures or graphs. If an athlete regressed it was up to the coach to determine the cause. Did the athlete lose form? Did he work hard enough or did he lose interest? Then it was up to the coach to solve the problem and remedy any errors associated with training. Finally, Littlefield recommended a smooth transition from the competitive season to the off-season. He felt that men should not suddenly quit their exercises at the end of the competitive season. Instead they should taper their training by exercising a little each week for at least three to four weeks.[45]

Littlefield's systematic application of prevailing (albeit limited) training theory represents a significant step towards a more sophisticated scientific approach to training. He advocated a structured variation in training intensity and volume during the week, individual prescription in the number of rest days prior to competition, a more structured off season, detailed monitoring of physiological and performance variables to help monitor the effectiveness of training, an emphasis on the use of prevailing scientific principles and a gradual cessation of training at the end of the competitive year. Such a rational, systematic approach to training undoubtedly contributed to Littlefield's significant success and longevity as a collegiate coach. The increased level of sophistication of the training process advocated by Littlefield, is an example of what sport

[44] Ibid., 18.
[45] Ibid., 85.

historian Allen Guttmann refers to as "rationalization"—one of seven distinguishing characteristics that he views as definitive of modern sport.[46]

BRUTUS HAMILTON

Figure 20. Brutus Hamilton.[47]

> Those who work the hardest, who subject themselves to the strictest discipline, who give up certain pleasurable things in order to achieve a goal, are the happiest men.[48]

Brutus Hamilton (1900-1970) was born on 19 July 1900 in Peculiar, Missouri. He is included by author, Gary Walton, as one of the greatest "philosopher coaches" of the twentieth century, along with Vince Lombardi, Woody Hayes, John Wooden, James "Doc" Counsilman, and Percy Cerutty.[49] Hamilton was both an outstanding athlete and coach. He placed second in the 1920 Olympic decathlon and won the national AAU

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[46] Guttmann, *From Ritual to Record: The Nature of Modern Sports*, 40-44.
[47] Image located at: http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=66 (accessed May 10, 2007)
[48] Kiell, *American Miler*, 375.
[49] Gary M. Walton, *Beyond Winning: The Timeless Wisdom of Great Philosopher Coaches* (Champaign, Ill.: Human Kinetics, 1992).

pentathlon and decathlon that same year. As the head coach for the University of California at Berkeley for thirty-three years, his athletes set two world records and seven Olympic records and won seven national collegiate team titles. For his accomplishments he was selected as an assistant Olympic coach in 1932 and 1936 and elevated to head coach for the 1952 Helsinki Olympics.[50] In keeping with the amateur ethos that prevailed in track and field at the time, Hamilton opposed the growing shift towards professionalism and intense, year-round training—"We are living in a victory-made, record-conscious time. There is a professional intensity creeping into interscholastic and intercollegiate sports comparable to the training of the professional ballet dancer…Yes victory is great but sometimes when it cannot be helped, defeat is also great."[51]

Hamilton viewed sport as an extension of humanity. He emphasized the personal elements of training such as the coach-athlete relationship and the role of the mind in elevating performance over the more scientific components of training such as form and technique. This is clearly illustrated by his statement, "Coaching track will always be rather a personal coach-athlete relationship and not a mimeographed affair, non-personalized like a computer machine…The more I coached the more I became convinced that the mind, the will, the determination, the mental approach to competition are of utmost importance. Yes perhaps even more than the improvements in form and technique."[52]

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[50] "USA Track and Field Hall of Fame: Brutus Hamilton," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=66 (accessed May 22, 2005).
[51] Walton, *Beyond Winning*, 117.
[52] Ibid., 120-121.

Archie Williams, one of Hamilton's students was born on 1 May 1915 in Oakland, California. In 1992, Williams gave an interview that revealed the humanistic qualities of Coach Hamilton. Before 1936 Williams had never run a quarter-mile faster than forty-nine seconds. In the fall of 1935 he began training at the University of California at Berkeley under the close tutelage of Hamilton. Williams repeatedly lowered his best running times in the spring of 1936 and peaked at the NCAA championships in Chicago where he broke the 400 meter world record in a time of 46.1 seconds. He proceeded to take first place at the US Olympic Trials and won the Olympic gold medal at the Berlin Olympics in a time of 46.5 seconds. Referring to the experience of training under Hamilton in the fall of 1935, Williams stated: "Well I got better. Brutus worked hard with me, gave me more exercises, gave me more coaching and all and he just made me feel good. As I said he showed a lot of interest in what I was doing, other than running track…He was a coach's coach. He didn't emphasize technique. He didn't criticize little nit-picking stuff. In other words he knew how to get you to do your best. That's the main thing. That's what a good coach is."[53]

Unfortunately for track and field coaches and for the history of track and field, Hamilton did not write a book on the technical aspects of training. However, as the legendary Stanford University track and field coach Payton Jordan put it, "No other coach

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[53] Archie F. Williams, "Archie F. Williams," Regional Oral History Office, University of California, Berkeley, http://content.cdlib.org/xtf/view?docId=kt0v19n496&doc.view=frames&chunk.id=d0e2253&toc.id=d0e2253&brand=oac (accessed May 23, 2005).

had his wisdom or depth. There was a warmth, a kindness. When he talked, it was almost spiritual."[54]

DEAN CROMWELL: MAKER OF CHAMPIONS

> How old is your own participation in this ancient sport? Older than your memory. It began when you found out you were strong enough to pick up a rattle or a cereal spoon and throw it; when you learned to move under your own leg power for the first time. It's born in you to want to run and jump and throw things. Born in you also is an urge to excel, a competitive spirit. Put together these inbred characteristics and you have track and field—every man's sport.[55]

[54] Bob Burns, "The Gentleman from California," University of California at Berkeley, http://www.alumni.berkeley.edu/Alumni/Cal_Monthly/April_2003/The_gentleman_from_California.asp (accessed March 12 2008).
[55] Cromwell, *Championship Techniques in Track and Field*, 3.

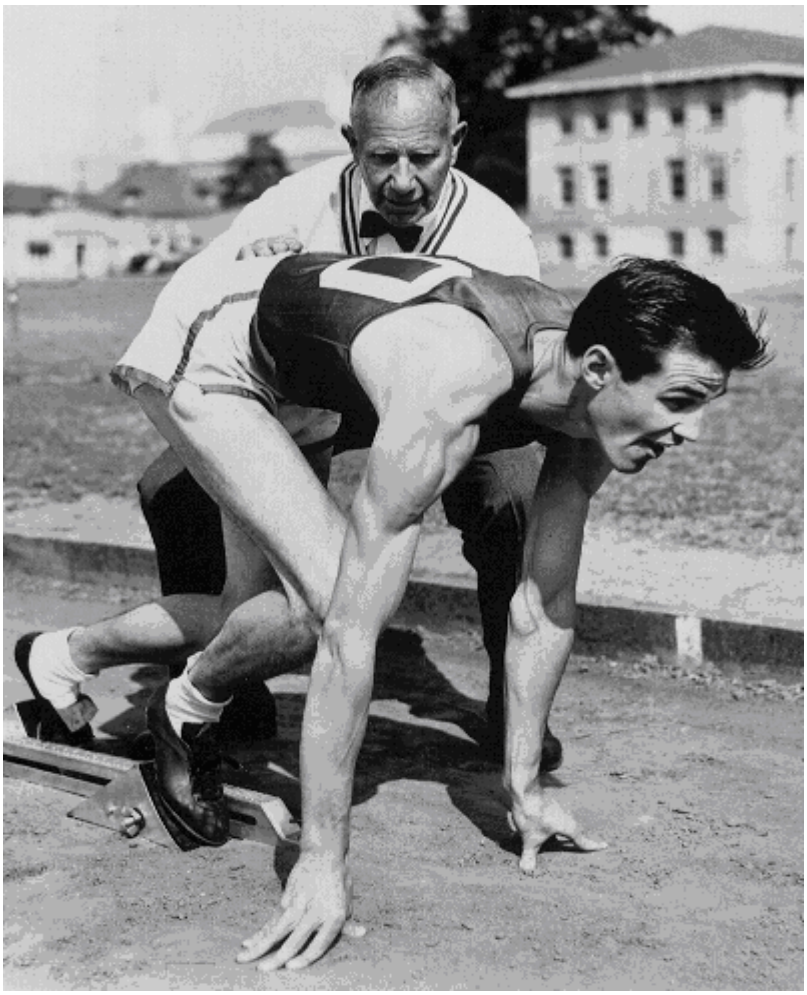

Figure 21. Dean Cromwell critiquing an athlete's start position. From *Championship Technique in Track and Field: A Book for Athletes, Coaches and Spectators* (1941).

Dean Bartlett Cromwell (1879-1962), nicknamed "Maker of Champions," was born in Turner, Oregon on 20 September 1879. He started his athletic career at Occidental Prep School in Los Angeles, California, played guard on the football team and competed in the pole vault, sprints, high jump, shot put and other events for the track team.[56] After a stellar competitive career Cromwell graduated and competed for the Los

[56] William Heuman, *Famous Coaches* (New York: Mead & Company, 1968), 57.

Angeles YMCA track team. In 1909 he was appointed the head football and track coach at the University of Southern California (USC). Cromwell coached football for five years and then continued as Head Track and Field Coach until 1948. During his time with the Trojans, USC won nine Intercollegiate Association of Amateur Athletes of America (IC4A) championships and twelve National Collegiate Athletic Association (NCAA) titles, nine of them in a row. Cromwell's pupils set fourteen individual and three relay world records. He coached ten Olympic gold medal winners and thirty-six U.S. Olympic team members. Cromwell is particularly known for coaching Charley Paddock, who came to be known as the "World's Fastest Man"—winner of the 100 meters at the 1920 Antwerp Olympics.[57] Cromwell retired from coaching in 1948—the same year he coached the United States Olympic team to victory. In 1974, he was inducted into the USA Track and Field Hall of Fame for his outstanding contribution to the sport.[58]

In 1941 Dean Cromwell wrote *Championship Technique in Track and Field: A Book for Athletes, Coaches and Spectators,* a text that has been described by track and field historians Tom McNab, Peter Lovesy and Andrew Huxtable as without question the "greatest coaching book of the first half of the twentieth century."[59] In Cromwell's classic text he ascribed American success in Olympic competition to a love of sports and "a willingness to study them and develop scientific techniques."[60] His approach to training could be summed up in one word—moderation. To Cromwell moderation was "the key in

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[57] Ibid., 55.
[58] "USA Track and Field Hall of Fame: Dean Cromwell," http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=36 (accessed June 22, 2005).
[59] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, 102.
[60] Cromwell, *Championship Techniques in Track and Field*, 11.

what we miscall training…If training means turning down food you like for a restricted diet, going to bed early when others are still up enjoying themselves, and rigidly denying yourself all the little pleasantries and luxuries of life then there is no such thing as training in track and field…any system of training that takes the joy out of the sport is a lot of nonsense."[61] Modest in his appraisal of his contribution to his athlete's success Cromwell felt that "the greatest teacher a coach has is the athlete, because the athlete's first teacher is Mother Nature…Charley Paddock taught me far more about sprinting than I ever taught him."[62]

Cromwell was particularly renowned for his ability to motivate and instill confidence in his athletes, inspiring them to performances they were unaware they were capable of. Everybody was "Champ," even the "scrub" runner who barely made the squad. He dispelled the myth of the "athletic heart" quoting medical research that had disproved its existence—preferring instead to call it the "strong heart."[63] Despite this assertion he preferred his athletes not to overextend themselves in practice. "We're not out to break records in practice," he once said, "nor to use up that vital store of energy needed for the big meet."[64] Cromwell warned of the danger of too much work in track and field. He preferred his athletes to be under rather than overtrained with the added benefit that "you can't hurt a boy by undertraining him."[65]

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[61] Ibid., 15.
[62] Ibid., 13-14.
[63] Ibid., 25.
[64] Heuman, *Famous Coaches*, 56.
[65] Cromwell, *Championship Techniques in Track and Field*, 41.

Cromwell offered the following training advice for sprinters. Training should commence the semester prior to competition in order to lay a solid physical foundation. During this period little attention was given to speed. Games such as tennis, handball, badminton and volleyball were recommended as was walking, but not less than two miles per day. Jogging and then wind sprints were added to the program two to three times a week during the fall which "will have the legs ready for speed work in the spring."[66] To the delight [I'm sure] of many a sprinter—long distance work was to be avoided as it would decrease "bounce"—an essential part of sprinting form. Hence, "sprinters should never jog more than two laps at a time."[67] Cromwell was a particular advocate of correct technique recommending the practice of "high knee" drills for hours in order to achieve optimal sprinting form.[68]

During the competitive season Cromwell felt that training programs should not be applied in a "cut and dry" fashion, instead they should be tailored to each individual. A typical week's sprint training during the competitive season consisted of:

> **Monday**: jogging and a few wind sprints
> **Tuesday**: 6-10 starts and from 1-3, 220-yard dashes at a breezing rather than sprinting pace
> **Wednesday**: more starts with the athlete sprinting from 30 to 50 yards, winding up his heaviest day of training with a series of wind sprints or a 300 yard dash
> **Thursday**: short sprints up to 50 yards
> **Friday**: rest

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[66] Ibid.
[67] Ibid., 39.
[68] Ibid.

Saturday: competition.[69]

Analysis of three of the most successful coaches (Clyde Littlefield, Brutus Hamilton and Dean Cromwell) of this era reveals contrasting coaching styles and philosophies. Littlefield paid particular attention to detail, keeping records on all aspects of training and felt that track meets and contests were won during training. In contrast, Hamilton emphasized the more humanistic qualities necessary for high performance playing down the role of form and technique in favor of a more mental, individualized approach to training. Cromwell's approach can be seen as a mixture of both philosophies. While emphasizing the importance of technique and science, he also acknowledged the role of the individual in elevating performance. Such contrasting styles clearly illustrate the nature of coaching track and field in this era—where, as Lawrie Woodman in "Coaching: Science, an Art, an Emerging Profession," notes, success inevitably required a blending of both art and (albeit limited) science.[70]

Analysis of athletic and physical education journals (*Athletic Journal, Research Quarterly, Scholastic Coach, The Amateur Athlete, The Journal of Health and Physical Education* and *Research Quarterly*) published during this period echoes the conservative attitudes and moderate training loads advocated by Littlefield, Hamilton and Cromwell. Physical education journals such as *Scholastic Coach* and *The Journal of Health and Physical Education* were tailored more towards physical educators and high school coaches and featured articles more elementary in nature, such as instructional advice on

[69] Ibid., 64.
[70] Woodman, "Coaching: Science, an Art, an Emerging Profession," 5.

how to perform each track and field event. In contrast, *The Athletic Journal* which began publication in 1921 was specifically billed as "A Professional Magazine for the Coaches of the Country," and featured articles with practical advice on how to train for track and field.[71] A 1941 article by Earl "Billy" Hayes, renowned distance coach at the University of Indiana covered the "finer points" of distance coaching. It summarized a high school clinic talk given by Hayes that echoed the earlier sentiments of Coach Littlefield by asserting that "it was better to underwork the boys than to overwork them."[72] Further advice entailed "not giving athletes too much work so that they will not be fully recuperated the next day."[73] This advice is in stark contrast to modern day training practices where athletes often use the day after a hard workout to recover. Alternatively, athletes may use two back-to-back days of relatively hard training followed by a recovery or restoration day.[74]

The conservative approach to training of this era is further highlighted by Harry Hillman, winner of three gold medals (400m, 200m low hurdles and the 400m hurdles) at the 1904 Olympics and track coach at Dartmouth College from 1910 to 1945.[75] In April 1945 Hillman authored a column in *Scholastic Coach* entitled "Question Box for Track

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[71] *The Athletic Journal* II, no. 7 (March 1922). The heading for the journal that was edited by John L. Griffith proclaimed that it was "A Professional Magazine for the Coaches of the Country."

[72] E.C. Hayes, "The Fine Points of Track Coaching: Distance Running," *Athletic Journal* XXI, no. 5 (1941): 29-31, 37-38.

[73] Ibid.

[74] Mark Verstegen, *Core Performance* (Emmaus, Penn.: Rodale, 2004), 176-177. Mark Verstegen is the founder of Athletes' Performance in Tempe, Arizona, one of the leading athletic training facilities in the world. A typical training week advocated by Athletes' Performance involves the use of two hard workouts (Monday and Tuesday) followed by a recovery day on Wednesday. The same cycle is repeated Thursday through Saturday with Sunday reserved for complete or active rest.

[75] "USA Track and Field Hall of Fame: Harry Hillman," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=74 (accessed August 6, 2006).

Coaches." The column was aimed at youngsters seeking advice on matters relating to training and conditioning. When asked by an aspiring fourteen-year-old middle distance runner about how to train for the 440 and 880 yards, Hillman replied, "You shouldn't compete in such strenuous races until you are at least eighteen." Another question regarding participation in cross-country running was met with a similar response and once again eighteen was deemed the recommended age to start training. Coach Hillman specifically advised that younger boys should stick to "light training."[76] This entailed long walks and occasional "hare and hound" chases with friends that involved a combination of running, walking and hiding to "ensure the running is not too continuous and strenuous."[77]

Analysis of the training content of this era reveals a significantly greater volume and intensity of training compared to the previous era (1885-1917). An eight-to-ten week preparatory period was replaced by fall and spring training culminating in the competitive season. The training in the previous era was considered "light." Therefore, (and in comparison to modern levels of training) the training advocated in this era (1917-1945) may be considered moderate in nature. The trend towards greater training loads is highlighted in an article in the 1941 November edition of *Athletic Journal* written by Hilmer G. Lodge of Santa Maria Junior College, in California. The article, titled "Purposes and Objectives of Fall Track and Field Practices," noted how track and field had expanded to include fall training. Track and field for many years was considered a

[76] Harry Hillman, "Question Box for Track Coaches," *Scholastic Coach* 14, no. 8 (April 1945): 22, 41.
[77] Ibid.

strictly spring season sport. Indeed, Lodge noted that, "If a coach dared mention that he was planning to hold fall track and field practice, other coaches might look at him in complete amazement, assuming that fall practice would really burn out the boys."[78] Today, fall track and field practice is the norm at the collegiate and professional level. Furthermore, athletes who start training later in the athletic year are often at a distinct disadvantage come the spring, and the competitive season. This is because a longer preparatory phase (fall) allows athletes to build a greater foundation that results in better performances during the competitive phase (spring).[79] Lodge confirmed this premise by stating that "Outdoor fall practice is desirable if the season's best performances are to be achieved during the spring and summer outdoor seasons."[80]

THE ATHLETES (1917-1945)

Compared to the modern era of high performance sport, detailed information of individual athlete's training programs during the years between 1917 and 1945 is limited. Track and field remained an amateur sport which meant that no one expected an athlete to participate in year-round arduous training. Journalistic accounts of track in this era focused on the building of heroes and heroines. Readers, it seemed, were far more interested in what an athlete accomplished and the athlete's personal history than they were in reading about how the athlete trained. Since the first magazine specifically devoted to track and field—*Track and Field News*—was not published until 1948, and

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[78] Hilmer G. Lodge, "Purposes and Objectives of Fall Track and Field Practice," *Athletic Journal* XXII, no. 3 (November 1941): 38.
[79] Bompa, *Periodization: Theory and Methodology of Training*, 55.
[80] Lodge, "Purposes and Objectives of Fall Track and Field Practice," 38.

since the first technical track and field journal, *Track Technique,* was not published until 1960, athletes and coaches during the interwar years had no venue in which to discuss training theory and methodology. The best source on how men actually trained in this era is, therefore, Fred Wilt's 1959 book, *How They Train*, which attempted to "illustrate the evolution of training methods by describing the actual workout programs of great athletes from 1900 to the present time."[81] Wilt, the inaugural editor of *Track Technique*, published the training programs of such noted inter-war Olympic champions as Paavo Nurmi and world record holders such as Gunder Hägg and Rudolph Harbig, who dominated middle and long distance training during this era and were widely emulated by athletes around the world. Although Wilt had to write his entries on these men based on their recollections rather than first hand observation of their training, he was able to get the men to speak about themselves and to get them to recreate from memory and their old training logs how they had prepared for competition. What he discovered was that a detailed manipulation of volume, intensity, and density of training—all key components of a more scientific approach to training—had had a marked influence on running performances in the first half of the twentieth century.

[81] Wilt, *How They Train: Half Mile to Six Mile*, 2.

PAAVO NURMI: THE "FLYING FINN"

> Mind is everything; muscles, mere pieces of rubber. All that I am, I am because of my mind.[82]

Paavo Johannes Nurmi was born in 1897 in the city of Turku in southwestern Finland. Nurmi dominated middle and long distance running in his era, winning a total of nine gold and three silver Olympic medals—three gold and one silver at Antwerp in 1920, five gold at Paris in 1924, and one gold and two silvers at Amsterdam in 1928.[83] An athlete ahead of his time, Nurmi trained with a dedication and intensity never previously seen. In a period when athletes were "lightly conditioned" he raised the quantity and quality of endurance training to levels that none of his contemporaries could equal. In a span of twelve years he set twenty-five world records at distances from 1,500 meters to 20,000 meters and brought new meaning to the phrase "competing at the highest level."

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[82] "Motivation Daily Quotes: Paavo Nurmi," *Runners World*, http://www.runnersworld.com/dailyquotearchive/1,5429,s6-187-0-0-0-1-,00.html (accessed August 10, 2006).

[83] "Paavo Nurmi: The Flying Finn," International Olympic Committee, http://www.olympic.org/uk/athletes/profiles/bio_uk.asp?PAR_I_ID=53102 (accessed December 21, 2007); "Paavo Nurmi," Ministry for Foreign Affairs of Finland, http://virtual.finland.fi/netcomm/news/showarticle.asp?intNWSAID=26157 (accessed May 30, 2005).

Figure 22. Paavo Nurmi during the 5,000 meters at the 1928 Amsterdam Olympics. (Photo by: Getty Images).

Nurmi recollected his training practices in a book entitled *Olympiiavoittajien Testamentii* (*The Will of the Olympic Champion*) that was translated into English by H. Lehmusvuori, Secretary of the Amateur Athletic Union of Finland. This book was then used by Fred Wilt as the basis of his discussion of Nurmi's methods in *How They Train*.[84] Between the ages of fifteen and twenty, Nurmi felt he suffered from a general lack of training volume with not enough speed work. "I practiced only in the summer…actual

[84] Wilt, *How They Train: Half Mile to Six Mile*, 65-66.

winter training was hardly known in those days."[85] At twenty-one years of age he entered military service which allowed him more time to train and he then began to experiment with different types of workouts and running at various speeds. Despite Nurmi's considerable success at the 1924 Olympics, he felt he still suffered from insufficient training between the 1920 and 1924 Olympic Games. Nurmi did not start training until the beginning of April and therefore felt he could have attained better results much earlier than he did. "In those days my workouts consisted mainly of walking on the road or running on the track or cross country. Some short sprints could be included, but hard runs of 400-600 meters were totally lacking in the program of training."[86] Nurmi's workout program in the lead up to the 1924 Olympic Games consisted of the following regime:

> An early morning walk of 10-12 km with some sprints included with the purpose of getting as supple as possible for the afternoon run. After the walk I always did some gym work at home and had a bath. After about one hour I started training on the track. As my body was already suitably warmed up by the early morning workout, I could begin to sprint almost immediately. Usually I ran 4-5 x 80-120 m sprints. After this a fast 400-1000m for time. Then 3000-4000m at even speed and the last lap always very fast. My evening workout consisted of cross-country running. The distances ranged from 4000-7000m, the last 1000-2000m always with considerably faster speed. After this cross country run I would run 4-5 x 80-100m sprints. This daily training helped me attain the condition I had at the 1924 Olympic Games in Paris.[87]

[85] Ibid.
[86] Ibid.
[87] Ibid.

On reflection, Nurmi acknowledged that his training may not have been considered entirely optimal. In particular, he felt the inclusion of walking could be criticized for a lack of "lather" or sweat. However, he defended the mixed use of walking with sprints as a useful means of conditioning. His biggest mistake he felt was the use of too much long, slow distance running "as it was not known then that speed training brings endurance."[88]

Analysis of Nurmi's training program reveals the structured manipulation of running different distances (or intervals) including repeated sprints. The pioneer in this area of training was the Finnish coach, Lauri Pikhala, who in 1920 stressed the balance between work and rest in a method he called "Terrace Training," with each layer built on the previous.[89] The basic principle of alternating work with recovery periods was further developed (as we shall see later in this chapter) in the late 1930s in the form of interval training.

The esteem to which Nurmi was held in America was reflected in 1942 by Emil Von Elling, the track coach at New York University. Von Elling had the privilege of witnessing Nurmi workout at the University's Ohio field after Nurmi contacted him on his arrival in America with a request to train. Von Elling noted that Nurmi's arrival had a direct impact on the popularity and training of distance runners as he candidly asserted, "The methods of the Finn brought results and knocked into a cocked hat our soft system of training for long distances. It killed once and for all those windbags who for years kept

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[88] Ibid.

[89] Claude Smit, "Interval Training," in *Run, Run, Run*, ed. Fred Wilt (Los Altos, Calif.: Track and Field News Inc., 1959), 180-185.

us in the class of 'pussy foot' with their fear of over-emphasis and the dangers of hard work."[90]

It is clear from the preceding coverage that Nurmi transcended the prior "light" levels of conditioning that typified preparation for track and field prior to WWI. Nurmi significantly elevated training levels by introducing multi-day—morning, afternoon and evening workouts. However, Nurmi's training can still be considered moderate compared to today's standards. Nurmi restricted his preparation to the spring and summer seasons and acknowledged that the intensity of his training could have been significantly increased by decreasing the amount of long slow distance running and by including more speed training.

[90] Emil Von Elling, "Something About Long Distance Runners," *Athletic Journal* XXII, no. 8 (April 1942): 36.

GLENN CUNNINGHAM : THE "IRONMAN" OF KANSAS

Figure 23. Glenn Cunningham.[91]

> People can't understand why a man runs. They don't see any sport in it, argue that it lacks the sight-thrill of body contact, the color of rough conflict. Yet the conflict is there, more raw and challenging than any man versus man competition. In track it is man against himself, the cruelest of all opponents. The other runners are not the real enemies. His adversary lies deep within him, in his ability, with brain and heart, to control and master himself and his emotions.[92]

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[91] Image available at: www.newton.k12.ks.us/tech/kansans.htm (accessed March 11, 2007).
[92] "Motivational Quotes: Glenn Cunningham," Oxford University Athletic Club, http://users.ox.ac.uk/~ouac/training/quotes.shtml (accessed July 28, 2006).

Glenn Cunningham was born on 4 August 1909 in Atlanta, Kansas. His life and times have been summarized by the state motto of Kansas "Ad Astra per Aspera," (to the stars through struggle) in that at the age of seven he was involved in a schoolhouse fire that took the life of his brother and left him with severely burned legs.[93] Cunningham was bed-ridden for months but eventually overcame this tremendous adversity to set a world high school record (Elkhart High School, Kansas) for the mile in a time of 4:24.7.

Cunningham attended Kansas University, where he won six Big-Six mile runs, two NCAA titles and eight AAU national titles. After winning the national collegiate and AAU championships in 1932, he placed fourth in the 1,500 meters at the Los Angeles Olympics. In 1934 during his senior year at college he set a world record in the mile of 4:06.8 that stood for three years. At the 1936 Berlin Olympics, he finished second to Jack Lovelock of New Zealand in the 1,500 meters. Two weeks later, he set his second world record with 1:49.7 in the 800 meters.[94]

As a fitting tribute, Cunningham's life and times were recently chronicled by psychiatrist and writer, Paul J. Kiell, in the book *American Miler*.[95] It included a detailed insight into Cunningham's training practices along with personal reflections on his training and career. In 1933, H.W. Hargiss the head football coach and trainer for all athletes at Kansas University presented a paper before the National Collegiate Coaches Association detailing the training that Cunningham undertook during his time at Kansas.

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[93] Kiell, *American Miler*, 373.
[94] "USA Track and Field Hall of Fame: Glenn Cunningham," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=37 (accessed July 27, 2006). Cunningham was inducted into the Hall of Fame in 1974.
[95] Kiell, *American Miler*.

After graduation Hargiss continued to function as Cunningham's ex-officio coach and administer the same training program that had brought him and Cunningham their earlier success—including the world record in the mile. Before training began, Hargiss collaborated with Brutus Hamilton, (who coached Cunningham up until 1932) to seek a full appraisal of Cunningham's mental and physical status. "Every vital characteristic was carefully studied; particularly his heart and lung condition, his nervous system, mental attitude, height and weight, muscular development, and form and style of running."[96] Hargiss proceeded to offer insights into Cunningham's mental make-up that was undoubtedly instrumental to his remarkable success. "Mentally, Cunningham has every essential for success. Scholastically, he is an honor student, but he does not believe everything he reads or hears…He has a will and determination to succeed that is almost undeniable. Never boastful yet deep in his mind Glenn feels that there is not a man living he cannot defeat in a foot race."[97] The training regimen that brought Cunningham success was outlined as follows:

> The training program for Cunningham has been one of under-distance running. Practically no over-distance running; seldom does he run three-quarters of a mile continuously in practice, yet I believe he can run two miles in less than nine minutes. When he works, he works hard. The work is varied with these objectives in view—speed, knowledge of pace and ease of effort, and improvement of form or style. For speed work he runs several 220's. For knowledge or judgment of pace, 440's, and for form and ease of stride, 660's and 770's...A typical mid-season training week is as follows: Sunday, a long

[96] Ibid., 138-139.
[97] Ibid., 139.

> walk. Monday, rope skipping, shadow boxing, bag punching and calisthenics. Tuesday, 660's with fifteen minutes rest between, the first one with heavy basketball shoes and sweat suit in about 1:30; the second one with track suit and spikes in about 1:23 or 1:24. This is the hardest workout of the week. Wednesday, judgment of pace work, about four 440's in 62, 63, 61, 58. At the conclusion of each lap, he swings into a fast walk for about 440 yards. Then with one-minute rest, he swings into the next 440. He finishes this practice period with a 220-yard sprint. This work is done in a sweat suit and heavy basketball shoes. Thursday, work is light and for each of form, occasionally he wears spikes in this work. He usually runs the curves of the track and walks the sides or straightaways. Occasionally, this day is used for starts and finishes, especially on indoor track. He starts in the middle of a group of runners near a curve and permits jostling, guarding himself from both pole and wall sides of the track without a break of stride. Friday, no work at all. He doesn't even suit up. Saturday, races. In traveling for races out of town, his training is confined to calisthenics and walking. He never goes on track to practice.[98]

Later in the mid-1960s, in an interview with Myra Brown, a writer and friend of the Cunninghams, Coach Hargiss offered further insights into Cunningham's training. In the first semester upon arriving at Kansas University, Cunningham was referred to Dr. Eddie Elbel, a professor in the department of physical education. There he underwent numerous physiological tests to assess his heart's response to vigorous exercise, including stair running in the gymnasium and stadium.[99] Coach Hargiss also advocated (and then supervised) a rudimentary weight training program for Cunningham that included squats, and a power-clean-to-push-press type motion that involved lifting a heavy barbell from the ground and throwing it up to shoulder height prior to jerking it

[98] Ibid., 139-140.
[99] Ibid., 141.

overhead. Hargiss admitted that he had not divulged this information to other coaches and trainers at the time because weight training was frowned upon in most circles and thought to induce bulky, muscle-bound athletes.[100]

Analysis of Cunningham's training reveals many of the ingredients required for success. It included measured work and rest intervals, alternating hard and easy days, upper body strengthening to enhance arm drive, contrast running (running with heavy clothing followed by lighter clothing), biomechanical analysis of form and running technique, race simulation, and the assimilation of science in the form of physiological analysis and screening. Hargiss also intuitively knew the benefits of weight training despite being told otherwise by the head of the department of physical education at Harvard University's Summer School of Physical Education.[101] However, one area where there was room for improvement was in the volume of training, or a lack of "over-distance" running, as Hargiss referred to it. In a 1987 post-banquet talk to the American Medical Athletic Association (AMAA), Cunningham specifically addressed this issue. When asked whether he felt he could have trained more vigorously, Cunningham replied, "I was never able to do a lot of training as far as practice running was concerned. Most of today's athletes run from seventy-five to 150 miles a week. I never ran over five to seven miles and only went on the track three days a week: Monday, Tuesday and Wednesday. Tuesday, I would take my hard workout, but after the warm up I would never run over three-quarters of a mile. I would only do that usually for short distances, like two 660's or

[100] Ibid.
[101] Ibid.

three single quarters. Sometimes I'd just sprint 220's and walk 220's and sprint 220's, or maybe sprint a straightaway and walk the turns."[102]

William Freeman, author of *Peak When it Counts: Periodization for American Track and Field*, felt Cunningham epitomized the type of training distance runners performed during this era (1936-1948). He characterized the training as "light"—where middle-distance runners would run in the region of fifteen miles per week and a heavy workout of interval training might be limited to four repetitions of 440 yards at race pace, with 440-yard recovery walks between each run.[103] However, in comparison to the previous era (1885-1917) training between 1917 and 1945 may be considered moderate in nature. The benefits of significantly increasing the volume of training (running more miles) in addition to quality speed work would not materialize in the middle distances until later in the second half of the twentieth century.

JESSE OWENS: AN AMERICAN HERO

A lifetime of training for just ten seconds.[104]

Jesse Owens was born on 12 September 1913 in Danville, Alabama.[105] His original name, James Cleveland, fell from use when a schoolteacher mistook his drawled

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[102] Ibid., 416.
[103] Freeman, "Distance Training Methods, Past and Present: The Evolution of Distance Training and Racing, 1880-1975," 4-11.
[104] "Quotes by Jesse Owens," Estate of Jesse Owens c/o CMG Worldwide, http://www.jesseowens.com/quotes/ (accessed August 10, 2006).
[105] "USA Track and Field Hall of Fame: Jesse Owens," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=126 (accessed May 15, 2005).

"J.C." for Jesse.[106] He is best remembered for winning four gold medals at the politically-charged 1936 Berlin Olympics. Yet arguably his greatest feat was accomplished at Ann Arbor, Michigan on 25 May 1935 while competing for Ohio State University at the Big Ten Championships. There, the five feet and ten inch, 160 pounds Owens set four world records in the space of seventy minutes. He started off by tying the existing world record of 9.4 seconds in the 100 yards. His first attempt of 26'8$^{1}/_{4}$" in the long jump shattered the previous world record and remained unbeaten for the next twenty-five years. He won his third event, the furlong (220 yards), in 20.3 seconds, another world record. He finished the historic afternoon by recording a new world record in the low hurdles in a time of 22.6 seconds.[107] Owens's outstanding accomplishments were lauded by *New York Times* columnist Arthur Daley as "the greatest day in track history;" a statement that was reaffirmed in 2002 by *Sports Illustrated* when the magazine voted Owens's achievement as the most impressive college sport feat ever.[108] At the 1936 Olympics, Owens went on to win the 100 meters, 200 meters, the long jump, and ran on the winning 4 x 100 meters relay team. He set Olympic records in the 200 meters and long jump, and the 4 x 100 relay team set a new world record.[109]

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[106] William Baker, *Jesse Owens: An American Life* (New York: The Free Press, 1986), x.
[107] Cordner Nelson, *Track's Greatest Champions* (Los Altos, Calif.: Tafnews Press, 1986), 17-20.
[108] "Jesse Owens: Biography," The Authentic History Center, http://www.authentichistory.com/1930s/sports/193608_Jesse_Owens_Olympics_Berlin.html (accessed May 28, 2005). K. Anderson, "Top Ten College Sporting Achievements," *Sports Illustrated* 1 April 2002.
[109] D.H. Potts, "The World's Fastest Humans," *Track and Field News* 2, no. 2 (March 1949): 5.

Figure 24. Jesse Owens demonstrating powerful triple extension of his hip, knee and ankle as he explodes out of the starting position.[110]

Examination of his two biographies: *Jesse Owens: An American Life* (1986) and *Jesse Owens: A Spiritual Autobiography* (1978) reveals scant information pertaining Owens's training practices, a fact which can be explained by the general lack of understanding of the importance of training in this era.[111] However, in 1986 Owens was featured in the *Track and Field News* publication, *Track's Greatest Champions*, a

[110] Image located at: http://www.jesseowens.com/photos/ (accessed September 27, 2007).
[111] Owens, *Jesse Owens: A Spiritual Biography*. William J. Baker, *Jesse Owens: An American Life* (London: Collier Macmilan, 1986).

compilation of twenty-one of the "greatest champions" of all time. Although light in training information (much like his biographies), the text outlined a typical week's training prior to Owens's record breaking achievements at Ann Arbor in 1935. It summarized his work as follows: "Owens worked hard in training. He began a session with comfortable striding. He ran a fifty to seventy-five yard dash five or six times from the starting gun. He toiled over three low hurdles, straining his natural seven-foot stride in order to clear the first hurdle. Three times a week he ran the first 300 yards with fifty-second quarter-milers, then burst into an astounding fifteen or twenty yard lead at 440 yards. He took a few care free practice jumps three times a week."[112]

Further information regarding Owens's training practices can be gleaned from comments made in *Jesse Owens: A Spiritual Autobiography* regarding the longevity of his world records. Owens's long jump record stood for twenty-five years until it was finally beaten by Ralph Boston of the USA in 1960 with a leap of 26' 11 1/4" (8.21 meters) and his 100 meter record lasted twenty years before it was broken by Armin Hary of the Federal Republic of Germany in a time of 10.1 seconds.[113] Owens stated, "Incredibly after all these years, mine were still standing. Athletes were getting bigger and stronger and faster, training methods and equipment have improved immeasurably, but my running and jumping records were still intact."[114]

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[112] Nelson, *Track's Greatest Champions*, 15-26.
[113] "Athletics World Record Progression: Men Long Jump," International Olympic Committee, http://multimedia.olympic.org/pdf/en_report_90.pdf (accessed August 5, 2006). "Athletics World Record Progression: Men 100 Meters," International Olympic Committee, http://multimedia.olympic.org/pdf/en_report_70.pdf (accessed August 5, 2006).
[114] Owens, *Jesse Owens: A Spiritual Biography*, 131.

Owens was clearly an extremely gifted athlete. Indeed with expertise in the sprints, hurdles and jumps it is feasible that he could have easily made the transition to the decathlon—the most demanding of track and field events. However, despite the need to train for multiple events, examination of information on Owens's training is sparse. The lack of detailed training information pertaining to Owens's preparation reflects an amateur era in which adherence to year-round highly structured training schedules was not considered important enough or essential for track and field success. This is reflected in the aforementioned *laissez-faire* description of Owens's training where his long jump preparation entailed a few "carefree" practice jumps three times per week. Such a carefree attitude had repercussions in the qualifying rounds of 1936 Olympic long jump where Owens fouled his first two (out of three) attempts. Only the unsolicited advice of Owens's greatest adversary, the German champion Luz Long, saved the day. For Owens the focus never was winning at all costs, indeed Owens later wrote "You can melt down all medals and cups I have and they wouldn't be a plating on the twenty-four-carat friendship I felt for Luz Long at that moment."[115]

[115] Wallechinsky, *The Complete Book of the Olympics*, 136.

GUNDER "THE WONDER" HÄGG AND FARTLEK TRAINING

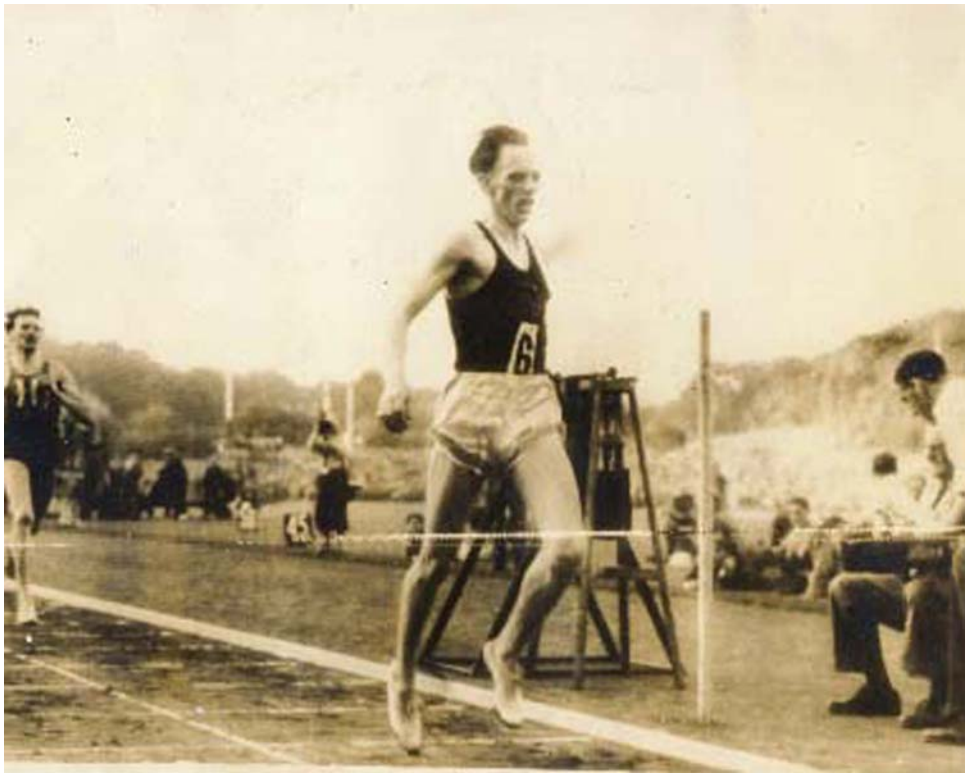

Figure 25. Gunder Hägg (ca. 1942).[116]

Gunder Hägg was born on 31 December 1919 in Albacken, Sweden. Hägg benefited from his country's neutrality during World War II by breaking fifteen world track records (ten of which were achieved over an eighty-two day period during the summer of 1942) in the field of middle distance running. His world record time of 4:01.4 in the mile lasted for the nine years prior to Roger Bannister's breaking the four-minute

[116] Image located at: www.sportsartifacts.com/trackandfield.html (accessed December 12, 2007).

barrier in 1954.[117] By the end of his career Hägg had lowered the 1,500 meters record by 4.8 seconds, the mile by 5.0 seconds, the 2,000 meters by 5.0 seconds, the 3,000 meters by 7.8 seconds, the two miles by 10.4 seconds, the three miles by 10.0 seconds, and the 5,000 meters by 10.6 seconds. In doing so he helped redefine the boundaries of middle distance running.[118]

In the book entitled *Gunder Hägg's Diary,* excerpts of which were featured in Fred Wilt's *How They Train*, Hägg recounted the training that made him so successful. From December 1939 until the spring of 1940 while engaging in military service in the far north of Sweden, Hägg ran daily over a 5,000 meter forest path. It consisted of the following continuous sequence: an uphill run, running on level terrain, a downhill run, a full speed 800 meter run on level ground, another uphill run, downhill relaxed running, full speed striding with mixed sprints on a level area and finishing with an uphill run of even speed. In the spring Hägg divided his workouts between the forest and the track. An example of one week's training taken from his diary is as follows:

> **4/30/43:** Morning: 5 km—sprinting and easy running; Evening: 6 km of the same
> **5/1/43:** AM: 5km—light running on the track; PM: 5 Km—sprinting and light running (track)
> **5/2/43:** Morning: 5 km—light running on track; Evening: Swedish bath
> **5/3/43:** Morning: 5 km—sprinting and easy running; Evening: same

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[117] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 146-148; "Obituaries: Gunder Hagg," Times Online, http://www.timesonline.co.uk/article/060-1382244,00.html (accessed June 14, 2005).
[118] Lennart Julin, "Gunder Hägg Passes Away - a Tribute to Sweden's World Record Breaker," American Track and Field, http://www.american-trackandfield.com/news/haggpassesaway04.html (accessed November 29, 2004); Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 146-148.

5/4/43: 5 km—light running on track

5/5/43: 4 km—sprinting and jogging.[119]

Hägg's training reveals the systematic use of altered running pace—sprinting, striding, and easy running. This innovative system of endurance training that alternated strenuous and easy running over varied and interesting terrain was termed *fartlek* which in English means "speed-play."[120]

In the middle of 1930, inspired by repeated losses at the hands of the Finns and Paavo Nurmi, Gosta Holmer, the Swedish national coach, studied Paavo Nurmi's training during a sojourn in Finland. There he decided to abandon the use of the stopwatch and adapt Nurmi's methods to Swedish conditions thus producing *Fartlek*—a name said to be inspired by the way children play. Major Raoul Mollet, Honary President of the National Officials Committee of Belgium and contributor to Fred Wilt's *How They Train,* summarized the impact of *fartlek* training. "*Fartlek* was perhaps the most alluring discovery since the beginning of the century in the realm of training. It encouraged severe training which is the means to good times, of thousands of practicing athletes and enabled them to attain very satisfactory results… a window was opened in the forest, and at the same time an idea of training emerged which one could classify as "happy." *Fartlek*, with its walks, its runs at slow pace through the woods, its short sprints, was able to revolutionize the training of the track world."[121] Hägg's daily 5,000 meter run in the

[119] Wilt, *How They Train: Half Mile to Six Mile*, 27-28.
[120] Doherty, *Track and Field Omnibook*, 375.
[121] Mollet, "Interval Training," 97-101.

forest typified this new, “free-willed” form of running and laid the foundation for a world record performance in the mile which for nine years seemed impossible to beat.

RUDOLPH HARBIG and INTERVAL TRAINING

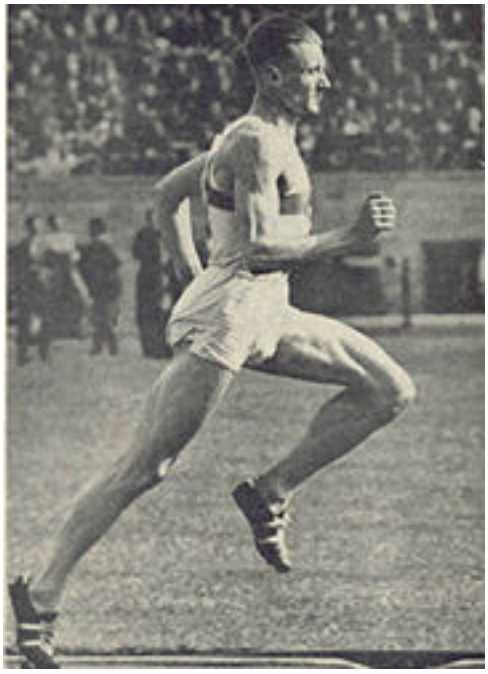

Figure 26. Rudolph Harbig.[122]

Rudolph Harbig was born on 8 November 1913 in Dresden, Germany. On 13 July 1939, Harbig set a world record time of 1:46.6 in the 800 meters and on August 12 of the same year he set another world record of 46.0 seconds in the 400 meters. His 400 meter record stood from 1939 to 1948 and his 800 meter time remained in the record books

[122] Image located at: www.volodalen.com/32historique/harbig.htm (accessed February 12, 2008).

from 1939 to 1955.[123] Harbig started his winter training in the middle of November with three workouts per week. On Sunday mornings he ran in the forest for one and a half to three hours changing speeds from fast and hard to slow and easy with occasional walks in the snow for an hour. Tuesday evenings were confined to the gymnasium lifting light dumbbells (thirty to forty pounds), skipping rope, climbing rope, calisthenics, and working on gymnasium apparatus. On Friday night he ran on the floodlit track at his local Dresden club. The following workouts provide examples of training sessions that Harbig performed prior to his record breaking marks and also serve to demonstrate the demarcation between work and rest:

> **7/13/39:** Workout recorded prior to 800 meter world record in Milan, Italy on 7/15/39 in a time of 1:46.6. Jog 20 minutes; 600 meters in 1:27 seconds; Jog 10 min; 300 meters in 36.9 seconds; jog 10 minutes; 500 meters in 66.7 seconds
>
> **8/8/39:** Workout recorded prior to 400 meter world record in Frankfurt, Germany on 8/12/39 in a time of 46.0 seconds: Jog 20 minutes; 3 x 250 meters in 30.6, 30.2 and 29.8 seconds with a 10 minute jog after each run. [124]

Harbig was coached by Woldemar Gerschler, a professor of physical education at Freiburg University in Germany. Gerschler studied the training methods of Paavo Nurmi but noticed a lack of one key element—speed. Nurmi, as previously discussed, had performed too much long slow distance running at the expense of speed work and naturally his pupils inherited similar qualities and faults. In addition to speed, Gerschler was also concerned about the lack of quantification in *fartlek* training, where distances or

[123] Wilt, *How They Train: Half Mile to Six Mile*, 5-6.
[124] Ibid.

recovery times were not precisely measured.[125] The aim therefore, was to look for new ways to add measured speed while still keeping the important quality of Nordic endurance. From Gerschler's studies came a revolutionary notion—resistance through repeated speed or so called "interval training."[126] Interval training can be defined as "A training system…which alternates measured runs (work) at a measured pace with easy recovery runs (rest) for a measured length of time."[127] It involves the manipulation of the following five elements: 1) distance of the run, 2) interval of recovery, 3) repetitions of the run, 4) time of the run, and 5) action undertaken during recovery.[128]

Betweeen 1935 and 1940 Gerschler and Dr. Herbert Reindell, a celebrated German cardiologist, worked in tandem to provide scientific validation to this method of training. They concluded that during a prescribed number of intervals, over a set distance and time, the athlete's heart rate should rise to 170-180 beats per minute (bpm). The athlete should then take a maximum of ninety seconds rest by which time the heart rate should return to 120-125 bpm.[129] When this had occurred the athlete should begin running again. If the heart took longer than ninety seconds to recover the run was either 1) too "violent" or fast, or 2) too long and should therefore be modified. A heart rate greater than 120 bpm indicated insufficient recovery and was associated with a reduction

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[125] P. Sprecher, "Visit with Dr. Woldemar Gerschler," in *Run, Run, Run*, ed. Fred Wilt (Los Altos, Calif.: Track and Field News, 1964), 150-151.
[126] Mollet, "Interval Training," 98.
[127] Doherty, *Track and Field Omnibook*, 378.
[128] Smit, "Interval Training," 180-185; Kenneth Doherty, "Interval Training," *Track and Field News,* March 1956, 11-13.
[129] Gerschler, "Interval Training," 391-396.

in performance of the next work bout.[130] The results of the research and training were outstanding as Harbig, who served as a guinea pig, bettered three world records, displacing the Americans from their supremacy in the 800 meters. When the public came to hear of Harbig's training they thought it was tantamount to suicide. A workout in which ten repetitions of 400 meters without stopping was considered unheard of and "pure foolishness."[131] The close monitoring of heart rate and division of time within time to form intervals represents a significant increase in the level of sophistication and objectivity of the training process. The use of measured work intervals facilitated a marked increase in training intensity at or above race pace that directly translated to enhanced performances on the track. A testimony to the revolutionary effect and success of interval training is that its use continues to form the cornerstone of the majority of competitive running training programs today.[132]

Analysis of the evolution of athletes' training programs between 1917 and 1945 reveals variations in all three major components (volume, intensity and density) of training. This coincided with significant improvements in running performances as the world mile record fell from 4:10.4 in 1923 (Paavo Nurmi 08/23/23) to 4:1.4 in 1945 (Gunder Hägg 07/17/45).[133] Nurmi increased the volume and intensity of training way beyond his contemporaries but still suffered from a lack of speed work and winter

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[130] Sprecher, "Visit with Dr. Woldemar Gerschler."
[131] Mollet, "Interval Training," 98.
[132] *USA Track and Field Coaching Manual*, (Champaign, Ill.: Human Kinetics, 2000),103-105; 113-118. Mike Poehlein (Head Track and Field Coach at Purdue University), Lance Harter (Head Women's Track and Field Coach at the University of Arkansas and Harry Groves (Head Men's Track and Field Coach at Penn State University) outline how to train for distances from 800 to 10,000 meters. The authors include detailed examples of how intervals are incorporated into training throughout the year.
[133] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 420-421.

preparation. Gunder Hägg also significantly increased the volume, intensity and density of training with his revolutionary use of *fartlek* and the introduction of winter training. However, in contrast to today's middle distance runners who routinely train six to seven days per week in the fall and winter periods, Harbig's winter training was light, providing room for further improvement after World War II. Finally, the revolutionary training devised by Woldemar Gerschler and Dr. Herbert Reindell and executed by Rudolph Harbig added a distinctly scientific approach to training where objective markers (heart rate, time, distance) were used to determine optimal workloads and recovery times. This resulted in a greater quality of training with increased intensities but decreased volume which facilitated better use of the athlete's (and coach's) time. It is clear from the above description, that manipulation of the key training variables—volume, intensity and density, had a significant positive effect on performance that would continue well into the second half of the twentieth century.

THE SCIENCE OF ATHLETIC TRAINING

In the 1920s the field of exercise physiology as we currently understand that term, did not exist. There were, however, a few physiologists at facilities such as the Harvard Fatigue Laboratory, founded in 1927, who added to our knowledge of human performance through their research on challenging work environments and occupational safety. To this end, some of the pioneering studies on work capacity examined human

performance in excessively cold, excessively warm, excessively humid, or excessively high environments.[134]

In 1923, Arthur H. Steinhaus, a pioneer in the field of exercise physiology, founded the YMCA College Laboratory for Physiologic Research in Physical Education, at George Williams College in Chicago. The new lab was responsible for research on a multitude of exercise related topics, but one of the most important articles to emerge from that lab was Steinhaus's 1933 review essay entitled the "Chronic Effects of Exercise," published in the *Physiological Review*. Steinhaus's article had a major impact on the development of exercise physiology in the 1930s and 1940s.[135] With 253 references it detailed the effects of exercise on the muscular, circulatory, respiratory, endocrine and central nervous system**.** One area particularly applicable to training and covered by Steinhaus was the adaptive response of an organism to exercise. The adaptations that occurred as a result of exercise facilitated the performance of further exercise—the sum total of which constituted the "trained" state.[136] One such adaptation, according to Steinhaus, was the phenomenon of cardiac hypertrophy, or the enlargement of the heart as a consequence of exercise. Steinhaus outlined three competing opinions as to the cause of cardiac hypertrophy before concluding that "the mass of evidence favors the view that in certain individuals, perhaps the majority, exercises of the endurance form will induce growth of heart muscle…and this hypertrophy will regress at least in part

[134] Martin, "Physiology: Its Role in Explaining Athletic Performance," 9-12.
[135] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 383.
[136] Steinhaus, "The Chronic Effects of Exercise," 103-147.

with the cessation of training, and is very likely an asset to the individual in pursuit of his sport."[137]

In 1922, Archibald Vivian Hill was awarded the Nobel Prize in Physiology or Medicine. Hill was the Joddrell Professor of Physiology at University College, London, where he was renowned for his pioneering work in exercise physiology and in particular, his work on muscular activity.[138] Hill began his research in 1910 investigating the time course of heat production in isolated frog muscle. He held a keen interest in athletics and sought to apply the concepts he discovered in frog muscle to the exercising human. "Athletics, physical training, flying, working," Hill wrote, "all require knowledge of the physiology of man."[139] Hill and his colleagues applied their work to an athletic environment where they studied the energy cost of running by measuring oxygen consumption of subjects as they ran around an eighty-five meter grass track. From their research they derived the terms "maximum oxygen intake [uptake]," and "steady state of exercise" which are still used in various forms today.[140] Hill's greatest contributions to science included the discovery of heat production in nerves, the series elastic component

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[137] Ibid., 112.

[138] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 390.

[139] Hill, "The Present Tendencies and Methods of Physiological Teaching and Research," 294-305.

[140] Maximum Oxygen Uptake (Max VO2) refers to the maximum capacity of an individual's body to transport and utilize oxygen during incremental exercise. Steady State Exercise refers to a state obtained in moderate muscular exercise when the removal of lactic acid by oxidation keeps pace with its production. For further information on Maximum Oxygen Uptake and Steady State Exercise including a full glossary of physiological terms pertaining to coaching sport see: Brian J. Sharkey and Steven E. Gaskill, *Sport Physiology for Coaches* (Champaign, Ill.: Human Kinetics, 2006).

of muscle, and the force-velocity equation in muscle used to calculate power production.[141]

In 1935 Adrian Gordon Gould and Joseph A. Dye published *Exercise and its Physiology*.[142] Gould was an Assistant Medical Advisor and Assistant Professor of Hygiene at Cornell University and Dye was an Assistant Professor of Physiology at the same institution**.** The book covered an extensive array of topics summarizing the findings of research relating to various aspects of exercise physiology. Chapter Twenty-Four was specifically devoted to "Training and Some of its Physiology." Most of the chapter focused on adaptive mechanisms to training with limited practical advice that could be applied at the track (or gymnasium). The authors did, however, address the topic of overtraining or "staleness" which was viewed as a condition that involved "expending more energy than can be replaced by food and rest."[143] A potential practical test for overtraining featured the work of C. Goodwin at Springfield College, Massachusetts. Goodwin's research discovered that adults between the ages of twenty to twenty-five who were classified as "stale" and were accustomed to exercise had an increase in heart rate of twenty to forty-eight beats per minute when changing from a horizontal to a vertical position compared to no more than twenty beats per minute in normal subjects.[144] The increased difference between standing and lying heart rates continues to be used today as

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[141] D.R. Bassett, "Scientific Contributions of A.V. Hill Exercise Physiology Pioneer," *Journal of Applied Physiology* 93, no. 5 (2002): 1567-83.
[142] Adrian Gordon Gould and Joseph A. Dye, *Exercise and Its Physiology* (New York: A.S. Barnes and Co., 1935).
[143] Ibid., 387.
[144] Ibid. Gould and Dye reported the results of C.Goodwin's Master's thesis conducted at Springfield, Massachusetts that was titled. "Diurnal Variations of the Heart Rate."

one potential indicator of overtraining.[145] Further practical advice was offered by the suggestion that athletes should not suddenly "break training," at the end of the competitive year as it had "neither a physiological nor hygienic foundation…and therefore the detraining process should be as gradual as the training process."[146]

While scientists were making significant gains concerning the physiological response to exercise, the systematic study of athletic performance was rare during this period. One study, published in 1928, that attempted to bridge the gap between physiology and performance was conducted at the Medical Laboratory of the Boston General Hospital in Massachusetts.[147] It compared the physiological response to exercise of seven-time Boston Marathon winner Clarence DeMar to a number of sedentary individuals and formed one of the original studies describing the dynamics of lactic acid production during intense exercise.[148] The authors concluded their study by stating, "The results indicate that training enables the organism to maintain an internal environment approaching that of the normal resting state even during severe work."[149] The data collected indicated the considerable improvements in performance possible as a result of

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[145] Bompa, *Periodization: Theory and Methodology of Training*, 135. Mary O'Toole, "Overreaching and Overtraining in Endurance Athletes," ed. Richard B. Kreider, Andrew C. Fry, and Mary L. O'Toole (Champaign, Ill.: Human Kinetics, 1998), 3-19. Other major symptoms of overtraining indicated by their presence in the literature include: the inability to meet previously attained performance standards or criteria; reduced toleration of loading; reappearance of mistakes already corrected; changes in blood pressure; decreased body fat; chronic fatigue; elevated basal metabolic rate; loss of appetite; increased aches and pains; increased internal and external distractability; flu-like illnesses; swelling of lymph glands; bacterial infection; mineral depletion; elevated cortisol levels and low free testosterone. For a complete breakdown of the major symptoms of overtraining, see Richard B. Kreider, Andrew C. Fry, and Mary L. O'Toole, eds., *Overtraining in Sport* (Champaign, Ill.: Human Kinetics, 1998), 5-7.

[146] Gould and Dye, *Exercise and Its Physiology*, 388.

[147] A.V. Bock et al., "Studies in Muscular Activity: Dynamic Changes Occurring in Man at Work," *Journal of Physiology* 66, no. 2 (1928): 136-161.

[148] Lactic Acid (Lactate) is a chemical that is formed when sugars are broken down for energy in the absence of adequate oxygen.

[149] Bock et al., "Studies in Muscular Activity: Dynamic Changes Occurring in Man at Work," 160.

training. However, David E. Martin, co-author of *Training Distance Runners,* former exercise physiology consultant to Sebastian Coe (winner of four Olympic medals—two gold, two silver), noted in an appraisal of the contribution of physiology to performance that scientists were unable to assist DeMar further with his performance because they could not "practically interpret his laboratory data to design an optimal training plan."[150] Indeed, DeMar attributed his failure in the 1912 Olympics (where he placed twelfth) to the misguided advice given to him by the so-called experts at the time.[151]

In an effort to bridge the gulf between science and the realm of physical education, a column was started in the October 1930 issue of *The Journal of Health and Physical Education* entitled "Physiology at the Service of Physical Education."[152] It featured a multitude of articles written by Arthur H. Steinhaus that included: the effect of exercise on stomach motility; metabolism of exercise and work cost; the heart size during exercise; the chronic effect of exercise on the size of the heart; tonus reflexes and the problem of corrective exercise; and the theory of muscular contraction. While such information would have undoubtedly been of interest to many physical educators and serve as background knowledge, it did little to convey to coaches how to scientifically train athletes to improve performance.

Research Quarterly, the sister publication of *The Journal of Health and Physical Education*, was as its name suggests, more scientific in nature. Analysis of its content

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[150] Martin, "Physiology: Its Role in Explaining Athletic Performance," 12.

[151] James H. Currens and Paul White, "Half a Century of Running," *The New England Journal of Medicine* 265, no. 20 (1961): 988-993. DeMar had a considerable disdain for officialdom, especially for trainers and coaches in the field of sports and he was never convinced that they could help him.

[152] Arthur H. Steinhaus, "Physiology at the Service of Physical Education: Concerning the Physiology of Work and Overwork," *The Journal of Health and Physical Education* 1 (October 1930): 34.

from its inception in 1930 to 1945 reveals limited information pertaining to the enhancement of track and field training. One article that did attempt to address this imbalance was written by James W. Coleman of the University of Nevada. It began with the statement, "Expert opinion on the contributing factors in track and field performances in the past has varied widely. Because of this fact, we are decidedly handicapped in our efforts to introduce into the daily practices the best methods and ideas."[153] The goal of the author was to discover some of the factors that control performance, the relationship that performance variables have to each other, the relative importance of each, and to set up a series of tests to predict with a high degree of accuracy the "latent ability of any given individual to the events involved."[154] The author devised five regression equations that were dependent upon the results of certain physical tests such as average yards per second in the 60-yard dash, height in inches, the standing broad jump, weight in pounds, and the baseball throw for distance in feet, predicted the running broad jump, 60-yard dash, velocity index, running high jump, and the sixteen-pound shot put. Despite such a valiant attempt to shed light on the factors that affect performance the author failed to appreciate the multi-factorial levels of skill, technique, coordination, speed, strength and genetic variability that make it difficult to predict performance across such a broad range of events.

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[153] James W. Coleman, "Pure Speed as a Positive Factor in Some Track and Field Events," *Research Quarterly* 11, no. 2 (May 1940): 47-53.

[154] Ibid., 47. Max Jones, the former United Kingdom Athletics Performance Director developed a similar standardized quadrathlon used to predict explosive power. It consists of the standing long jump; standing triple jump; thirty yard dash and the overhead backwards throw with a sixteen pound shot put. It is used by many collegiate track and field programs to evaluate and predict performance, particularly in the off-season. For further information see: "Quadrathlon," Brian Mac, http://www.brianmac.co.uk/quad.htm (accessed December 5, 2007).

More specific research related to sprinting was conducted by Arthur Slater-Hammel of Oberlin College, Ohio, who examined a "Possible Neuromuscular Mechanism as the Limiting Factor for Rate of Leg Movement in Sprinting." The study involved measuring and comparing the rate of leg turnover of a group of subjects running the 100- yard dash and cycling a stationary bicycle. The author concluded that the rate of reciprocal leg motion in running was not limited by the rate of neuromuscular coordination of the legs, as the rate of leg turnover in cycling far exceeded that encountered in high speed running.[155] Although the author provides thought-provoking information regarding the neuromuscular coordination associated with cycling, he fails to offer any practical advice on how to improve leg turnover (stride frequency) or stride length, the two determinants of running speed.[156]

The disparity between science and its application to sport is symptomatic of an era where exercise physiology and sport science were very much in their infancy. Exercise physiologists were understandably more concerned with basic questions related to exercise—such as the mechanisms of muscular contraction and the effects of exercise on the heart than applying their research to help improve and understand athletic performance. Also, as sport historian Roberta Park insightfully notes, it would have taken a major shift in thinking, to transform the results of laboratory experiments into information that was useful to the practicing athlete.[157]

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[155] Arthur Slater-Hammel, "Possible Neuromuscular Mechanism as the Limiting Factor for Rate of Leg Movement in Sprinting," *The Research Quarterly* 12, no. 4 (December 1941): 745-756.
[156] Frank Dick, "Development of Maximum Sprinting Speed," *Track Technique*, no. 109 (Spring 1999): 3475-3480.
[157] Park, "Athletes and Their Training in Britain and America, 1800-1914," 70.

The period between 1917 and 1945 thus witnessed a transition from 'light" to "moderate" conditioning levels. The eight to ten week preparatory period characteristic of training prior to WWII was supplemented by both fall and winter training. Furthermore, the limited weekly mileages and preparation of the likes of Joe Binks and John Paul Jones, (both former world record holders in the mile prior to WWI) evolved into more moderate training levels typified by Glenn Cunningham—who normally ran somewhere in the region of fifteen miles per week.

The post World War I period gave rise to two of the greatest innovations in the history of track and field—interval training and *fartlek*—methods that continue to form the foundation of competitive track training programs today. The inter-war years also demonstrated the potential role that sport science can play in enhancing performance. While American sport scientists struggled to make the connection between science and sport, in Germany the doctor and coach worked together to improve training practices that could be directly applied at the track. The revolutionary use of interval training (as we shall see in Chapters Four and Five) gained increasing acceptance and usage after WWII and was instrumental in achieving what many experts consider to be the greatest athletic feat of the twentieth century.

CHAPTER FOUR

THE QUEST FOR THE FOUR-MINUTE MILE: THE TRAINING OF ROGER BANNISTER, WES SANTEE AND JOHN LANDY

> To be first in this contest had developed into an inter-continental as well as an international struggle and the three protagonists concerned although thousands of miles apart, had reached identical conclusions on the methods likely to ensure success. All had decided that hard training and the building up of their powers of endurance to a limit previously unattained were to be the order of the day. The punishing method of training and racing that had already revolutionized distance running throughout the world also had to be applied to the mile and, if possible, intensified. To this end it was necessary to analyze every factor, physical and mental, that could improve performance. An almost superhuman task demanded for its solution a combination of scientific study, unremitting effort, and an implacable will to win.[1]

At the end of 1953 and the early half of 1954, three runners (Roger Bannister of England, Wes Santee of the United States, and John Landy of Australia) were locked in a three-way battle to reach the "Holy Grail" of track and field—to be the first man to run a mile in under four minutes. Although many had tried, no one in the nearly ten years after Gunder Hägg set the world mile record in 4:01.4 had been able to lower the standard.[2] The record had, as Roger Bannister explained it, "become rather like an Everest—a challenge to the human spirit. It was a barrier that seemed to defy all attempts to break

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[1] Smith, *All Out for the Mile*, 102.

[2] Lawson, *World Record Breakers in Track and Field Athletics*, 89-90. Gunder Hägg's mile record of 4:01.4 was set in Malmö, Sweden, on 17 July 1945**.**

it."[3] The following histories serve as a case study to illustrate the different training approaches and schedules each athlete used to attack the same noble goal—to be the first man to run the imperial mile in under four minutes.

Statistics in record books only identify the athletes who are victorious in beating the clock or their opponents to the finish line. However, like a Formula One Ferrari race car that needs to be designed, built (and ultimately driven), credit must also be given to the coaches, without which many an athlete would fail to reach their full potential. For this reason, full coverage is also given to the three coaches (Franz Stampfl, Percy Cerutty and Bill Easton) who each had their own unique part to play in what is considered by many to be not just one of the greatest moments in track and field history, but one of the greatest moments in all of sport during the twentieth century.[4]

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[3] Bannister, *The First Four Minutes*, 169.

[4] "Bannister's Four-Minute Mile Named Greatest Athletic Achievement." David Wallechinsky describes 6 May 1954, the day Roger Bannister ran the fist ever sub-four minute mile as "probably the greatest day in track and field history." For further information see: Wallechinsky, *The Complete Book of the Olympics*, 44.

ROGER BANNISTER: THE CONQUEROR OF THE SUB-FOUR MINUTE MILE

Figure 27. Roger Bannister crosses the line at Oxford University's Iffley Road stadium in a time of 3:59.4 to complete the first ever sub-four minute mile on 6 May 1954.[5]

> The world's one mile record is doomed. I have just come from Motspur Park; Bannister and Chataway, finishing together, ran three-quarters of a mile in three minutes dead, and both were as fresh as paint at the finish. Believe me my friend great things are about to happen in the near future.[6]

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[5] Image available at: http://corporate.gettyimages.com/masters2/BeforeAfter.aspx?id=bannister (accessed July 11, 2007).

[6] Bascomb, *The Perfect Mile*, 177. The quote was made on 24 April 1954 by Geoffrey Dyson, Chief National Coach of the Amateur Athletic Association.

Roger Gilbert Bannister was born on 23 March 1929 in Harrow, Middlesex, England. He lacked the physical frame to play rugby, was considered too slight for rowing, and did not have the hand-eye coordination needed to excel at ball games. He found his niche in running, however, and focused himself from a fairly early age on running the middle distance events. His interest in the mile was piqued by witnessing Arne Anderson beat Sydney Wooderson (former world-record holder) in the mile at London's White City stadium in 1945.[7] Following that race, Bannister became more serious about track. However much he enjoyed the exhilaration of running, he nonetheless never let it affect his academic responsibilities or his aspirations to become a doctor. In the fall of 1946 Bannister enrolled as a medical student at Oxford University and joined the University track team. Because of medical commitments, Bannister was unable to adhere to a seven-day week, multiple daily workout training schedule, and rarely trained five days a week until the end of his career.[8] As a freshman he finished his first official mile race in a time of 4:53. At an Oxford versus Amateur Athletic Association (AAA) meeting on 5 June 1947 Bannister ran 4:24.6 at the age of eighteen—faster than Sydney Wooderson (who had broken the world mile reord in 1937) at the same age.[9]

In November 1947 Bannister received an invitation to receive financial assistance with a view to representing Great Britain at the 1948 Olympics. However, he declined the offer on the grounds that he was not ready for competition at the Olympic level.

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[7] Bannister, *The First Four Minutes*, 41-42.
[8] Fred Wilt, *Run, Run, Run* (Los Altos, Calif.: Track ad Field News, 1964), 75.
[9] Bannister, *The First Four Minutes*, 46-57.

During his years at Oxford, Bannister's times steadily improved. In 1949 he ran the 880 yards in 1:52.7 and won mile races in times of 4:11.1 and 4:11.9.[10] In 1951, while running the Benjamin Franklin Mile at the Penn Relays, Bannister broke away from the pack and with a 56.7 second final lap, and finished in 4:08.3.[11] In 1952, Bannister felt he was ready to be part of the British Olympic team and at Helsinki finished fourth in the 1,500 meters with a British record of 3:46.0.[12] Disappointed by finishing out of the medals, Bannister reportedly spent the next two months reflecting on whether to give up running entirely and focus on his medical career. In the end, he decided to give running one more try. As a focus for his training he decided to pursue a new and heretofore elusive goal—the four minute mile.

To achieve this new goal, Bannister decided to alter his training regimen in significant ways. Because he was still a medical student, the amount of time he could allocate to training was relatively small, and so he upped the intensity of his workouts considerably from what they had been in the past. He began, in February of 1953 by intensifying his interval training.[13] He would sometimes run as many as ten quarter-miles, each in approximately sixty-three seconds, with an interval of only two to three minutes between each run. "This was much more strenuous training than I had done before. It left me exhausted for several days, but it could be accomplished within the half-hour a day that I was able to spare for training."[14] By the end of 1953, George Smith, an AAA staff

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[10] Ibid., 81-92.
[11] Ibid., 126.
[12] Wallechinsky, *The Complete Book of the Olympics*, 43-44.
[13] Bannister, *The First Four Minutes*, 164-165.
[14] Ibid., 165.

member and author of *All Out for the Mile*, came to the conclusion that Bannister needed additional power and stamina to achieve the magic mile. His output of energy over the course of four laps was unbalanced and from the experience of his 1952 and 1953 races he had been continually frustrated in the home straight.[15]

For seven years Bannister followed his own training program and steadily improved his running times. To Bannister, running had always been a personal voyage, a pursuit where an "athlete could be sufficient to himself."[16] Employing a coach he believed, would detract in some way from a sense of individual accomplishment. However, in the autumn of 1953, Bannister took his first step away from self-reliance by running with fellow British athlete Chris Brasher, gold medalist at the 1956 Olympics in the steeplechase. During lunchtime the two met at the Paddington track in London for short workouts.[17] Brasher had trained with Austrian athletics coach Franz Stampfl for a year prior to teaming up with Bannister. Stampfl had held part-time coaching positions at Oxford and Cambridge Universities at varying times, in addition to coaching athletes at the Duke of York's Chelsea Barracks on Friday evenings and in Battersea Park at the weekends.[18] He provided Brasher with a training program, part of which Brasher completed by running with Bannister at the Paddington track. On some occasions Brasher and Bannister were joined by Chris Chataway—fifth in the 5,000 meters at the 1952 Helsinki Olympic Games—who had also started training with the Austrian coach. Brasher was convinced that employing a coach was essential to fulfilling an athlete's

[15] Smith, *All Out for the Mile*, 110-112.
[16] Bannister, *The First Four Minutes*, 187.
[17] Bascomb, *The Perfect Mile*, 167.
[18] Ibid., 168.

potential. “It is absolutely necessary to have someone to whom you can turn, who is entirely honest with you,” he said, “who you know will not give you give spurious advice…it wasn’t so much how to lift my arms or legs up, but when I felt that I had had it, he came on, reassured, showed me the goals ahead…I don’t think anyone can be so self-sufficient that they don’t feel the need for somebody else.”[19]

As 1953 drew to a close Bannister reached the conclusion that he lacked enough stamina to sustain running four laps at sub-four-minute-mile pace. He therefore took Brasher’s advice and sought the advice of Franz Stampfl. Beginning in December of 1953, Bannister traveled with Brasher on Friday evenings to the Chelsea barracks where Franz Stampl directed their training sessions.[20] Stampfl’s approach to training was much more rigorous than what Bannister had done in the past. He pushed Bannister, Brasher and Chataway, to higher levels of performance by having them run ten consecutive quarter-miles in sixty-six seconds, several times a week. In January and February of 1954, the trio gradually increased the intensity of their training by running faster intervals while keeping the same two-minute rest interval between each run. By April they had lowered their times to sixty-one seconds for each quarter mile repeat but then hit a wall, and no matter how hard they tried, they could not reach their target of sixty seconds. After a break in training, during which they traveled to Scotland for some rock climbing, they surpassed their target by running the quarter-miles in fifty-nine seconds. Finally,

[19] “The Loneliest Place in the World” (British Broadcasting Company Sound Archives) in *The Perfect Mile*, 169.
[20] Smith, *All Out for the Mile*, 112.

they were back on the track Stampfl had originally planned.[21] It was now less than three weeks to the Oxford University versus AAA race, the first opportunity of the year to attack the four-minute mile.

On Thursday, 6 May 1954, Bannister left Paddington station in London and traveled to Oxford University's Iffley Road sports stadium. It was Bannister's first race in eight months. Near gale force winds had blown most of the day and threatened to curtail Bannister's record-breaking attempt, but when the time finally came and Bannister lined up for the start of the race, he glanced up at the flag of St. George flying from a nearby church and realized that the wind was now soft enough that conditions were indeed favorable for the attempt.

> Yes, the wind was dropping slightly. This was the moment when I made my decision. The attempt was on…We seemed to be going slowly. I went on worrying until I heard the first lap time, 57.5 sec…I barely noticed the half mile, passed in 1 min. 58 sec…At three-quarters of a mile the effort was still barely perceptible; the time was 3 min. 0.7 sec and by now the crowd were roaring…I felt that the moment of a lifetime had come…It was my chance to do one thing extremely well…With five yards to go the tape seemed almost to recede. Would I ever reach it? Those last few seconds seemed never ending…I leapt at the tape like a man taking his last spring to save himself from the chasm that threatens to engulf him.[22]

After crossing the finish line, Bannister collapsed almost unconscious into the supporting arms of the crowd. Filled with the agonizing pain that only the body of an athlete at the absolute limit of his capabilities could feel, Bannister felt certain he had

[21] Bannister, *The First Four Minutes*, 183-184.
[22] Ibid., 190-192.

broken the barrier. Only the stopwatches would reveal the answer. Two minutes later, the timekeepers handed the announcer, Norris McWhirter the official time of the race. The uproar on the track silenced as the result was read over the loudspeakers.

> Ladies and Gentlemen, here is the result of event number nine, the one mile: first, number forty-one, R.G. Bannister, of the Amateur Athletics Association and formerly of Exeter and Merton Colleges, with a time which is a new meeting and track record and which subject to ratification will be a new English Native, British (National), British (All-comers), European, British Empire and World Record. The time is three (and lost in the roar were the words) minutes fifty-nine point four seconds.[23]

Bannister crossed the line in 3:59.4—the first ever sub-four minute mile. He had conquered the Mount Everest of track and field and Bannister's name would be forever immortalized in track and field history. "We shared a place where no man had yet ventured—secure for all time, however fast men might run miles in the future. We had done it where we wanted, when we wanted, how we wanted, in our first attempt of the year."[24]

Ross McWhirter, the twin brother of the day's announcer, Norris, wrote the most reliable record of the build up to the first four-minute mile in the May 1954 edition of *Athletics World*. McWhirter, *Guinness Book of Records* co-founder and a close friend of Bannister (who witnessed many of his workouts), was aware of the immense significance

[23] John Bale, *Roger Bannister and the Four-Minute Mile* (London: Routledge, 2004), 84.
[24] Bannister, *The First Four Minutes*, 193.

of Bannister's feat. He noted that "it may be of almost historical importance to list his immediate preparation," It consisted of:

Monday, April 12: 7 times 880 yards at an average of 2:10, with 3 minutes rest between each
Wednesday, April 14: 3/4 mile solo—3:02 (laps 61, 61, 60)
Thursday, April 15: 880 in 1:53 solo.
Friday to Monday, April 16-19: rock-climbing in Scotland
Thursday, April 22: 10 times 440 yards (average—58.9) First—56.3; last—56.3
Saturday, April 24: 3/4-mile in 3:00 in company with Chataway
Monday, April 26: 3/4-mile in 3:14; eight minutes rest; 3/4 mile in 3:08.6
Wednesday, April 28: 3/4-mile solo in 2:59.9 in high wind
Friday, April 30: Final 880-yard time trial—1:54
May 1 to May 6: Rest. Five days.[25]

Despite his record-breaking achievements Bannister remained philosophical with regards to how far improvements in training and performance had come, "For long distances…we are only just beginning to realize the amount of training the body can endure, and the improvement in performances has been meteoric, with new records several times a year."[26] As a doctor of medicine and elite athlete Bannister was in the ideal position to appraise the application of science to sport. In 1955, he reflected on the rudimentary level of applied sport science at the time, "Experiments in the laboratory are not of much practical value to athletes. There is, in fact, little scientific evidence in favor of many of the things done in training. The adaptation of the body to the stress of running

[25] Ross McWhirter, "The Long Climb," *Athletics World* II, no. 5 (May 1954): 35.
[26] Bannister, *The First Four Minutes*, 169.

is of such bewildering complexity that the athlete is forced to fall back on common sense as his practical guide."[27]

In 2006, Arnd Krüger of the The University of Gottingen in Germany, wrote a rigorous and enlightening article entitled "Training Theory and Why Roger Bannister was the First Four-Minute Miler."[28] As a former international middle distance runner, West German National Athletics Coach, and now internationally acclaimed sport historian, Krüger was ideally positioned to apply his academic and practical sporting expertise to analyze Bannister's record breaking attempt. He began his assessment by highlighting the important cultural link between sport and society—where compared to mainland Europe, the Anglo-American tradition cherished the mile much more than any other distance.[29] Bannister naturally followed in the British and Oxbridge tradition and gravitated towards the mile—a distance he felt seemed "to present a perfect test of judgment, speed, and stamina."[30]

Analysis of Bannister's preparation for the mile reveals a carefully devised plan that utilized high quality progressive intervals, periodic time trials to ensure measured progress, the guidance of an experienced coach, a team approach using Chris Brasher and Chris Chataway as pace-setters, specific race selection, and peaking at the right time. Other factors that Arnd Krüger felt contributed to Bannister's success included enhanced

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[27] Ibid., 121.
[28] Krüger, "Training Theory and Why Roger Bannister Was the First Four-Minute Miler," 305-324.
[29] The British tradition carried on well into the late 1970s and 1980s as Sebastian Coe, Steve Ovett and Steve Cram of England and Great Britain all ran the mile in world record time. For precise details of Sebastian Coe, Steve Ovett and Steve Cram and their world record breaking accomplishments see: Lawson, *World Record Breakers in Track and Field Athletics*, 95-97.
[30] Bannister, *The First Four Minutes*, 170.

biomechanical efficiency that aided stride length, functional strength training provided by periodic hiking and mountain climbing, and a periodized approach to training that divided the year into early, middle and peak periods that were further broken up into months and weeks.[31] Periodization (discussed in Chapter Seven) was developed by Lev Pavlovich Matveyev of the former Soviet Union in the late 1950s and early 1960s. The main difference between the type of periodization recommended by Matveyev and that used by Bannister was that Matveyev recommended the use of a "rest week" (where the volume and intensity of training are manipulated to facilitate recovery) every third or fourth week of training. In contrast Bannister continued to train without any special provision for rest or recuperation. This fundamental difference is crucial because the one key ingredient that Bannister appeared to be lacking was rest, but after a three-day break rock climbing in Scotland, he made the breakthrough in training (fifty-nine second quarter miles) that would lay the foundation for his attempt at the four-minute mile. A further five to six days of relative rest preceded Bannister's world-record attempt resulting in a level of "supercompensation" (in which the post training period results in a higher capacity than the original one) necessary to complete the task in world record time.

[31] Krüger, "Training Theory and Why Roger Bannister Was the First Four-Minute Miler," 305-324. For example Krüger notes how photographs of Bannister reveal optimal range of hip extension that allowed him to "open up" his hips necessary for an efficient stride length. Functional strength training of Bannister's lower extremities was provided by periodic hill and rock climbing. However, in comparison to the modern day preparation of runners advocated by Arthur Lydiard's structured phase of hill running Bannister's use of rock and hill climbing can be considered extremely light—used more as a respite from regular training.

At the end of the 1954 season Bannister retired from athletics in order to focus on his medical career where he became a noted neurologist. Bannister documented his historic attempt in the autobiographical, *First Four Minutes*—a special fiftieth anniversary edition of which was published in 2004.[32] In 1975 he was knighted for his services to medicine and sport that included spearheading a campaign for the British Sports Council to discourage athletes from taking performance enhancing drugs through random testing. He was also made the Master of Oxford University's Pembroke College.[33]

On 6 May 2004, Sir Roger Bannister returned to Oxford University's Iffley Road sports ground to commemorate the fiftieth anniversary of his historic achievement. He reflected on what came to be considered by many commentators as the twentieth century's most symbolic sports barrier.[34] "It may seem incredible today that the world record at this classic distance could be set by an amateur athlete, in bad weather on a University running track," he told the crowd before adding, "I hope this acts as an inspiration to sportsmen and women everywhere to keep striving to achieve their best through personal effort alone."[35]

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[32] Bannister, *The First Four Minutes*. Roger Bannister, *The First Four Minutes: 50th Anniversary Edition* (Stroud: Sutton Publishing, 2004).
[33] Bannister, *The First Four Minutes*, 4; Bascomb, *The Perfect Mile*, 316.
[34] "Bannister's Four-Minute Mile Named Greatest Athletic Achievement." "Sir Roger Bannister," Academy of Achievement, http://www.achievement.org/autodoc/page/ban0pro-1 (accessed March 30, 2008). *Sports Illustrated* rated Bannister's breakthrough alongside the scaling of Everest as the most significant athletic feat of the 20th century.
[35] "Bannister Relives Mile," British Broadcasting Company, http://news.bbc.co.uk/sport1/hi/athletics/3688893.stm (accessed November 15, 2007).

FRANZ STAMPFL: ADVISOR TO THE FIRST FOUR-MINUTE MILER

> Training is principally an act of faith. The athlete must believe in its efficacy: he must believe that through training he will become fitter and stronger.[36]

Figure 28. From left to right: Chris Brasher, Roger Bannister, Franz Stampfl and Chris Chataway from the inside cover of *The First Four Minutes* (1954).

Franz Stampfl, although officially only an advisor to Roger Bannister, was nonetheless instrumental in helping him achieve his life-changing world record. Stampfl, the son of an Austrian general, was born in Vienna, Austria, in 1913. A talented skier and javelin thrower, he participated in the 1932 Olympics where he threw the javelin. In 1936,

[36] Stampfl, *Franz Stampfl on Running*, 53.

he moved to England but was interned to Australia as an "enemy alien" during World War II. Although he suffered as a result of the war, he admired the English, particularly their love of amateur sport and returned to England after the war to coach at the Oxford University Athletic Club.[37] In addition to the work he did with Bannister, Chataway and Brasher, Stampfl also coached Australian, Ralph Doubell, to an Olympic gold medal in the 800 meters at the 1968 Olympics in Mexico in a time that equaled the previous world record set by Peter Snell of New Zealand.[38]

In the 1950s one of the most important books on distance running was unquestionably *Franz Stampfl's On Running.*[39] Chapter Two of that volume is specifically devoted to training. Stampfl disagreed with the notion that concentrated and repeated training led to overtraining or "staleness" as it was then termed. He argued that, "it is a belief that finds no support in other fields of endeavor. The child learning to write, the pianist who practices for six hours a day, the bricklayer laying bricks—the work of these people does not deteriorate as a result of constant repetition of the same movements."[40] Stampfl felt that staleness could be avoided by a gradual build up in the volume and intensity of training, by sufficient competition and by athletes not losing sight of their desires or goals. Accordingly, Stampfl professed that "most athletes suffered from too little training."[41] Citing the training regimen of Emil Zátopek (see Chapter Five), three-time gold medalist at the 1952 Olympics (who claimed to have trained four hours

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[37] Bascomb, *The Perfect Mile*, 170-171.
[38] Wallechinsky, *The Complete Book of the Olympics*, 37.
[39] Stampfl, *Franz Stampfl on Running*; McNab, Lovesy, and Huxtable, *An Athletics Compendium*, xlii.
[40] Stampfl, *Franz Stampfl on Running*, 38.
[41] Ibid.

per day, seven days per week) as an example, Stampfl felt distance runners were capable of much greater workloads. Indeed, the same principle could be applied to all athletes. "Why should sprinters not benefit equally. The throwers have already done so; where before, ten practice throws were considered all that was necessary or even desirable, now a hundred are not thought too many."[42]

To ensure a gradual progression to peak running condition, Stampfl recommended the following training progression: It began with cross country running, which was the least demanding on the body. This was followed by *fartlek*, a little more demanding but still not too difficult; followed by interval training which was relatively severe; then came repetition running which was severer still, and finally the use of time trials that represented "the sternest test of all."[43] Cross country running was recommended for all athletes (including sprinters) and consisted of continuous easy running. The goal was to enhance basic conditioning levels by improving breathing patterns and to develop muscular strength. Repetition running consisted of high quality runs with full or close-to-full recovery. Finally, time trials were the last stage of the runner's preparation for racing. They were generally run over three-quarters of the racing distance and always at race pace.[44]

To help facilitate consistent progress Stampfl relied heavily on the stopwatch (during interval, repetition running, and time-trials) which he viewed as "the only means

[42] Ibid., 41.
[43] Ibid., 44.
[44] Ibid., 48.

he [the athlete] has of accurately measuring his rate of improvement."[45] The use of timed runs, Stampfl argued, also helped the athlete acquire pace judgment necessary for successful racing.

The following seven-day schedules (repeated for each week of the month) were proposed by Stampfl for the months of November and May. They are based on the assumption that the track season began in the middle of May and continued until the end of September. The volume and intensity of the training recommended were tailored towards attainment of a four-minute mile.[46]

NOVEMBER

First day:	20 minutes warming-up. 5 minutes rest 10 x 440 yards interval running, 70 seconds, 2 ½ -3 minutes recovery lap Warming-down.
Second day:	20 minutes warming-up. 5 minutes rest 5 miles easy run on the track Callisthenics
Third day:	20 minutes warming-up. 5 minutes rest 10 x 440 yards interval running, 70 seconds, 2 ½ to 3 minutes recovery lap Warming-down.
Fourth day:	20 minutes warming-up. 5 minutes rest 6 x 880 yards repetition running. 2:20, 10 minutes rest between each Warming-down.
Fifth day:	Indoor training—calisthenics

[45] Ibid., 35.
[46] Ibid., 110.

Sixth day: 6-8 miles *fartlek* over country

Seventh day: Rest

MAY

First day: 20 minutes warming-up.
5 minutes rest
10 x 440 yards interval running, 60 seconds, with 2 ½ to 3 minutes recovery lap
Warming-down.

Second day 20 minutes warming-up.
5 minutes rest
5 x 880 yards repetition running, 2:04.0, 10 minutes rest between each
Warming-down

Third day: 20 minutes warming-up.
5 minutes rest
10 x 440 yards interval running, 60 seconds, 2 ½ to 3 minutes recovery lap
Warming-down.

Fourth day: 20 minutes warming-up only.

Fifth day: 20 minutes warming-up.
5 minutes rest
10 x 440 yards interval running, 60 seconds, 2 ½ to 3 minutes recovery lap
Warming-down.

Sixth day: 3-5 miles gentle *fartlek* over flat country

Seventh day: Rest. [47]

Examination of Stampfl's weekly training schedules for the mile from November to the first week in May reveals a gradual increase in the intensity and volume of interval training with progressively faster sets of repetitions**.** For example, the 10 x 440 yards recommended by Stampfl progresses from seventy seconds with a two and one-half to three minute recovery lap in November, to sixty seconds in May with the same recovery

[47] Ibid., 111-117.

period. The volume of interval work also increases, starting with 14,080 yards of interval training in November and progressing to 17,600 yards in May.

In addition to a weekly competition schedule (that culminated in a Saturday race) Stampfl also included a special ten-day program in the build up to a major race. The program was specifically designed for a four-minute miler and included the following workouts:

Day One:	6 x 880 yards repetition running, 2:00.0, 10 minutes rest between each.
Day Two:	10 x 440 yards interval running, 60 seconds or slightly below, with $2^1/_2$ to 3 minutes recovery lap
Day Three:	¾ mile, 3:00 time trial
Day Four:	10 x 440 yards interval running, 60 seconds or slightly below, with $2^1/_2$ to 3 minutes recovery lap
Day Five:	½ mile in 1:54 (or below) time trial
Day Six:	¾ mile, 3:00 time trial
Days Seven thru Nine	Complete rest
Tenth Day:	Competition.[48]

Stampfl's special ten-day program is the first encountered in the literature that was specifically designed to ensure the athlete peaked for a major competition. It differed from the regular competitive schedule in that it included a time trial and tapered to include a longer period of rest (three days) prior to the major competition. Stampfl's recommendations are in accordance with a more scientific and periodized approach to training with the inclusion of detailed prescriptions of how to adjust the volume and

[48] Ibid., 118.

intensity of training over time. However, it is important to note that Stampfl prescribed an increase in both the volume *and* intensity of training over time and did not advocate running at speeds in training greater than race pace. This clearly illustrates the evolutionary stage of middle distance running at the time—where it was still possible to increase the intensity and volume of training. Ultimately, there comes a point when an athlete is unable to concurrently increase the volume *and* intensity of training. This is because at a certain juncture an inverse relationship exists between volume and intensity. As exercise intensity increases greater time is needed for recovery and the volume of training has to decrease accordingly.[49]

Stampfl also recommended repeating the same workouts two to three times per week, which arguably could be considered extremely monotonous for an athlete. Herb Elliott, Percy Cerutty's most successful runner and winner of the Rome 1960 Olympic 800 meters, expressed his distaste of regimented running and in particular, Franz Stampfl's use of intervals. "Stampfl's methods," Elliott remarked, "are ideal for mass coaching of classes, but not in my opinion individual athletes…Under this kind of unimaginative drudgery an athlete becomes a machine governed by a chart. He doesn't run as he feels; he runs as his coach tells him. In time he loses his initiative, his originality and any brilliance he may possess."[50] However, in Stampfl's defense, by helping and advising Roger Bannister, he proved that his methods worked. He may therefore, have been reluctant to deviate too far away from a winning formula.

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[49] Matveyev, *Fundamentals of Sports Training*, 48.
[50] Herb Elliott and Alan Trengove, *The Herb Elliott Story* (Edinburgh: Thomas Nelson & Sons, 1961), 70.

Stampfl's recommendations mark a significant increase in the sophistication of the training process. The introduction of structured "cause and effect" running progressions was a significant step towards making the training process more scientific. As such, Stampfl's contribution to the coaching literature was considerable and is acknowledged by track and field historians Tom McNab and colleagues as probably "the first progressive resistance book of middle distance training."[51] Despite these significant advances (that helped reap the greatest athletic prize in the history of track and field), Stampfl reflected on the level of training in the mid 1950s by acknowledging that, "Our knowledge of training is still elementary, and a great deal of experimenting must continue for years to come."[52]

WES SANTEE: THE "KANSAS FLYER"[53]

> In retrospect, there is no question that if I had taken time out and we had all gotten together in the U.S. and set up a paced race like Bannister did, I would have broken it.[54]

Wes Santee was born on 25 March 1932 in Ashland, Kansas, just one hundred miles east of Glenn Cunningham's home in Elkhart, Kansas (featured in Chapter

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[51] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, xlii.
[52] Stampfl, *Franz Stampfl on Running*, 40.
[53] The "Kansas Flyer" was the heading (with an accompanying picture of Santee) on the front cover of the 1954 Kansas Relays program which read "The Kansas Flyer – Wes Santee."
[54] "A Brief Chat with Wes Santee by Dave Kuehls," *Runner's World*, http://www.runnersworld.com/bannister/040503chatsantee.html (accessed August 12, 2006). Santee was of course referring to the first ever sub-four minute mile.

Three).[55] Santee was an illustrious mile and 1,500 meter runner who set a world record in the 1,500 meters on 4 June 1956 at the Compton Invitational in California. In the 1952 US Olympic Trials Santee qualified for the 5,000 and 1,500 meters but against his wishes, was not allowed to compete in his favored 1,500 event for fear of overexerting himself in too many races. However, with the passage of time, he is probably best remembered as one of the three runners who contended for the right to be the first to break the four-minute mile.

Figure 29. Wes Santee.[56]

[55] "USA Track and Field Hall of Fame: Wes Santee," USA Track and Field, http://www.usatf.com/HallOfFame/TF/showBio.asp?HOFIDs=214 (accessed August 12, 2006). See Chapter Three for details on the career of Glenn Cunningham.

[56] Image available at: www.kshof.org/hof-profiles.cfm?record_id=127 (accessed January 10, 2008).

Like Glenn Cunningham before him, and Jim Ryun after him, Santee attended the University of Kansas where he trained under the guidance of Coach Bill Easton. A disciple of the esteemed Indiana University coach Bill Hayes, Easton applied a systematic approach to training that included adherence to detailed training schedules and the monitoring of athletes' weight before and after runs.[57] On 5 June 1953, in Compton, California, Santee exhibited his considerable potential by running the mile in a blazing 4:02.4—a new American record and just one second outside of Gunder Hägg's world record.[58] Having come so close to the world-record Santee gained confidence and realized that the pinnacle of track and field was within his grasp, "I don't know when it will be, but I'll run it, you can be sure of that. I'm as certain I can run the four-minute mile as you are that you can drive your car home. There's always a chance of an accident but barring that I'll do it."[59]

However, before Santee could accomplish the task he first had to overcome the obstacle of being firmly entrenched in the collegiate scholarship system where his first obligation was to the team. As the quest for the four-minute mile intensified Coach Easton came to the conclusion that Santee would have to change focus slightly, away from the team. "I want you to run for the team," Easton said, "but when we get down to certain meets I want you to enter the open mile event only."[60] This meant a change in training focus with more individualized workouts aimed at decreasing the time for the

[57] Bascomb, *The Perfect Mile*, 99.
[58] Sears, *Running through the Ages*, 270.
[59] Bascomb, *The Perfect Mile*, 107.
[60] Ibid., 108.

mile. “You’re going to have to do different workouts than anybody else. You need to put more pressure on yourself,” Easton declared.[61]

The training background to Santee’s assault on the mile record consisted of a mixture of cross-country and interval running totaling thirty to thirty-five miles per week. His interval training for the mile often consisted of five repetitions of 440 yards starting at sixty seconds and ending at around fifty-two seconds.[62] Moreover, while preparing for the 1954 outdoor season, Santee, in addition to training with his teammates, also included numerous extra quarter-miles throughout the week. Some days he ran five quarter-miles in fifty-two seconds, considerably faster than the average sixty seconds per lap required to run a four-minute mile. However, the type of break he took between each quarter made the workout particularly challenging. Instead of slowly jogging a lap before the next fast quarter-mile he jogged the 110 yards around the bend, sprinted the back straight, and then started another fast quarter-mile; “My break between quarters was no break,” Santee stated.[63] On other occasions he ran eight to ten quarter miles in one session, starting the first two at sixty seconds, increasing the speed to fifty-eight seconds for the second two repetitions and the fifth at fifty-five seconds. If he had trouble keeping to the desired times, he shortened the distance, usually to 220 yards and speeded up. In this way he maintained the quality of the workout without slowing down.[64]

In front of a home crowd at the Kansas Relays on 17 April 1954, in what transpired to be his last major attempt at breaking the four-minute barrier before

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[61] Ibid.
[62] Sears, *Running through the Ages*, 270.
[63] Bascomb, *The Perfect Mile*, 150.
[64] Ibid.

Bannister's record breaking accomplishment, Santee came up short. Despite an exceptional last lap of 58.6 seconds, Santee was hindered by a preceding flash storm that deadened the track resulting in a disappointing time of 4:03.1.[65] Although "pipped at the post" by Bannister, Santee continued his own assault on the sub-four minute mile. On 4 June 1954, in Compton, California, despite outpacing Bannister's record breaking time at the three-quarter mile stage, Santee finished the four laps in an agonizing close time of 4:00.6. Unsuccessful once more, Santee nonetheless etched his name in the track and field history books by passing the 1,500 meter mark in a time of 3:42.8—a new world record.[66] In 1956 Santee had hoped to go to the Melbourne Olympics. However, he was thwarted by A.A.U. officials who banned him from taking part after contravening amateur rules that prohibited the remuneration he received for races ran in 1955.[67]

In an interview done as part of a retrospective on the fiftieth anniversary of Bannister's achievement, Santee reflected on what might have been. He felt aggrieved that his chances of breaking the four-minute mile were hindered by the structure of the collegiate system and by having to run too many races. Although his coach had allowed him certain liberties, as a team member, he too frequently had to sacrifice his personal goals for the good of the team. As he told the reporter that day, "So in meets I ran the half and the mile, sometimes the two mile. I ran anchor on our mile relay. I ran 48.6 for the quarter. I had to be able to run all those distances for us to win meets and team titles. In retrospect, there is no question that if I had taken time out and we had all gotten together

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[65] Ibid., 167.
[66] Lawson, *World Record Breakers in Track and Field Athletics*, 76.
[67] Bascomb, *The Perfect Mile*, 308-311.

in the U.S. and set up a paced race like Bannister did, I would have broken it."[68] For Santee, the inability to break the four-minute mile all stemmed from the 1952 decision not to allow him to compete in his favored 1,500 meter event. "How else can you evaluate it? And that in turn would have changed the whole picture for the four-minute mile."[69]

Fifty years after Bannister's record breaking feat, Santee lived just a short distance from where he ran his first fast mile. After leaving Kansas University (KU) he entered the Marines where he fulfilled a long and distinguished career serving as a reservist while running his own insurance business in Lawrence, Kansas. A Jayhawk at heart, Santee remained deeply connected to the University of Kansas by attending the KU Relays every year. In 2004 he was inducted into the Kansas Sports Hall of Fame, shortly followed a year later by induction into the USA Track and Field Hall of Fame.[70]

It is clear from the preceding coverage that Santee possessed the potential to break the four-minute mile barrier. However, as mentioned, he was entrenched in a collegiate system that demanded multiple races (both intra and inter meets), which decreased his chances of being able to peak at the right time. As a result, Santee never cracked the four-minute barrier. Examination of Santee's training reveals the execution of significantly

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[68] "A Brief Chat with Wes Santee by Dave Kuehls."

[69] Ibid.

[70] "Wes Santee," Kansas Sports Hall of Fame, http://www.kshof.org/hof-profiles.cfm?record_id=127 (accessed May 23, 2007). "Runner Wes Santee Chats with KU Sports.Com Readers," KU Sports.com, http://www.kusports.com/news/chats/story/110310 (accessed August 12, 2006 April 14, 2004). The Jayhawk is a cross between two hunting birds—the noisy blue jay and the quiet sparrow hawk. During the 1850s, the Kansas Territory was filled with such Jayhawks. With the admission of Kansas as a free state in 1861, Jayhawker became synonymous with the people of Kansas. When KU football players first took the field in 1890, they were logically called Jayhawkers and the name has been adopted by University of Kansas athletes ever since. For more information see: "The History of the Jayhawk," KU Athletics, http://kuathletics.cstv.com/trads/kan-jayhawk-history.html (accessed March 25, 2007).

faster 400 meter repeats (as low as fifty-two seconds) than those encountered in a mile race. While such speeds may have facilitated faster 800 meter times, they did not mimic the physiological demands necessary to run the mile in a more evenly paced average of sixty seconds per quarter. Furthermore, Santee's weekly mileage of thirty to thirty-five miles per week although twice the volume of Glenn Cunningham's in the 1930s (see Chapter Three) is still considered moderate compared to more recent standards. Even Sebastian Coe, (winner of the 1980 and 1984 Olympic 1,500 meters), who was considered conservative in the total weekly miles that he amassed, averaged as many as fifty-three miles per week.[71]

[71] Chris Walsh, *The Bowerman System* (Los Altos, Calif.: Tafnews Press, 1983), 35-38. Fifty-three miles per week referred to a week's training in the schedule of Sebastian Coe prior to setting the world-record in the 800 meters (1:42.33) in 1979.

JOHN LANDY M.B.E., A.C.[72]

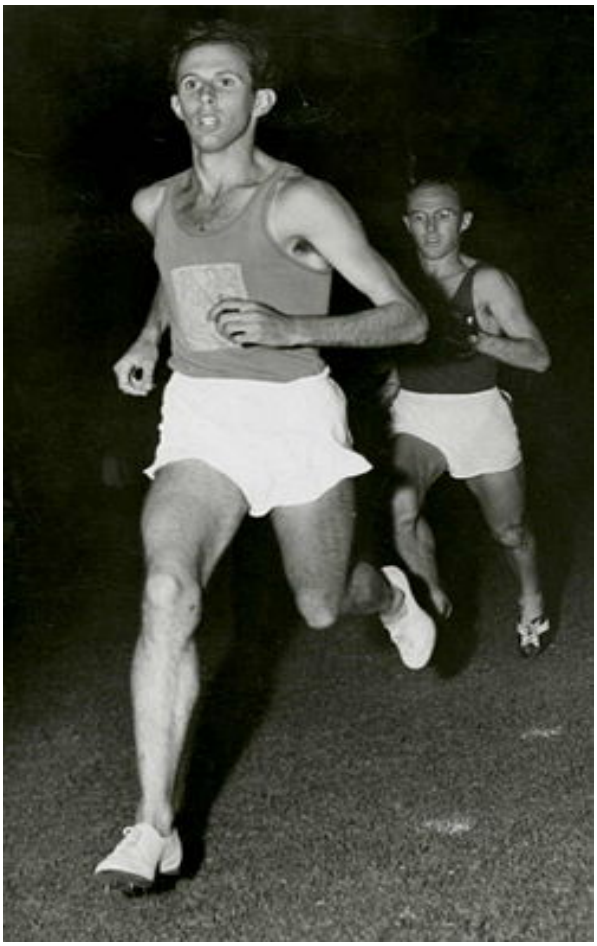

Figure 30. John Landy.[73]

The mile has a classic symmetry. It's a play in four acts.[74]

[72] M.B.E. refers to a Member of the British Empire and A.C refers to a Companion of the Order of Australia which was awarded to Landy in 2001 for services to sport.
[73] Image located at: http://en.wikipedia.org/wiki/Portal:Australia/Featured_picture/2007 (accessed December 10, 2007).
[74] "John Landy," Run the Planet, http://www.runtheplanet.com/resources/historical/runquotes.asp (accessed July 12, 2007).

John Landy, who was born on 12 April 1930 in Melbourne, Australia, attended Malvern Grammar school where at an early age he displayed his gift of running by winning the sprint race at the annual sports meeting.[75] At the age of fourteen he entered Geelong Grammar, an elite boarding school where in his final year, he dominated the distance events by claiming a clean sweep in the school cross-country, 440-yard, 880-yard, and one-mile. He then won the All Public Schools mile championship in a time of 4:43.8.[76]

Landy enrolled at Melbourne University (to study agricultural science), where he continued running and also played football. In late 1950, at the suggestion of Geelong Athletic Club captain, Gordon Hall, Landy sought the advice of Percy Cerutty, the outspoken running coach who trained athletes at Melbourne's Olympic Park.[77] In the space of six months, under Cerutty's guidance and vigorous conditioning program, Landy lowered his time for the mile by a staggering twenty-two seconds to 4:16. Neil Bascomb, author of *The Perfect Mile*—the definitive account of all three protagonists' assault on the four minute mile, suggests that Cerutty placed Landy on the path to "athletic greatness."[78]

In 1952 Landy was unsuccessful in his attempt to make the Australian qualification standard for the Olympic 1,500 meters but via a loophole in regulations, raised enough

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[75] Bascomb, *The Perfect Mile*, 42-43.
[76] Ibid.
[77] Graem Sims, *Why Die?: The Extraordinary Percy Cerutty, Maker of Champions* (South Melbourne: Lothian Books, 2003), 100-101.
[78] Bascomb, *The Perfect Mile*, 53.

money to travel to Finland.[79] At the 1952 Helsinki Olympics, however, Landy failed to advance from the first qualifying round of the 1,500 meters. Cerutty took the loss as a personal condemnation of his training methods and was far from complimentary in his appraisal of Landy's efforts. Determined to make the most of his Olympic experience, Landy seized the opportunity by studying athletes' training habits at the practice track near the stadium. In particular, he sought inspiration and advice from Emil Zátopek (winner of the 1952 Olympic 5,000 and 10,000 meters and the marathon and featured in Chapter Five) who, as he jogged around the practice track, spoke candidly about his training. In contrast to Cerutty's "train as you feel" philosophy, Landy admired Zátopek's analytical approach that involved detailed training schedules and methods aimed at maintaining the balance between speed and endurance throughout the year.[80]

On his return to Melbourne, Landy put Zátopek's advice into practice embracing his disciplined approach to training and his use of repetition running. Cerutty, also on his return, sought to bring his most talented protégé back into the fold but Landy had made his mind up. "I'm taking no more advice from anyone," he said. "I simply want to put together the best of what I've seen."[81] Landy continued to implement his solo approach and in preparation for the 1953-54 season, realizing that he had a chance to break the four-minute barrier, significantly elevated his level of training. Between 21 July and 30 September 1953 Landy averaged ten high quality repetitions of 600 yards performed at a roughly sixty-six second quarter-mile pace interspersed with six hundred yards of jogging

[79] Ibid.
[80] Ibid., 65.
[81] Harry Gordon, *Young Men in a Hurry: The Story of Australia's Fastest Decade* (Melbourne: Lansdowne Press, 1961), 104.

for recovery.[82] While studying in October and November of 1953 for his final exams in agricultural science at Melbourne University Landy decided that on alternate days, he would double his normal number of training sessions. On the other days he jogged at a five-to-six-minute-mile pace for half an hour to allow more time to study. On the hard alternate days in October, he ran twenty 600-yard fast laps with a jog recovery in between each lap that totaled approximately fourteen miles per session. On the hard alternate days in November, Landy used a quarter-mile grass lap on the inside of the Central Park, Melbourne to run twenty 440-yard laps at a sixty-two-second pace, to further develop his stamina.[83]

The Australian track and field season starts in early December. Therefore, as the start of the 1953-1954 Australian season approached, Landy had the first major opportunity to break the coveted four-minute barrier. In the first competitive race of the season on 12 December 1953 that *Athletics World* labeled "Landy's 'D' Day," Landy recorded a time of 4:02.[84] This was just one-tenth of a second faster than his best mile of the previous year, despite significantly increasing his level of training. Despondent after his failure, Landy told reporters that he felt the feat of breaking the four-minute mile might well be impossible for him. "No one outside of sport can imagine the grind of years of continuous training. I feel I could go on for ten years, but I don't think it's worth it. Frankly, I think the four-minute mile is beyond my capabilities. Two seconds may not sound like much, but to me it's like trying to break through a brick wall. Someone may

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[82] Fred Wilt, ed., *How They Train: Middle Distances*, 2nd ed. (Los Altos, Calif.: Track and Field News, 1973), 102-103.
[83] Bascomb, *The Perfect Mile*, 173.
[84] Ibid., 174-176.

achieve the four-minute mile the world is wanting so desperately, but I don't think I can."[85]

Despite Landy's unsuccessful attempt to break the four minute mile on 12 December 1953, Landy made it clear to reporters after the race that he would not be letting up, "My idea is to carry through this heavy training program right through the winter," and between 18 March and 24 May of 1954 he ran over three hundred miles, primarily composed of endurance runs completed on roads leading out of Melbourne, Australia.[86]

Roger Bannister, of course, ultimately beat Landy, to the sub-four minute finish line. On hearing the news via cable of Bannister's record-breaking feat Landy remained upbeat. "This is great, great, great…I think the brilliant achievement will be bettered," he told Finnish miler Denis Johansson.[87] Landy intuitively knew that Bannister's achievement could be improved and true to his words, forty-six days later on 21 June 1954, in Turku, Finland, Landy ran the mile in a blazing 3:58.0—a time that eclipsed Bannister's record by almost a second and a half.[88] The following program was used by Landy in the month prior to setting his new world record:

5/21/54: Jog 8 laps. 2 x 300 in 35.6 and 36.0.

5/22/54: Jog 3 laps. 11 x 400m in 60.4 average.

5/23/54: Jog 20 laps. 440 in 61.0

5/24/54: Jog 10 laps. 8 x 440 in 58.8 average.

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[85] "Landy: Only Two More Tries," *Herald* 14 December 1953.
[86] Bascomb, *The Perfect Mile*, 205-206.
[87] Smith, *All Out for the Mile*, 117; Norris McWhirter, "The Four-Minute Mile Story," *Athletics World* (May 1954).
[88] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 421. See section: Statistics—Leading Track and Field Performances Throughout the Years: 1500 Meters and One Mile.

5/25/54: Jog 8 laps. 1200m in 3.00.5

5/27/54: 17 laps accelerating straightaways, jogging curves. 1600m steady run. 5 minutes sprinting and jogging.

5/28/54: Jog 10 laps on 300m track. 2 build-ups per lap. 400m in 58 secs.

May 29 and 30, 1954: Rest.

5/31/54: Mile race in 56.3, 1:55.7, 2:58, 4:01.6.

6/7/54: Jog 30 min. A few sprints

6/8/54: 30 min. warm up. Mile race in 59.5, 1:59.5, 3:01.0, 4:01.6.

6/9/54: Jog one hour.

6/10/54: 30 min. jog and stride. A few 300m runs in 42 sec.

6/11/54:. 1 hour warm up. 1500m race in 59.6, 1:59.2, 3:01.4, 3:46.0

6/13/54 and 6/14/54: Jog and stride one hour.

6/16/54: 300m in 37 sec. 400m in 49.7.

6/19/54: 6 laps warm up. 1200m in 2:58.8

6/21/54: 1 hour warm up, 3:00 PM to 4:00 PM. Rest until 6:00PM. Warm up 6:00PM to 6:45 PM. WORLD RECORD MILE in 3:58.0 at Turku, Finland.[89]

Landy elucidated on his preparation for the 1954 season in an interview with Fred Wilt. "Much of the training I did in 1954 was 'against the clock' time trials. This was the only year I resorted to such a rigid routine. In all other years my training was away from the track and in 1955-56 I did no more than three time trials in training."[90] Landy described his 1955-56 routine as "much less exacting," made to fit the particular mood he was in at the time. Landy's approach to training mirrored that of his mentor and former coach, Percy Cerutty. While he acknowledged the contribution of Franz Stampfl's "systematic timed training" to Bannister's success, Landy preferred to be guided by intuition, or "perhaps more accurately guessing," he explained to Wilt. "The system of

[89] Wilt, *How They Train: Half Mile to Six Mile*, 26.
[90] Ibid., 125.

training must be a matter of personal preference. The controversy is as old as the training schedule of Gunder Häag and Emil Zátopek. In training I played it very much by ear, and am very much a 'train as you feel' man."[91]

Analysis of Landy's build up to breaking the four-minute barrier and the world mile record reveals the use of timed intervals performed over distances ranging from three hundred meters to twelve hundred meters interspersed with days of jogging and strides for recovery. Unfortunately, Landy does not expand on the precise details of his rest periods, which can be equally important as the duration of the intervals themselves. It is revealing to note that 1954 was Landy's most successful year in terms of running the fastest time he ever ran in the mile, an accomplishment that shattered Bannister's newly acquired world record. It was also the year that he resorted to a more structured scientific routine that included multiple time trials running against the clock. It is surprising therefore that in 1955-56 Landy reverted back to a "less exacting" regime that although allowed for more self-expression, did not manifest itself in terms of a faster mile time or an Olympic gold medal.

After teaching for a time at Geelong Grammar school, Landy joined Imperial Chemical Industries (ICI) as a rural scientist and eventually became head of rural research and development. He maintained an active role in sport by serving on the Melbourne Olympic Committee and leading the Australian Sports Drug Agency. For his services to sport he was made a Member of the Order of the British Empire (M.B.E.) in 1955 and in 2001 became a Companion of the Order of Australia. (A.C.). In 2000 he

[91] Ibid.

changed career focus and was appointed Governor of the state of Victoria, a position he held until he retired in 2006.[92]

PERCY WELLS CERUTTY: "CONDITIONER OF MEN AND MAKER OF CHAMPIONS"[93]

Figure 31. Percy Cerutty checks Herb Elliott's pulse as he lies in bed. (Allsport Hulton/Archive).

[92] Bascomb, *The Perfect Mile*, 316; "John Landy."

[93] Sims, *Why Die?: The Extraordinary Percy Cerutty, Maker of Champions*, 216-217. Note: The heading "Conditioner of Men and Maker of Champions" was used by Cerutty on his personal stationary.

> I always knew I could beat the world at something. I spent my life up to fifty trying to find out what it was.[94]

The story and life (at least the latter part) of Percy Wells Cerutty was truly extraordinary—in every sense of the word. Herb Elliott, Cerutty's most famous protégé and winner of the 1960 Olympic 1,500 meters described him as "the most unorthodox athletic coach the world has known."[95] Percy Wells Cerutty was born on 10 January 1895, in Prahan, a working class district of Melbourne, Australia.[96] After leaving school in 1907, he began work at the post office as a telegraph messenger. Diminutive in stature, he was refused admission for military service in 1914 on the grounds of his "fragile, five foot five inch frame, defective lungs and poor teeth."[97] Cerutty suffered from migraines and chronic ill health throughout his working life which culminated in a physical and mental breakdown at the age of forty. This led to a period of self-reflection and rehabilitation that would transform his life as well as the lives of some of Australia's finest middle distance runners. Cerutty radically changed his diet (eliminating salt and animal fats) and partook in an intensive walking, swimming, and running program. His physical, mental and spiritual revival was complete when at the end of 1945, close to his fifty-first birthday, he completed a marathon in three hours and two minutes.[98]

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[94] Ibid., 89.
[95] Elliott and Trengove, *The Herb Elliott Story*, 34.
[96] Sims, *Why Die?: The Extraordinary Percy Cerutty, Maker of Champions*, 8.
[97] Graeme Kelly, *Mr. Controversial: The Story of Percy Wells Cerutty* (London: Stanley Paul, 1964), 25.
[98] Bob Stewart, "Percy Wells Cerutty: A Pioneer of Modern Sports Conditioning" (paper presented at the 7th Biennial Conference of the Australian Society for Sports History, Sydney, 8-9 July 1989), 2.

Cerutty revived the *mens sana in corpore sana*—healthy mind in a healthy body, philosophy of the ancient Greeks by espousing, "Only those who excel in something physical, but yet exercise the mind can ever hope to be balanced: to live balanced lives."[99] Cerutty formulated a philosophy that he termed "Stotanism," a combination of the terms stoic and Spartan. Specifically, a Stotan was one who "hardened, toughened, strengthened and beautified the body through consistently regular habits and exercise."[100] Stotans were lovers of nature and naturally identified with the sea and the mountains in preference to the artificial confines of the city and hardened athletic race tracks.

In 1948, Cerutty purchased land for a training base at the ocean-side town of Portsea on Victoria's Mornington Peninsula, where he set himself up as a freelance running coach. None of Cerutty's first group of runners made the 1948 Olympic team. However, by 1950 he had established himself as a credible running coach by assembling a talented group of runners that came to be known as "Cerutty's gang." One athlete of particular note was John Landy, who later became locked in an international battle to become the first man to break the elusive four-minute mile barrier. Unfortunately for Landy, the honor went to Roger Bannister, but Bannister's record proved short lived as Landy broke it just forty-six days later at Turku, Finland on 21 June 1954 with a time of 3:57.9.[101] Cerutty's greatest disciple, however, was Herb Elliott, winner of Olympic gold medals in the 1960 1,500 meters**,** the 1964 800 and 1,500 meters, and former world-record holder in the mile and 1,500 meters.

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[99] Cerutty, *Athletics: How to Become a Champion*, 105.
[100] Percy Cerutty, *Stotans and Stotanism (Unpublished)* (1946). In Stewart, "Percy Wells Cerutty: A Pioneer of Modern Sports Conditioning," 7.
[101] Stewart, "Percy Wells Cerutty: A Pioneer of Modern Sports Conditioning," 3.

In keeping with his "back to nature" approach, Herb Elliott noted that Cerutty was totally opposed to "scientific and regimented training sessions dictated by a coach holding a stop watch," as typified by Cerutty's nemesis, Franz Stampfl.[102] Instead, "Nothing must be dictated, fixed or regimented," such as the premeditated writing of training schedules for athletes.[103] Interval and circuit training, methods of training in which athletes use specific, timed periods of work alternated with periods of rest or light work were the antithesis of Cerrutty's naturalistic approach. Indeed, coaches who subscribed to the printed schedule "would never know the pleasures of true athleticism," as high performance could only arise from spontaneous uninhibited expression.[104] Instead, Cerutty favored the use of Fartlek or "speed play," and encouraged his athletes to train on natural terrain such as grassed ovals, golf courses, horse-racing tracks, beaches, bush paths and on sand dunes by the sea.[105]

Cerutty's objection to fixed regimented schedules is reflected in his first book, *Athletics: How to Become a Champion*, published in 1960, that includes a chapter specifically devoted to conditioning and training that is general in nature.[106] For Cerutty, conditioning was "anything that conspires to make us stronger, freer, more resilient, conquering, all that trains us to endure, to sustain suffering that calls upon our best

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[102] B. Lenton, *Off the Record: Running Interviews with R. Clarke, R.Dixon, H.Elliott, J. Foster, J.Landy, A. Lydiard, A. Thomas, C. Wardlaw* (Duffy, Australia: Lenton Publications, 1981), 57.
[103] Percy Cerutty, *Running with Cerutty* (Los Altos, Calif.: Track and Field News, 1959), 16.
[104] Cerutty, *Athletics: How to Become a Champion*, 14.; Stewart, "Percy Wells Cerutty: A Pioneer of Modern Sports Conditioning," 10.
[105] Stewart, "Percy Wells Cerutty: A Pioneer of Modern Sports Conditioning," 8.
[106] Cerutty, *Athletics: How to Become a Champion*, 105.

qualities continually."[107] Cerutty offered the following advice on how to structure training. He divided the athletic year into three periods that transitioned smoothly into one another. The first and most important was the Conditioning Period, which extended for at least six months of the year (April to November). This consisted of running up sand hills, over sand dunes, on the heavier parts of sand beaches, and an occasional run up into the mountains. Twice a week (or more) Cerutty's athletes lifted the heaviest weights they could handle for a period of two hours. Occasionally his athletes went for a long continuous run—upwards of twenty miles. Athletes who ran in the one-to-three mile category would build up to around two hundred miles per month during this time period.[108]

The second period, the Race Practice Period, lasted approximately three months. Here, Cerutty's athletes would taper their heavy conditioning work and start to practice running at speeds conducive to racing. They would visit the track about once per week to gain precise feedback on running distances and speed using a stopwatch. The third and final period was devoted to performance. During this period little or no conditioning was done—just enough "to keep the body and mind 'tuned up,' fit and anxious to work."[109]

Although Cerruty deliberately withheld information regarding training regimes and their progressions, insights into the effectiveness of his training methods can be gleaned from the use of Portsea's training terrain. Three landmarks affectionately named after athletes, were of particular significance. The first, the "Hall Circuit" (named after Gordon Hall, club captain of Geelong Athletic Club), measured one mile 285 yards and consisted

[107] Ibid., 126.
[108] Ibid., 128.
[109] Ibid., 131.

of sandy trails that meandered up and down. Herb Elliot recorded the best time on the circuit with 5:21.4. The second, the "Stewart Circuit" (named after the young English runner Ian Stewart) consisted of an undulating quarter mile course that finished at the top of a steep hill. The third was a grueling, eighty foot sand dune with roughly sixty degrees of incline. In training one day, Elliot had made forty-two uninterrupted repetitions up and down the hill. The record time up the sand dune was eleven seconds, held by Russell Mockridge, an Olympic cyclist.[110]

Despite Cerutty's vehement objections to the use of the stopwatch and interval training—close analysis of the Cerutty's method reveals the use of three precisely measured courses over which an athlete's progress could be accurately assessed. Furthermore, the regular use of an eighty-foot sand hill in many ways represents the ultimate in interval training—where consistent repeated efforts over a measured distance were combined with a recovery period of walking or jogging down the hill.

Cerutty was a pioneer in incorporating weight lifting into an athlete's training program. He argued that strength was the key to enhanced athletic performance and the means for obtaining increased strength was progressive resistance training. Heavy, rather than light weights were used to build strong powerful legs and upper bodies that were able to generate more force. In doing so, he and Harry Hopman, (an Australian tennis player and coach who introduced weight training to Australian tennis) helped explode the myth

[110] Walton, *Beyond Winning*, 143; Bascomb, *The Perfect Mile*, 50.

that weight lifting made athletes slow and muscle-bound.[111] Another area where Cerutty was ahead of his time, was advocating the importance of proper nutrition. To Cerutty, truly nutritious food was "raw, unadulterated, unrefined and unprocessed."[112] A typical breakfast consisted of raw oatmeal mixed with dried fruits, nuts, wheatgerm and chopped banana that helped sustain energy levels for the day ahead.[113]

By the 1970s Cerutty had significantly slowed down. He had not coached an athlete to international success since the glory days of John Landy, Herb Elliott, Ron Clarke, Ralph Doubell and Derek Clayton. Australia's best runners either trained independently or under the guidance of Cerutty's archenemy**,** Franz Stampfl—who to the disdain of Cerutty had moved to Australia in 1955 to be appointed athletics coach at Melbourne University.[114] Bob Stewart, sports historian and Associate Professor at Victoria University, notes that Cerutty's resistance to the application of science and rational practice was a significant factor leading to the demise of his influence in Australian sport during the latter part of the 1960s**.**[115] Furthermore, Cerrutty's training programs were difficult to duplicate as he deliberately refused to replicate precise training schedules on the grounds that it would hinder an athlete's natural progression.[116] Coaching for Cerutty was more art than science. He didn't create monolithic training schedules because he

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[111] Walton, *Beyond Winning*, 142. For further comprehensive coverage of the advent of weight training for athletics see Chapter Six, "Science Discovers Strength," and Todd, "The Myth of the Muscle-Bound Lifter."
[112] Cerutty, *Athletics: How to Become a Champion*, 111.
[113] Sims, *Why Die?: The Extraordinary Percy Cerutty, Maker of Champions*, 193.
[114] Stewart, "Percy Wells Cerutty: A Pioneer of Modern Sports Conditioning," 17.
[115] Ibid.
[116] Freeman, "Distance Training Methods, Past and Present: The Evolution of Distance Training and Racing, 1880-1975," 4-11.

believed in the need for individualized training prescriptions, now common in elite sport training.

In the end, however, Cerutty's "back to nature" approach and Stotan philosophy proved highly influential and were copied around the world during the late 1950s and early 1960s.[117] He stretched the mental and physical barriers of endurance, enabling continued improvements in performance over extended periods of time. Furthermore, his belief in an individualized, holistic approach continues to motivate and inspire athletes today.

The quest for the first ever sub-four minute mile provides a fascinating case study of the type of training and planning necessary to reach the pinnacle of human performance in track and field during the amateur athletic era of the early 1950s. As George Smith, author of *All Out for the Mile*, noted, the pursuit had developed into a three-way international struggle and of all the protagonists it was Bannister who combined all of the fundamentals of training necessary to conquer the Mount Everest of track and field.

But what were the key factors that separated Bannister from his competition? To improve it is critical that athletes and coaches are aware of their weaknesses (and strengths). Bannister, at the end of 1953 came to the conclusion that he lacked the stamina necessary to sustain a sub-four-minute-mile pace. After seven years of self-reliance he took Chris Brasher's advice and sought the counsel of Franz Stampfl who helped design the workouts necessary to achieve the task. While Santee maintained a close alliance to his coach Bill Easton, Landy had effectively split from Percy Cerutty

[117] Ibid.

and was on his own voyage of training discovery. The significant role of Franz Stampfl in Bannister's success highlights the increasing role of coaches during this and the subsequent era (1955-1975). For sports historian Allen Guttmann, this provides a telling example of the advancing role of specialization in the modern era, as professional coaches such as Franz Stampfl developed their own unique training systems and methodologies encapsulated in books like *Franz Stampfl on Running*.[118]

The cornerstone of Bannister's assault on the world mile record was the use of scientific cause and effect progressive intervals. Bannister with the aid of Stampfl, was able to duplicate in training the physiological stresses required to break the four minute mile. In the aftermath of the first ever sub-four minute mile, newspapers duly reported the details of Bannister's training leading up to his record-breaking feat. The information included the 10 x 440 yards that Bannister performed in 58.9 seconds—a key indicator that he was ready for the attempt. Landy made full use of this knowledge by duplicating the same workout (but over a second faster) in his own successful attempt at the world record.[119] In contrast, although Santee ran quicker intervals during training, his faster times did not translate into a sub-four minute mile.

Other key factors that contributed to Bannister's success included periodic time trials that checked measured progress and reinforced the conviction to attack the desired goal. This is clearly reflected by Chief National Coach Geoffrey Dyson's confident

[118] Guttmann, *From Ritual to Record*; Stampfl, *Franz Stampfl on Running*.
[119] Bascomb, *The Perfect Mile*, 236.

prediction that the world's one mile record was "doomed" after witnessing Bannister and Chataway, run three-quarters of a mile in three minutes flat.[120]

When Bannister finally broke the sub-four minute barrier it represented the culmination of a concerted effort on behalf of four team members: Bannister, Brasher, Chataway and Stampfl. Each team member had their own unique role to play. In particular, as pacesetters Brasher and Chataway took Bannister through the first three laps exactly where he needed to be. The role of Brasher and Chataway as pacesetters cannot be underestimated. With the advent of professionalism in the early 1980s substantial cash prizes were awarded for breaking world records and pacesetting became commonplace.[121] Athletes such as David Kiptoo Singoei of Kenya played a key role (and made a lucrative living) as a "rabbit" for the likes of world record holders Noureddine Morceli, Hicham El Guerrouj and Wilson Kipketer.[122] In contrast to Bannister, neither Santee nor Landy benefited from the help of pacesetters. Landy preferred to lead from the front and therefore was reluctant to use someone to help him achieve the proper pace

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[120] Ibid., 177. The quote was made on 24 April 1954 by Geoffrey Dyson, Chief National Coach of the Amateur Athletic Association.

[121] For a history of the change in I.A.A.F. regulations that allowed athletes to benefit from the money they earned in competition and via endorsements see: Turrini, "Running for Dollars: An Economic and Social History of Track and Field in the United States, 1820-2000," 394-395.

[122] Dan Pfaff, "Pacemakers," 10 January 2008, personal email (12 January 2008). David Kiptoo Singoei was a former athlete of coach Dan Pfaff at Louisiana State University. Coach Pfaff kept close tabs on Singoei's progress throughout his career For further information on David Kiptoo Singoei and his accomplishments see: "David Kiptoo Singoei," International Amateur Athletics Federation, http://www.iaaf.org/athletes/biographies/country=KEN/athcode=9821/index.html (accessed April 16, 2008). For information on each of the world record holders biographies see: http://www2.iaaf.org/Results/Bio/1936.html (Noureddine Morceli); http://www.olympic.org/uk/athletes/profiles/bio_uk.asp?heros=94549 (Hicham El Guerrouj) and http://www2.iaaf.org/Results/Bio/4681.html (Wilson Kipketer).

while Santee was convinced that if he had the benefit of pacesetters he would have definitely broken the sub-four minute barrier.[123]

A key component of breaking national, Olympic and world records and winning gold medals is peaking at the right time. Bannister with the benefit of five days of rest reached a level of supercompensation that allowed him to finish the mile in less than four minutes. Bannister believed that because of adequate rest he "was so full of running that I didn't feel that I was running fast," and feared that Brasher, one of his pacesetters wasn't going fast enough**.**[124] Landy attempted to peak on numerous occasions, but ultimately ran his fastest ever time for the mile after Bannister on 21 June 1954 in Turku, Finland**.**[125] Bannister, like a champion heavyweight boxer preparing for a title fight, knew exactly when he would make his assault on the mile. The pre-determined race selection clearly benefited Bannister by allowing him to peak at the right time. Landy, after months of preparation, had planned on breaking the sub-four minute mile barrier on 12 December 1953, but came up short. Following Bannister's record, Landy knew Bannister's achievement could be bettered but was unsure of exactly when. In contrast, despite his considerable potential, Santee was locked into the American collegiate racing calendar with limited, if any opportunity to rest and peak for an all out assault on the mile.

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[123] "A Brief Chat with Wes Santee by Dave Kuehls."

[124] "Sir Roger Bannister." According to the Academy of Achievement website Sir Roger Bannister was first interviewed on 27 October 2000 in London, England and again on 7 June 2002 in Dublin, Ireland. The transcript from which the above quote was taken drew upon both interviews.

[125] John Landy's world record time of 3:58.0 set on 21 June 1954, in Turku Finland lasted for over three years until Derek Ibbotson of Great Britain bettered it at the White City Stadium in London, on 1 July 1957 with a time of 3:57.2. For further information see: Lawson, *World Record Breakers in Track and Field Athletics*, 92.

The precision to which Bannister's carefully devised plan came to fruition can be summarized by his reflections on the historic achievement. "We had done it where we wanted, when we wanted, how we wanted, in our first attempt of the year."[126] Arnd Krüger, at the end of his rigorous appraisal of "Training Theory and Why Roger Bannister Was the First Four-Minute Miler" reached the conclusion that although Bannister may have trained more he could not have trained more systematically nor intelligently.[127] The ability to carefully plan training to ensure measured progress and peak when it counts is the foundation upon which periodization is based.[128] The exact nature of periodization and the extent to which training can be controlled and manipulated will be covered in full detail in Chapter Seven. Before periodization appears on the scene, however, a number of other coaches, athletes and sport scientists will also contribute to the changing paradigm of track training that takes root in the 1950s and 1960s.

[126] Bannister, *The First Four Minutes*, 193.
[127] Krüger, "Training Theory and Why Roger Bannister Was the First Four-Minute Miler."
[128] Gambetta, "Concept and Application of Periodization," 64-66.

CHAPTER FIVE

THE ADVENT OF "HEAVY" TRAINING LOADS AND THE DAWN OF MODERN-DAY PERIODIZATION (1945-1975): THE COACHES AND ATHLETES

During the three decades between 1945 and 1975 the track and field record books were rewritten countless times. The world mile record dropped from 4:01.4 to 3:49.4. The world 800 meter record fell from 1:46.6 to 1:43.7 and the 1,500 meter record went from 3:43.0 to 3:32.2. Even the race that seemed to outsiders to be the least likely to be effected by training–the 100-meters–saw its world mark fall from 10.2 seconds in 1945 to 9.9 seconds in 1975.[1] Obviously, technological improvements in equipment aided some of the new records. The introduction of the fiber glass pole for the pole vault, for example, helped that world record soar from 15'10$^{1}/_{4}$" in 1961 to 17'10$^{1}/_{4}$" by 1969. Similarly, improvements in shoes and training clothes, and the introduction of rubberized, synthetic tracks also made for faster times and new world records.[2] However, the major change that occurred in this era was the introduction of new, more rigorous, and scientifically based forms of training.

Following the end of World War II, interest in the scientific aspects of training increased exponentially among coaches, athletes, and university researchers. In the coaching arena the progressive training methods of Franz Stampfl and Percy Cerutty

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[1] Lawson, *World Record Breakers in Track and Field Athletics*, 9-10, 59, 69-70, 85-86.

[2] A. Guy, "Technology in Athletics," *New Studies in Athletics* 9, no. 4 (1994): 9-11; James Dunaway, "Five Game-Changers, Track & Field," *Scholastic Coach*, http://www.scholastic.com/coach/article.asp?ItemID=295 (accessed August 10, 2006).

(featured in Chapter Four) who published their ideas in books such as *Franz Stampfl on Running* (1955*)* and *Running with Cerutty* (1959) were soon joined by other eminent coaches who decided to publish their own theories and methods.[3] William Bowerman and Arthur Lydiard, for example, revolutionized the world of running when they shared their ideas and in doing so they personally became celebrities of a sort.[4] George Bresnahan, Kenneth Doherty, and Payton Jordan likewise published their unique training methods and subsequently helped thousands of coaches and athletes reach new goals.[5] As Guttmann suggests in *From Ritual to Record*, track's increasing modernity in the decades after World War II could be partly explained by the increasing specialization seen in coaches' approach to the preparation of athletes, and in the growing dependency of athletes on coaches for training advice and supervision.[6]

The three decades after World War II witnessed a decided strengthening of the bridge between science and sport. James "Doc" Counsilman, University of Indiana head swimming coach, epitomized this new enthusiasm for applying science to sport and although he was not a track coach, Councilman is included in this chapter because his ideas had a significant impact on the evolution of training for track (and field) during this era. Counsilman proved to be an important link between the West and the Soviet Union's

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[3] Stampfl, *Franz Stampfl on Running*; Cerutty, *Running with Cerutty*.
[4] William Bowerman, W.E. Harris, and James S. Ward, *Jogging* (New York: Grosset and Dunlap, 1967); Bowerman, *Coaching Track and Field*; Lydiard and Gilmour, *Run to the Top*; Arthur Lydiard and Garth Gilmour, *Running the Lydiard Way* (Mountain View, Ca: World Publications, 1978).
[5] Doherty, *Modern Track and Field: Promotion, History and Methods*; Doherty, *Track and Field Omnibook*; Jordan and Spencer, *Champions in the Making: Quality Training for Track and Field*; George Thomas Bresnahan, Francis X. Cretzmeyer, and Waid Wright Tuttle, eds., *Track and Field Athletics*, Fourth ed. (St. Louis: C.V. Mosby Company, 1956).
[6] Guttmann, *From Ritual to Record*.

state-supported research programs. By applying science to sport (which was the foundation upon which Soviet training methods were executed), Counsilman demonstrated the level of training sophistication possible (and arguably desirable) to enhance athletes' performance.

To examine this paradigm shift, this chapter focuses on the training of athletes for the middle and long distance events. This focus is representative of the general trend that occurred during this era and is not meant to suggest that sprinters, marathoners, and other track athletes didn't also make substantial changes in their approach to training in the post-war years. However, the training of Emil Zátopek (winner of the 5,000 and 10,000 meters and the marathon at the 1952 Olympic Games), Peter Snell (winner of the 800 and 1,500 meters at the 1964 Tokyo Olympics) who completed up to 100 training miles per week, and Jim Ryun (former world record holder in the mile) provide examples of athletes who epitomized the general transition from moderate to heavy training loads that occurred during these decades.

SPORT AND TRACK AND FIELD IN POST-WAR AMERICA (1945-1975)

In the quarter of a century following World War Two, racial and gender barriers began to be dismantled as civil rights legislation, the initiation of the women's rights movement, and a re-examination of athletes' rights heralded a "gradual opening of organized sport to all segments of society."[7]

[7] Betty Spears and Richard A. Swanson, *History of Sport and Physical Education in the United States*, 4th ed. (Boston: WCB McGraw-Hill, 1995), 253.

The post-war period was an especially favorable time in the nation's history. Many Americans enjoyed affluence, the trappings associated with enhanced technology, sufficient healthcare, and opportunities for education and employment. However, the status quo was seriously challenged in the 1960s when the civil rights and women's movements combined with a growing opposition to American involvement in the Vietnam War. The march on Washington to protest against various forms of discrimination in August 1963 attracted 250,000 people and aided the passage of the 1964 and 1965 Civil Rights Acts. Title VII of the 1964 Civil Rights Bill contained a provision banning discrimination on the basis of race, sex, color, religion or national origin.[8] Athletes supported the cause as African American members of the 1968 United States Olympic team threatened to boycott the games and then (after medaling in their events) held non-violent protests symbolizing "Black Power" on the podium during the playing of the American national anthem.[9]

Following World War II, professional sport became the dominant player in American sporting life.[10] As professional team sport expanded, teams moved to new areas or to larger cities and new franchises were formed. By the end of the 1950s ninety-percent of all households owned at least one television set which meant that television had become the primary medium delivering sport to its rapidly expanding audience.

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[8] Hugh Graham, *The Civil Rights Era: Origins and Development of National Policy 1960-1972* (New York: Oxford University Press, 1992), 125-152.
[9] Harry Edwards, *The Revolt of the Black Athlete* (New York: Free Press, 1969), 40-47; Wallechinsky, *The Complete Book of the Olympics*, 20.
[10] Rader, *American Sports: From the Age of Folk Games to the Age of Televised Sports*, 253-272.

Teams benefited from this increased exposure and the new, lucrative television contracts ensured the financial stability of many sport team franchises and leagues.[11]

Amateur sport also expanded at a remarkable rate. Participation increased, performances improved, records at all levels were broken, and international competition became commonplace as air travel improved and became affordable. The Amateur Athletic Union (AAU) controlled amateur sport in the United States during most of this period, including track and field. This led to a number of struggles with the increasingly influential NCAA over various matters including the official sanctioning of meets that ultimately led to an uneasy truce lasting into the mid 1970s.[12]

In the Fifties American track and field stars broke many barriers. Bob Richards, the "Flying Parson," became the second man to clear fifteen-feet in the pole vault; in 1954 Parry O'Brien broke the sixty-foot mark with a revolutionary shot put technique; Charles Dumas surpassed the seven-foot high jump barrier in 1956; and Glen Davis broke the fifty-second barrier in the 440 yard and 400 meter intermediate hurdles.[13]

America's sporting dominance began to be seriously challenged, however, with the entrance of the Soviet Union into the Olympic arena. With the investment of vast resources, the Soviet Union used sport as a political weapon, winning the medal count in

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[11] Ibid.

[12] Turrini, "Running for Dollars: An Economic and Social History of Track and Field in the United States, 1820-2000," 311-312.

[13] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 167-180. Parry O'Brien revolutionized the shot put with a new technique that involved starting the throw facing the back of the throwing circle. Previously, all athletes had shuffled across the ring facing the direction in which they were going. This new rotational technique allowed O'Brien to dominate the shot put throughout the 1950s. For further information see Lawson, *World Record Breakers in Track and Field Athletics*, 237-238.

four out of the next six Olympic Games (1956-1976).[14] The most outstanding performance of the 1952 Helsinki Olympics was by Emil Zátopek of Czechoslovakia who captured the 5,000 meters, the 10,000 meters and the marathon in his first ever attempt at the distance. In the Melbourne Olympics of 1956 the American team retained its track and field dominance by amassing fifteen gold medals out of a possible twenty-four.[15] Bobby Morrow of Abilene Christian College, Texas, doubled in the 100 meters and 200 meters with times of 10.5 and 20.6 seconds—an Olympic record—respectively.[16] The standout performer in the long distances was Vladimir Kuts, a Russian who won both the 5,000 meter and 10,000 meter runs in Olympic record times. In the Rome Olympics of 1960 the favored USA track and field team did not fare so well winning a total of twelve gold medals. Most of the American favorites faltered, including Ray Norton who entering the Olympics was the world-record holder in the one hundred and two hundred meters and had been unbeaten in the previous two years. He finished sixth in both events.[17] The highlight of the 1964 Games was the triumph of the two Americans in the distance events—Bob Schul in the 5,000 meters and Billy Mills in the 10,000 meters. No American had ever won the 10,000 meter run and as one writer put it, "to cover any distance greater than 1,500 meters, the feeling was Americans took cars."[18]

The year 1964 witnessed the emergence of Jim Ryun, the first high-school runner to run the mile in less than four minutes. In 1966 Ryun established the world record for

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[14] Riordan, "The Rise and Fall of Soviet Olympic Champions," 25-44.
[15] "Olympic Medal Table," International Olympic Committee, http://www.olympic.org/uk/athletics/results/search_r_uk.asp (accessed June 20, 2007).
[16] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 130-135.
[17] Ibid., 136.
[18] Ziewacz, *The Games They Played: Sports in American History, 1865-1980*, 291.

the mile in a time of 3:51.3 and in 1967 he lowered it further to 3:51.1. Although expected to be a favorite, Ryun was unable to live up to his reputation and failed to qualify for the 800 meters at the 1968 US Olympic Trials. He did make the team as a 1,500 meter runner but, to the disappointment of many, finished second to Kip Keino of Kenya. The 1968 Games were not without American heroes, however. Al Oerter claimed his fourth gold medal in the discus; Bob Beamon recorded a world record long jump of 29' $2^{1}/_{2}$" a record that lasted for twenty-three years; and Dick Fosbury introduced a revolutionary high jump technique which would become known as the "Fosbury Flop" in which he cleared the bar head first with his back towards the bar.[19]

The Munich Olympics of 1972 once again witnessed the intrusion of politics into the world of sport as eight Palestinian terrorists broke into the Olympic village and killed two members of the Israeli team.[20] Three of the longest winning streaks in US Olympic history (pole vault, springboard diving and basketball) came to an end as the Soviet Union convincingly topped the medal table, outscoring the United States in the gold medal tally by a score of fifty to thirty-three.[21] In the short sprints Valery Borzov of the Soviet Union, edged the Americans and won both the 100 and 200 meters.[22] In American track and field Dave Wottle lived up to his reputation as the joint reigning world record

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[19] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 244-245.

[20] Wallechinsky, *The Complete Book of the Olympics*, xxviii. Nine hostages were also taken but all were eventually killed along with five of the terrorists and one policeman. David Wallechinsky notes that although the incident did not do much to advance the Palestinian cause, it did force future Olympic organizers to turn the athletes' village and competition arenas into heavily secured sites.

[21] Ibid., xxviii-xxix.

[22] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 201-203. Robert Hayes of the USA won the 1964 100 meters at the Tokyo Olympics and James Ray Hines also from the USA won the 100 meters title at the 1968 Mexico Olympics.

holder in the 800 meters by claiming the Olympic 800 meters title. After placing fifth in the 10,000 meters Frank Shorter won the marathon, a feat that earned him the 1972 Sullivan award as America's top amateur athlete.[23] In the 5,000 meter final, Steve Prefontaine, a protégé of Coach William Bowerman of the University of Oregon (discussed later in this chapter), took the lead with four laps to go but narrowly missed out on a medal in the final strides of the race.[24] Finally, in swimming, Mark Spitz who was coached at University of Indiana by James "Doc" Counsilman (also featured in this chapter) won a record seven swimming gold medals a feat unequalled past or present by any other athlete in a single Olympiad.[25]

THE COACHES

In 1947 just after WWII, George T. Bresnahan, Assistant Professor of Physical Education and track and field coach at the University of Iowa, joined forces with Waid W. Tuttle, Professor of Physiology at the same institution, to publish *Track and Field*

[23] Lawson, *World Record Breakers in Track and Field Athletics*, 65-66. David Wottle was a graduate of Bowling Green University. On 1 July 1972 he won the US Olympic 800 meter trials in 1:44.3, a time that equaled Peter Snell's and Ralph Doubell's world record; Wallechinsky, *The Complete Book of the Olympics*, 79-80. For further info on David Wottle and Frank Shorter see: "Dave Wottle," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=189 (accessed April 6, 2008); "Frank Shorter," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=153 (accessed April 6, 2008).

[24] Steve Prefontaine tragically lost his life on 30 May 1975 in a car accident at the age of twenty-four. More than twenty years later, two fictional films about his life were released: "Prefontaine" (1997) and "Without Limits" (1998). For further information on Prefontaine's running career see: "Steve Prefontaine," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=130 (accessed March 10, 2008).

[25] For information on Mark Spitz and his achievements at the 1972 Olympics see: "Mark Spitz," Olympic.Org, http://www.olympic.org/uk/athletes/profiles/bio_uk.asp?PAR_I_ID=20272 (accessed January 12, 2008).

Athletics.[26] The book marked the first time that an exercise scientist tried to apply the emerging information coming from the field of exercise physiology to track and field. Organizationally, the book included the latest scientific findings, detailed technical information for each track and field event, and comprehensive practice schedules for early, middle and late seasons.[27]

The book was highly revered, so much so, that McNab and colleagues note that in the mid 1960s it provided the main work of reference (along with Kenneth Doherty's *Modern Track and Field,* 1953) in British colleges of physical education. Moreover, in 1956 further practical knowledge was provided by the addition of author Francis X. Cretzmeyer, the head men's cross country coach at the University of Iowa.[28]

The authors' specific advice on "Conditioning for Track and Field Events" was basic—covering diet, elimination, exercise, use of weight charts (to monitor an athlete's progress), rest, sleep, staleness, use of stimulants and tobacco. The daily practice schedule was brief in nature—limited to the length of the American collegiate track and field season. It consisted of the following four periods: 1) Preliminary season—March 15 to April 1; 2) Early season—April 2 to April 15; 3) Midseason—April 16 to May 15; and 4) Late Season—May 16 to June 17. The remainder of the year was devoted to activities, which, for the majority of athletes, entailed complementary sports and games such as football, basketball and tennis.[29]

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[26] Bresnahan and Tuttle, *Track and Field Athletics*.
[27] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, 103.
[28] Bresnahan, Cretzmeyer, and Tuttle, eds., *Track and Field Athletics*.
[29] Bresnahan and Tuttle, *Track and Field Athletics*, 46.

The preliminary season the aim of which was to get the athlete into "basic physical shape," is of particular note, being only two weeks in duration. After two to three weeks of preliminary training the athlete was deemed ready for event-specific work as they transitioned to their competitive season.[30] It is implausible to think (unless an athlete was transferring from another sport) how two weeks of training could adequately prepare an athlete for an event. To illustrate how track and field training has evolved, modern-day American collegiate preparation (other than cross-country running) starts in late August (or early September) and ends in early January for the start of the indoor season—longer than the whole of the aforementioned competitive season.[31] It is clear from the preceding training schedule recommended by Bresnahan and Tuttle, that their ideas about training for track and field could still be considered "light" in nature—a continuation of the light training loads that epitomized track and field preparation prior to WWII.

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[30] Ibid., 88.

[31] William H. Freeman, *Peak When It Counts: Periodization for American Track and Field*, 3rd ed. (Mountain View, Ca.: Tafnews Press, 1996), 54-63. Note: In this section of the book (Chapter 8) Freeman covers how to apply periodization to the American track and field program.

KENNETH (KEN) DOHERTY

Figure 32. Kenneth Doherty.[32]

> Now he [the coach] needs to have a 'muscle and nerve' knowledge of things. Now he requires understanding of what present champions are doing, why other coaches and athletes have discarded certain forms and persisted with others, and why his own coaching methods are best for this particular situation and for this particular boy. There is no easy way to such knowledge, and to assume otherwise is deliberately to deceive those in or intending to enter the coaching profession.[33]

John Kenneth (Ken) Doherty (1905-1996) was born on 16 May 1905 in Detroit, Michigan.[34] As a gifted athlete, Doherty won the United States Olympic decathlon trials in 1928 and proceeded to place third in the Amsterdam Olympics of the same year. At the end of his competitive career he became an assistant track coach at Princeton University and then head coach at the University of Michigan from 1939 to 1948, where his teams

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[32] Image located at: www.usatf.org/athletes/hof/doherty.shtml (accessed September 12, 2007).
[33] Doherty, *Modern Track and Field: Promotion, History and Methods*, viii.
[34] "USA Track and Field Hall of Fame: John Kenneth (Ken) Doherty," USA Track and Field, www.usatf.org/athletes/hof/doherty.shtml (accessed November 12, 2006).

won nine Big Ten titles. He finished his coaching career at the University of Pennsylvania (1948-1961) where he directed the Penn Relays (the longest uninterrupted collegiate track meet in the United States) and the first USA-USSR dual track meet.[35] After retiring from coaching, Doherty excelled as a writer of track and field instructional texts. His books incorporated pragmatic advice to such an extent that track and field historians McNab, Lovesy and Huxtable felt his work "represented in many events, the best knowledge of the period in the English language."[36] Between 1953 and 1986 Doherty published two classic books that went into multiple editions and covered the entire contents of track and field.[37] Doherty had a profound interest in training and was concerned with not only the "how" aspect of training but also the "why."

An examination of Doherty's books provides an interesting lens for viewing the growth of training theory in the three decades after World War II. His first book, *Modern Track and Field: Promotion, History and Methods* (1953), did not specifically address the topic of training and made no reference to the emerging use of weight training to enhance performance.[38] Doherty's 1953 work discussed the technical details of each track and field event, but provided no training programs or schedules for would-be athletes to

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[35] Joseph Turrini, "'It Was Communism Versus the Free World': The USA Versus USSR Dual Track Meet Series and the Development of Track and Field in the United States, 1958-1985," *Journal of Sport History* 28, no. 3: 427-471; "USA Track and Field Hall of Fame: John Kenneth (Ken) Doherty."

[36] McNab, Lovesy, and Huxtable, *An Athletics Compendium*, 103.

[37] Doherty, *Modern Track and Field: Promotion, History and Methods*; Doherty, *Modern Track and Field*; Doherty, *Track and Field Omnibook*; Kenneth Doherty, *Track and Field Omnibook*, 4th ed. (Los Altos, Calif.: Tafnews Press, 1985). Note: in 2007 *Track and Field News* published the fifth edition of T*rack and Field Omnibook*. It continues to promote itself as the "benchmark" for track and field textbooks. For further details see: "Track and Field Omnibook," Track and Field News, http://www.trackandfieldnews.com/catalog/index.php?main_page=product_info&products_id=376 (accessed October 25, 2007).

[38] Doherty, *Modern Track and Field: Promotion, History and Methods*.

follow. This omission is an indication of how little understanding there still was in this era about the benefits or importance of proper training. However, in the second edition of *Modern Track and Field,* published ten years later in 1963, Doherty included a full chapter on "The Basic Training for Track and Field," after stating that "basic sports fitness cannot be gained completely through the actions of the event itself."[39] In this chapter, Doherty argues that maximum performance for specific events can only be achieved when an athlete includes training for strength (self and partner resistance and weight training), speed training, endurance training, power training, flexibility work, and mental conditioning.[40] Doherty proceeded to outline the basics of training, including the importance of building a solid foundation to attain a higher peak in performance and the necessity of rest to allow for adequate "supercompensation" (where the post training period results in a higher functional capacity than the original one) after a given training stimulus.[41] Clearly, events witnessed during the decade of the 1950s had convinced Doherty that training not only mattered but that a scientific approach to training was highly desirable.

In 1971 Doherty published his first edition of *The Track and Field Omnibook,* and then five years later, released a second edition. The second edition contained more than five hundred pages and was considered by the author to be "ahead of its time in its science orientation, its leadership emphasis and its overall judgment" of track and field.[42] The text included detailed analysis and advice for each track and field event, but also

[39] Doherty, *Modern Track and Field*, 301.
[40] Ibid., 300.
[41] Ibid., 303.
[42] Doherty, *Track and Field Omnibook*, vi-vii.

proposed the adoption of a "Systems" approach (borrowed from business management) to coaching that would allow a more systematic study of the human side of sport.[43] Doherty's "Systems" approach never did gain acceptance in the track and field community and, as we shall see in Chapter Seven was superceded by a more all encompassing theory and methodology of training that would gain acceptance and implementation throughout the world of sport. Now in its fifth edition, Doherty's Omnibook was the standard text used in physical education classes around the country. As such it was the "benchmark for track & field textbooks" and perhaps influenced more coaches than any other book published in this era.[44]

[43] Ibid., 79.

[44] Review of Doherty, *Track and Field Omnibook*, 5th edition, viewed on 8 March 2008 at: http://www.amazon.com/Track-Field-Omnibook-Kenneth-Doherty/dp/0911521747.

ARTHUR LYDIARD: RUNNING MAN

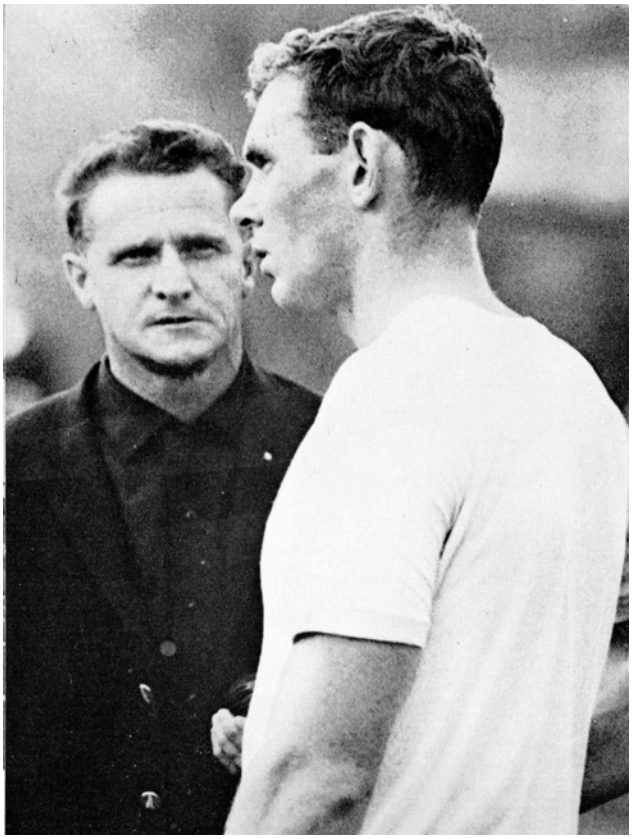

Figure 33. Arthur Lydiard (left) pictured here with his most famous pupil, Peter Snell.[45]

Champions are everywhere, all you have to do is train them properly.[46]

Arthur Lydiard was born on 6 July 1917 in Mount Eden, Auckland, New Zealand. In school he excelled at boxing, rugby football and track. The Great Depression forced

[45] Image taken from: Lydiard and Gilmour, *Run to the Top*.
[46] "Arthur Lydiard: The Maker of Champions," Lydiard Foundation, http://www.lydiardfoundation.org/ (accessed June 13, 2006).

Lydiard at the age of fifteen to leave school early to help with family finances. After a year working at a farmer's foundry he switched professions to become a shoemaker, a career he held for the next twenty-four years, eventually becoming the manager of a local shoe factory.[47] However, it was in his spare time that Lydiard discovered, first as a runner, and then as a coach, his true vocation in life. He is best known for coaching Peter Snell and Murray Halberg to gold medals (800 meters and 5,000 meters, respectively) at the 1960 Rome Olympics and for helping Peter Snell attain two Olympic gold medals (800 and 1,500 meters) at the 1964 Tokyo Olympics.[48] For his achievements and innovative training methods Lydiard has been called by some authorities the finest distance running coach in the world. *Runner's World* magazine, for example, in their Millennium issue named him one of the five most influential running figures of the twentieth century.[49]

As New Zealand's top marathon runner in the early 1950s, Lydiard spent many years experimenting with different combinations of running speeds and distances (up to an incredible three hundred miles per week) to derive the "Lydiard System."[50] The most important part of the system for all distances from 800 to 10,000 meters was an initial period of marathon training that Lydiard advised should last "as long as possible," but

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[47] Garth Gilmour, *Arthur Lydiard: Master Coach* (Cheltenham: Sport Books, 2004), 20-29.
[48] "Arthur Lydiard: Running Man," New Zealand Edge.Com, http://www.nzedge.com/heroes/lydiard-arthur.html (accessed October 22, 2006).
[49] Bowerman, *Coaching Track and Field*, 9; "Arthur Lydiard: Running Man." Note in 2006 Lydiard was also named as one of "The 40 Most Influential People and Moments of the Past Four Decades" by *Runner's World* magazine. Kenny Moore, "Unforgettable: The 40 Most Influential People and Moments of the Past Four Decades I Remember Arthur Lydiard," *Runner's World*, http://www.runnersworld.com/article/0,7120,s6-243-297--10545-7-6X11X16X20X25X27X28X29X30X31X32-12,00.html (accessed December 24, 2007).
[50] Lydiard and Gilmour, *Running the Lydiard Way*, 17.

typically lasted ten weeks.[51] "The key to my conditioning training is one hundred miles a week," Lydiard wrote.[52] The fundamental goal of marathon training was to develop enough stamina to enable athletes to maintain the necessary speed over their full competitive distance.[53] To achieve the desired one hundred miles Lydiard recommended the following program:

Monday:	10 miles half effort over an undulating course
Tuesday:	15 miles one-quarter effort over reasonably flat course
Wednesday	12 miles one-half effort on hilly course
Thursday	18 miles one-quarter effort over reasonably flat course
Friday	10 miles at three-quarter effort over flat course
Saturday	20-26 miles at one-quarter effort over reasonably flat course
Sunday	15 miles at one-quarter effort.[54]

Lydiard recommended performing marathon training at a pace just under "maximum steady state running"—the state that occurs in moderate muscular exercise when the removal of lactic acid by aerobic metabolism keeps pace with its production. This zone he explained provided sustained pressure on the circulatory and respiratory systems necessary to achieve optimal physiological adaptation.[55] Lydiard contended that runners who incorporated marathon training achieved better levels of conditioning compared to athletes using interval training alone. The effectiveness of "Lydiard's

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[51] Ibid., 187. Freeman, "Distance Training Methods, Past and Present: The Evolution of Distance Training and Racing, 1880-1975."
[52] Lydiard and Gilmour, *Run to the Top*, 22.
[53] Lydiard and Gilmour, *Running the Lydiard Way*, 16.
[54] Arthur Lydiard, *Arthur Lydiard's Running Training Schedules* (Los Altos, Calif.: Track and Field News, 1965), 25.
[55] Lydiard and Gilmour, *Running the Lydiard Way*, 20.

System" over interval training alone was validated by Pekka Vasala, the 1,500 meter gold medalist at the 1972 Munich Olympics. He noted how in 1950, Finnish runners began to be coached using interval training methods. "It was a big hit and for the next ten years my country trained virtually no other way." The methods proved successful, but over the course of the next decade international triumphs became fewer and fewer. Vasala noted how Lydiard significantly changed running practices during his time as chief Finnish running coach, as gradually both new and established coaches began to include his conditioning and speed-training methods into their own programs.[56] Lydiard's methods paid dividends and along with the success of Pekka Vasala came the gold medal triumph of Finland's Lasse Virren in both the 5,000 and 10,000 meters at the 1972 and 1976 Olympics.

Lydiard, unlike Percy Cerutty, was adamant in his distaste of weight training, preferring instead to use the specificity of running to achieve desired levels of conditioning. "Halberg never lifted a weight in his life, yet he runs all right," Lydiard contended. Moreover, "I think conditioning by distance running is many times faster and better than conditioning by weight training."[57] Once a solid foundation of marathon training had been established, Lydiard proposed incorporating small quantities of anaerobic training—progressively increasing both volume and intensity. "This is the period for developing speed, power, suppleness, technique, and increasing your capacity to exercise anaerobically."[58] To challenge the body anaerobically and to build strength and

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[56] Gilmour, *Arthur Lydiard: Master Coach*, 229.
[57] Lydiard, *Arthur Lydiard's Running Training Schedules*, 36.
[58] Lydiard and Gilmour, *Running the Lydiard Way*, 36.

suppleness, Lydiard advocated six weeks of hill training. The ideal hill was three-hundred meters long with a gradient of approximately one-in-three with 400-800 meters of reasonably flat ground at the top and bottom. A typical hill session for a mature runner consisted of one hour of running interspersed with recovery periods of jogging at the top and bottom of the hill. The weekly schedule was divided into three days a week of hill training alternating with three days of "leg-speed" training and one day of long-distance running.[59] Leg-speed training referred to running up to ten repetitions of 100-120 meters, moving one's legs as fast as possible with three minute rest intervals between each repetition.

The final phase of training was "Track Training" which lasted six to ten weeks, where the aim was to develop speed**.** It consisted of a mixture of increased volumes and intensities of anaerobic training, as well as sprint training, fast relaxed running, and sprint racing. It also featured "sharpening" training that aided racing technique by performing: 1) multiple repetitions of sprinting for fifty meters and then floating (relaxed running with good form and velocity) for fifty meters; 2) time trials to coordinate stamina and speed; and 3) races over sprint, middle and long distances to improve racing condition. Lydiard acknowledged that because of the increased intensity of training during the "sharpening" period it was "advisable to drop the volume and increase the intensity."[60]

The final period prior to racing entailed lightening the training load in order to "freshen up" and lasted ten days.[61] This was the average time that Lydiard felt was needed

[59] Ibid., 40.
[60] Ibid., 48.
[61] Ibid., 49.

to achieve peak condition. However, Lydiard acknowledged that individuals varied and should develop their own preparation strategy based upon previous trial and error. The emphasis during this period was staying sharp and fresh and training well within one's capabilities. A typical week's schedule for the final competitive period of the year included:

Monday: a few sharpeners or easy *fartlek*
Tuesday: light sprint training session or stride-outs
Wednesday: race sprints and middle or short distance
Thursday: jog
Friday: stride–outs (Strides)
Saturday: race
Sunday: an easy, long run.[62]

Analysis of Lydiard's system reveals the systematic manipulation of the volume and intensity of training over the course of the year. He starts with a large volume of training in the form of marathon running, increases the intensity of training by incorporating anaerobic hill running, and then finishes with very high intensity (low volume) track training in preparation for racing. Unlike Stampfl, Lydiard acknowledged the need to decrease the volume of training once high quality speed work was introduced. Lydiard's recommendation to incorporate marathon training signifies a radical departure from the low weekly mileages and reliance on interval training as advocated by Franz Stampfl during the mid 1950s. The incorporation of such a large volume of work in the

[62] Ibid., 50.

form of marathon running can be seen as a significant move towards what can be classified as "heavy" training, particularly when contrasted with the "light to moderate" training of the previous era (1917-1945).

Lydiard reaped significant success with his methods, forged out of many years of trial and error. However, caution should be applied to the use of such high mileages, particularly in the marathon stage of training. While a number athletes may be able to reach the ideal one hundred miles per week many athletes may fall by the way side and suffer set backs if they are not biomechanically predisposed to handle such mileage.[63] Indeed, even Peter Snell, Lydiard's most successful athlete, struggled at times with injury and the inability to consistently achieve the desired one hundred miles. This is clearly chronicled by Cordner Nelson, inaugural editor of *Track and Field News,* who noted that in the fall of 1959, a year after beginning full scale training with Lydiard, Snell suffered a stress fracture, a clear indication of excessive forces and the inability of the body to adapt to stress.[64] Nelson further notes that 1964 was the first time that Snell had been able to endure Lydiard's one-hundred mile schedule for a full ten weeks. Previously, the best Snell could manage was a meager three weeks.[65] Despite this potential limitation Lydiard's system can be seen as a well thought out and organized synthesis of various training methods (marathon, *fartlek*, interval, hill and speed training) all geared towards

[63] In order to handle such high mileages athletes need to have excellent mechanical alignment of their bodies. If athletes suffer from excessive or prolonged pronation (foot rolling in) or functional leg length discrepancies this may predispose them to injury and overuse injuries. For further information see Peter R. Welsh and Linda J. Woodhouse, "Overuse Sydromes," in *Endurance in Sport*, ed. R.J. Shephard and P.-O. Åstrand (London: Blackwell Scientific Publications, 1992), 505-515; Peter Renström and Pekka Kannus, "Prevention of Injuries in Endurance Athletes," in *Endurance in Sport*, ed. R.J. Shephard and P.-O. Åstrand (London: Blackwell Scientific Publications, 1992), 325-350.
[64] Nelson, *Track's Greatest Champions*, 153.
[65] Ibid.

the ultimate attainment of quality speed and endurance during the racing season. As such Lydiard may be viewed as the most influential coach of the 1960s and his methods have since become the basis of much of modern distance training.[66]

PAYTON JORDAN

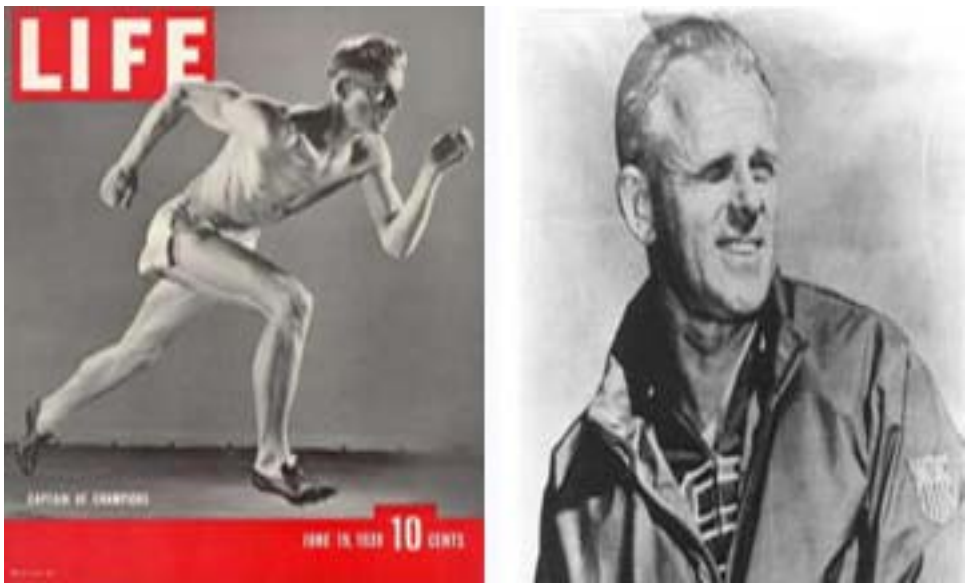

Figure 34. Payton Jordan—the athlete on the 19 June 1939 cover of *Life Magazine,* and later as the head coach at Stanford University.[67]

The basic pattern of quality track and field training follows one simple path. An athlete must understand what he is doing, why he is doing it, and how to do it.[68]

[66] Freeman, "Distance Training Methods, Past and Present: The Evolution of Distance Training and Racing, 1880-1975," 4-11. McNab, Lovesy, and Huxtable, *An Athletics Compendium*, 115.
[67] Photos located at http://www.life.com/Life/ (Photo by Gjon Mili) and http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=87
[68] Jordan and Spencer, *Champions in the Making: Quality Training for Track and Field*, 7.

Payton Jordan was born on 19 March 1917 in Whittier, Los Angeles County, California.[69] As an outstanding athlete at the University of Southern California, Jordan was coached by USA Track and Field Hall of Famer Dean Cromwell, where he excelled in rugby, football and the short sprints. In track he helped the Trojans win two national collegiate team championships, was a member of the 1938 world-record setting 4 x 110-yard relay team, and in 1941 won the Amateur Athletics Union one hundred meter title. Jordan was denied the opportunity to express his talent at the Olympic level because of World War Two.[70]

After the war, Jordan switched focus to coaching, turning Occidental College, a small liberal arts college in Los Angeles into a National Association of Intercollegiate Athletics (NAIA) powerhouse. In 1957, after ten years at Occidental, he became the head coach at Stanford University. Over the next twenty-two years he took the Cardinals to a second-place NCAA finish in 1963, produced seven Olympic athletes, five athletes who broke world records, six individual NCAA champions, and twenty-nine All-Americans. The highlight of his career came as the head coach of the 1968 US Olympic team (after serving as an assistant at the 1964 Olympics) which won twenty-four medals—the most in Olympic track and field history, including an unprecedented twelve golds and set six world-records. For his achievements, in 1982 Payton Jordan was inducted into the USA

[69] "USA Track and Field Hall of Fame: Payton Jordan," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=87 (accessed July 12, 2006).
[70] Ibid.

Track and Field Hall of Fame.[71] In testimony to Jordan's contribution to track and field, Brutus Hamilton, the legendary University of California at Berkeley coach and USA Track and Field Hall of Famer (featured in Chapter Three) declared, "I know of no man in track and field who has a greater reputation as an inspirational teacher, or who has matched his brilliant competitive record with a vast understanding of all events and the skill to interpret them to athletes."[72]

In 1968, Jordan, along with Bud Spencer, former world-record holder in the four hundred meters co-authored *Champions in the Making: Quality Training for Track and Field*.[73] The authors made the immediate distinction between the quality and quantity of work performed, which is clearly reflected in the title of their work. "It isn't how many miles you run in a day's work; it is how well you run one mile or even 440 (yards) that measures steps on an individual progress sheet."[74] Accordingly**,** Jordan dismissed the long slow distance (LSD) training or "over-the-hill-and-into-the-valley" training as he referred to it, typified by Arthur Lydiard the New Zealand running coach (featured earlier in this chapter). He felt that this type of training may be of benefit for long distance runners, but not where economy of motion and speed were concerned.[75] For Jordan, the increased volume (mileage) of training defied the concepts of good logic and without solid speed and pace work a runner was seldom prepared for the finishing sprint. Endurance instead

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[71] "Legacy of a Champion: Payton Jordan," Stanford Alumni Organization, http://www.stanfordalumni.org/news/magazine/2005/mayjun/features/champion.html (accessed May 21 2007); "USA Track and Field Hall of Fame: Payton Jordan."
[72] Jordan and Spencer, *Champions in the Making: Quality Training for Track and Field*, iv.
[73] Ibid.
[74] Ibid., 11.
[75] Ibid., 7.

could be attained through repetitive speed work, which, over time, would develop necessary stamina and resistance to fatigue.[76]

To ensure high quality training, Jordan deemed it essential to duplicate the types of "physical, organic and psychological disturbances" encountered in a meet during practice.[77] To acquaint an athlete with the feel of actual competition, workouts required running, jumping and throwing under near meet conditions. Jordan's quality approach advised against strictly regimented training practices as a certain degree of individuality was always necessary to get the best out of each athlete. Accordingly, "it is the athlete that makes a system and any system that fails to recognize the individual is no system at all."[78] Furthermore, to become a champion or standout athlete it was almost imperative to train year-round, as the idea that man became "burned out" due to excessive workloads, the authors asserted, had been previously refuted.[79]

Chapter Two specifically outlined the authors' philosophical approach to training. Jordan's beliefs and coaching style was heavily influenced by his college mentor, Dean Cromwell, who emphasized the more mental aspects of training. This is clearly reflected in the author's statement that "the realization of human potential in sport is a mental-psychological combination as well as a physical-mechanical one. Thus the setting of

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[76] Ibid., 11. For many years coaches persisted in including long distance training for sprinters during the initial conditioning phase. However, research has proven that endurance capabilities such as maximum oxygen uptake can be improved with repetitive speed work. For detailed analysis see Brian Dawson et al., "Changes in Performance, Muscle Metabolites, Enzymes and Fiber Types," *European Journal of Applied Physiology and Occupational Physiology* 78, no. 2 (July 1998): 163-169. The authors' research involved subjects performing sixteen outdoor sprint training sessions over a six week period which had a significant effect on VO2 max (maximum oxygen uptake). The authors concluded that six weeks of sprint training can be significant in improving endurance capabilities in runners.

[77] Jordan and Spencer, *Champions in the Making: Quality Training for Track and Field*, 9.

[78] Ibid., 5.

[79] Ibid., 4.

positive attitude patterns becomes as important as training programs and technique skills."[80]

In Chapter Three of *Champions in the Making* entitled "The Liquid Action of Running Motion," Jordan divided the school-year into three parts—the off-season (October, November, December); preliminary season (January, February, March); and the competitive season (April to June).[81] Specifically, the off-season was composed of various forms of conditioning including, gymnastics, weight lifting, stair running, progressive relays, competitive and non-competitive cross country and variations of *fartlek* and speed play**.** The greatest volume of work occurred in the preliminary season with a general theme of increasing intensity over time. Once the competitive season was under way, "a man should be at his physical and mental peak, and improvement is no longer the result of work but more of feel and economy of effort."[82] However, this did not exclude intensive training if an athlete appeared short of "top" condition**.** Despite detailed technical descriptions of each track and field event, the authors failed to offer structured training schedules and how they should be manipulated over the course of the year.

In 2003 (two years after establishing a world-record in the eighty to eighty-four Master's age group in the one hundred meters), Jordan had the opportunity to reflect on the dramatic changes in training that had taken place since he first began coaching. "Unquestionably," he explained, "coaches and athletes are better trained than ever in history. The nutrition, medical services and modalities of sports medicine are superior.

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[80] Ibid., 3.
[81] Ibid., 23.
[82] Ibid.

The facilities and equipment are state-of-the-art, with all-weather track surfaces and their consistency, scientifically developing implements, shoes and wearing apparel, the athlete has the opportunity to maximize his potential."[83]

Jordan's emphasis on quality over quantity of training offers balance to the idea proposed by Lydiard that a heavy volume of training is necessary to achieve success. This raises the question whether or not it is possible to achieve the same results, but via two different routes. For all of Jordan's contributions to track and field, it is evident from the numerous glowing tributes in *Champions for Life* (where authors John B. Scott and James S. Ward contacted well over two hundred former student-athletes, coaches, faculty members and Olympians associated with Jordan) that perhaps Jordan's greatest contribution was his role as "teacher of character development" via the positive influence he exerted with his athletes.[84]

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[83] "A Living Legend: Payton Jordan Interview with Catherine Sellers U.S.O.C Coaching Division," U.S. Olympic Team, http://coaching.usolympicteam.com/coaching/kpub.nsf/v/2Deco3 (accessed September 16, 2006).

[84] John B. Scott and James S. Ward, *Champions for Life* (Columbus, Ohio: Nicholas Ward Publishing, 2004); "Letters to the Editor: Remembering the Coach," Stanford Alumni Organization, http://stanfordalumni.org/news/magazine/2005/julaug/dept/letters.html (accessed May 21, 2007).

WILLIAM BOWERMAN

Figure 35. Bill Bowerman standing on the side of a track field, while five athletes are running laps. Identification from left to right: Bill Bowerman, Mark Robbins, Phil Knight (co-founder of Nike Corporation with Bowerman), Wilcey Winchell, Dick Miller, and unidentified athlete. The year of the photo is estimated to be about 1959. From the University of Oregon Libraries—Special Collections and University Archives**.**

> A teacher is never too smart to learn from his pupils. But while runners differ, basic principles never change. So it's a matter of fitting your current practices to fit the event and the individual. See, what's good for you might not be worth a darn for the next guy.[85]

[85] "Inspirational Quotes: Training," Copacabanarunners, http://www.copacabanarunners.net/iquotes.html (accessed March 12, 2008).

William Bowerman was born on 9 February 1911 in Portland, Oregon. As an undergraduate at the University of Oregon, Bowerman played basketball, football and joined the track team in his junior year where he ran the 440-yard dash. After graduation he coached high school sports and then fought for the US army during WWII. In 1949 Bowerman joined the University of Oregon athletics staff where he replaced his former track coach Bill Hayward who had passed away.[86]

During his tenure as head track and field coach at the University of Oregon (1949 to 1972) Bowerman produced four national collegiate championship teams plus two more that were runners-up. Individually his athletes set thirteen world and twenty-two American records and won twenty-four NCAA titles. He coached Otis Davis, the 1960 Olympic gold medalist in the 400 meters and 400-meter relay team and some of America's finest ever distance runners such as Dyrol Burleson, Jim Grelle, Bill Dellinger, Ken Moore, Wade Bell, Steve Savage, Keith Forman, and the late Steve Prefontaine.[87]

In Eugene, Oregon, he started the country's first running club, and with the subsequent publication of his book, *Jogging,* is credited with turning the college town of Eugene, Oregon into the "running capital of the world." Bowerman was also the co-founder of the Nike corporation (where he invented the waffle sole), and in 1981 for his endeavors was inducted into the USA Track and Field Hall of Fame.[88]

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[86] "USA Track and Field Hall of Fame: Bill Bowerman," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=21 (accessed November 10, 2007).
[87] Ibid.
[88] Bowerman, Harris, and Ward, *Jogging*; "Bill Bowerman," National Distance Running Hall of Fame, http://www.distancerunning.com/inductees/2002/bowerman.html (accessed July 10, 2006).

The "Bowerman System" (otherwise known as the "Oregon School") had its genesis in the coaching theories of Bowerman's predecessor, William H. Hayward (also known as "Colonel Bill"), who coached track and field at the University of Oregon from 1904 to 1947. Initially drawing upon mainly American experiences of distance training, Bowerman experimented with his willing athletes and discovered the great value of *fartlek* and the principle of "hard-easy" training.[89] His theories developed from Gosta Holmer's work with *fartlek*; observations of John Landy's (Australian world-record holder in the mile) training before the 1954 British Empire Games; Franz Stampfl's writings on interval training; the theories of Hungarian coach, Mihaly Igloi; personal contacts with Arthur Lydiard; and useful ideas from many of America's finest coaches.[90] In 1974 Bowerman summarized his approach to training as follows: "The basic system is a combination of interval training and *fartlek*. It has been developing around the basic concepts for almost twenty-five years now and is still developing."[91]

The first significant, outside influence on the Bowerman system was Gosta Holmer, the Swedish national coach, who as previously discussed (see Chapter Three), is generally recognized as the person responsible for introducing *fartlek* or "speedplay," training to running. Holmer developed a ten-day training program that was adapted into one of Bowerman's first training patterns. Franz Stampfl then provided the framework upon which interval training was added, with a gradually quickening pace as the year

[89] Bowerman, *Coaching Track and Field*, 7.
[90] Ibid.
[91] Ibid., 8.

progressed. Finally, Bowerman owed much to Arthur Lydiard and his year-round training patterns. For Bowerman, there was "no better distance coach in the world."[92]

Bowerman's approach was based on what he termed the "Hard-Easy" method of training, where each day of hard training was followed by a day of light or "easy" training, such as jogging or easy *fartlek*. A hard session could include intervals and/or *fartlek* or a long slow run, whereas an easy session consisted of no more than twenty minutes of running, swimming, weight training or dancing. In Bowerman's own words:

> The principles that I thought were most important were what I have chosen to call the hard-easy. This does not mean that a person runs hard one day and takes it pretty easy the next. It depends on the individual. Perhaps a Steve Prefontaine or a Dyrol Burleson might work hard two or three days and then he might take two or three very light days. Kenny Moore was a fragile runner and after one of his very solid workouts, it might take two or three easy days before he was ready to apply the next hard effort. Nevertheless the hard-easy principle applies and, in general, I don't think a person can go wrong either as a coach or as an individual runner, working hard one day and taking the next relatively easy, or perhaps an effort in some other physical activity.[93]

Bowerman's rationale for alternating hard and easy days was based on the assumption that rest was always necessary for the body to recover and replenish itself. Although basic in principle, the rotation of hard and easy days was not rigidly applied as some runners were able to tolerate two hard days followed by an easy day, while others required two easy days after a hard day. This knowledge was not born out of scientific

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[92] Ibid., 9.
[93] Walsh, *The Bowerman System*, 7.

research but rather by trial and error. Bowerman experimented with his runners to see how long they could hold up to the rigors of heavy training with no recovery days. Most of the runners lasted just one week while only one runner, Bill Dellinger—a twenty-five year-old graduate student and veteran of two Olympics, was able to last two full weeks.[94]

In relation to peaking at the right time, Bowerman was conscious that athletes were unable to remain in top condition for long periods of time. For this reason he purposely prevented his athletes from peaking, choosing instead to "sharpen" them up at the end of the season for the most important meets. Bowerman justified this claim by observing that a number of athletes were world-beaters at the start of the season but failed to make the finals of their national meets at the end of the season.

Bowerman's "Oregon System" used an annual cycle that was divided into three-month periods. For Bowerman the early training during October, November and December consisted of general conditioning, cross country running and basic testing. The pre-track and longer distance training performed in January, February and March was designed to stress fundamentals and increase strength. Finally, during the competitive season in April, May and June all efforts were directed to achieve and maintain "top physical and psychological condition."[95] Bowerman summarized the distribution of workload over the year as follows, "the volume of work is rather modest at the start of the training period. It builds up as the year progresses, reaches a peak just before the competitive season and is reduced as the weekly competition demands maximum strength

[94] Bowerman, *Coaching Track and Field*, 9.
[95] Ibid., 24.

and attention."[96] Despite this assertion, close examination of the Oregon's training schedule for a four-minute miler reveals a steady volume of training with increasing intensity, as 440-yard intervals decrease from a seventy-five second pace in October to a fifty-seven second pace in August.[97] In order to achieve performance goals, each three-month period was further divided into seven-ten-fourteen-and twenty-one-day training schedules. Each schedule generally concluded with a test effort or a time-trial run at three-quarter effort. The first pattern to evolve was a seven-day pattern that "developed simply as a way to plan ahead of time where to put the training emphasis for a given period."[98] The pattern was based on the hard-easy sequence as discussed earlier:

Monday:	Heavy Training
Tuesday:	Light Training
Wednesday:	Heavy Training
Thursday:	Light Training
Friday:	Heavy Training
Saturday:	Light Training
Sunday:	Heavy Training

Examination of Bowerman's "hard-easy" program reveals two consecutive days (Sunday and Monday) of hard training. Bowerman acknowledged individual variability in the response to training by stating that "some runners will benefit from the two heavy

[96] Ibid., 26.
[97] Ibid., 28. The inconsistency in what Bowerman purports to occur in training progressions to what actually happened in terms of sets and repetitions is likely to be due to a lack of consensus in the use of precise terminology, where volume was substituted for intensity.
[98] Ibid., 29.

days back to back whilst others will need to make Sunday a light or rest day."[99] Later, Bowerman extended his seven-day program to fourteen days to accommodate the school calendar and to prepare for competition. His fourteen-day pattern once again alternated days of heavy and light training but also included two consecutive light days at the end of the second week prior to competition or a test effort. This pattern was justified by Bowerman's "strong belief that runners will compete best if their major efforts are two weeks apart."[100] Finally, Bowerman's twenty-one day schedule used a combination of two ten-day patterns with a day's rest interjected where necessary. Most training in the lead-up to a track meet began with this particular training schedule.

In 1984 Chris Walsh, author of *The Bowerman System*, condensed Bowerman's training philosophy into a number of key principles.[101] The first principle was *Regularity*. Bowerman observed that one of the main differences between runners in the 1930s and the 1970s was an increased regularity of training that facilitated adequate rest, proper diet, better equipment, and an extended timeframe for athlete maturation. Bowerman felt that training schedules should be completed at least two weeks, if not three months, in advance. "Much of the success of many of the teams that I've coached was based on the use of written plans and the keeping of precise records."[102]

Another key principle was *Moderation* and the use of regulated training loads. Bowerman, like Payton Jordan before him, rejected a heavy volume of training in favor of quality interval sessions. For the middle distance runner, he advocated a slow run of no

[99] Ibid.
[100] Ibid.
[101] Walsh, *The Bowerman System*, 35-38.
[102] Ibid., 35.

more than ten miles, once per week. “One hundred miles a week is ridiculous and will only give the guy sore legs.”[103] Using the training schedule of British runner Sebastian Coe when he set the world-record in the 800 meters (1:42.33) in 1979 as an example, Bowerman stressed that the most weekly mileage Coe totaled in 1979 was fifty-three miles with his longest run being around eleven miles.[104]

Rest was a critical ingredient in the “Bowerman System,” as important as the workout itself, especially for maturing runners. If an athlete turned up for practice dull-eyed and complained of sore-legs and fatigue the day after an easy session or if they went to bed late the night before, Bowerman sensibly reduced the workload. “There’s no reason for two people to be fools. If the athlete doesn’t have the sense to go to bed early, there’s no reason for a coach to risk injury or illness by overworking the athlete.”[105] Another key principle at the heart of the “Bowerman System,” was the rotation of hard and easy training which has been previously covered.

Analysis of the “Bowerman System” reveals a sound understanding of the effects of stress on the body. By alternating hard and easy days Bowerman facilitated the recovery process which resulted in enhanced work output the following day. This helped ensure his runners made steady and consistent progress year after year, instead of progressing rapidly one year, only to stagnate or regress over the next several years.[106]

Bowerman derived his system from a synthesis of previously used methods and systems (Woldemar Gerschler, Franz Stampfl and Arthur Lydiard) and old-fashioned trial

[103] Ibid., 36.
[104] Ibid.
[105] Ibid., 37.
[106] Ibid., 32.

and error. He used interval progressions that bore marked similarities to the programs proposed by Franz Stampfl in the 1950s. This brought Bowerman considerable success including the production of almost twenty sub-four minute milers.[107] However, at the Olympic level, Bowerman experienced limited success with only one gold medalist, Otis Davis in the 400 meters, and one bronze medalist, Bill Dellinger in the 1,500 meters. It is feasible that while Bowerman's system was highly successful, it lacked the innovation of the likes of Lydiard, Cerutty, Stampfl and Gerschler, which would separate his athletes and allow them to dominate in the middle-and long-distance events at the Olympic level.

[107] Freeman, "Distance Training Methods, Past and Present: The Evolution of Distance Training and Racing, 1880-1975."

JAMES "DOC" COUNSILMAN: THE FATHER OF SWIMMING

Figure 36. James "Doc" Counsilman.[108]

> To learn about the world around him a scientist must ask, observe, suppose, experiment and analyze…the coach must ask himself, 'Am I a scientist? Am I asking questions of other coaches, the athletes and other experts?[109]

Although James Counsilman was not a track coach, he was heavily influenced by the innovations in track and field training that evolved in the 1950s and his detailed,

[108] Image located: http://www.indiana.edu/~hplab/ccs_photogal.html (accessed November 12, 2007).
[109] Counsilman, *Science of Swimming*, viii. The first part of quotation was used by Counsilman and taken from the inscription located at the science building at Seattle's 1962 World Fair.

scientific approach to swimming had a reciprocal effect on the training of track and field athletes. Tom Tellez, the legendary track and field coach to Carl Lewis (who in 1999 was voted the athlete of the century by the International Amateur Athletic Federation) and Vern Gambetta, former editor of *Track Technique*, both acknowledged the significant impact Counsilman had on their own, as well as numerous track and field coaches' development.[110] Other coaches, such as DeLoss Dodds, former head track and field coach at Kansas State University, also incorporated Counsilman's work in his treatise on the "*Physiological and Practical Bases for the Planning of Middle Distance Training at Kansas State*."[111] Furthermore, in 2003, in an effort to honor coaches who use science and technology to enhance performance, the United States Olympic Committee instituted the "Doc" Counsilman Science Coaching Award. In 2004, Dr. Joe Vigil the renowned former track and field coach of Adams State College and coach to Deena Kastor, the

[110] In an interview conducted by the author on 24 August 2006 at the University of Houston, legendary track and field coach Tom Tellez was asked: What were your greatest resources in terms of applying biomechanics from the books to the athlete? He replied, "I learned a lot from the swimming coach at Indiana [Counsilman]…I read a lot of his stuff," thereby demonstrating the cross pollination in training knowledge that occurred between swimming and track and field. Coach Tellez was the coach to Carl Lewis, who in his career, won nine Olympic gold medals and one silver medal and in 1999 was voted the athlete of the century by the IAAF (International Amateur Athletic Federation). Furthermore, in a personal email Vern Gambetta (former editor of *Track Technique*) expressed how in his personal opinion Counsilman had an enormous effect on the training of track and field athletes. More than just interval training, Gambetta contended that Counsilman made significant contributions in the areas of power development, training monitoring, sports psychology and skill acquisition. Moreover, to illustrate the far-reaching effect of Counsilman's work, in 1989 Counsilman was quoted in the book by Làszlò Nàdori and Istvan Granek, *Theoretical and Methodological Basis of Training with Special Considerations within a Microcycle* (Lincoln, Nebr.: National Strength and Conditioning Association, 1989). The text was translated from the Hungarian book, *Edestervezes*, that was published in 1986. In the bibliography, Counsilman's *Science of Swimming* is the only English text (out of the seven references) that was quoted.

[111] DeLoss Dodds, "Physiological and Practical Bases for Planning Middle Distance Training at Kansas State," *Track and Field Quarterly Review* 72, no. 3 (1972): 143-151.

2004 Olympic bronze medalist in the marathon was endowed with the award.[112] Counsilman's inclusion in this chapter is therefore warranted on the basis that it demonstrates the cross pollination of ideas between sports as well as highlighting the level of training sophistication possible and the application of science to sport. Counsilman was unique in combining experience as an exercise scientist (at the doctoral level) with the practical knowledge of a "hands on" collegiate-level swimming coach. For Counsilman, swimming was an arena in which science and performance merged and where "each practice session can be a course of scientific discovery."[113]

James E. Counsilman was born 27 December 1920 in Birmingham, Alabama. He attended Ohio State University where he set world records in the fifty meter and 300-yard breaststroke events early in his collegiate career. His college career was interrupted by WWII when in 1943, two weeks before the AAU meet, Counsilman was called to serve in the Army Air Corps.[114] After the war Counsilman earned a Masters degree at the University of Illinois where he also assisted coaching the swim team. In 1951, he attended the University of Iowa to earn a doctoral degree, studying the application of force in two types of swimming crawl stroke.[115]

In 1957, "Doc" (short for Doctor of Philosophy) Counsilman moved to Indiana University where he was appointed assistant swimming coach, only to be promoted to

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[112] "2004 Coach of the Year: "Doc" Counsilman Science in Coaching," *Olympic Coach* 17, no. 2 (Summer 2005): 7.
[113] James E. Counsilman, "Coaches Can Be Their Own Scientists," *American Coach* (November 12, 1987): 4.
[114] "Doc Counsilman: Making Waves," University of Indiana, http://www.indiana.edu/~radiotv/wtiu/doc/docbio.html (accessed May 23, 2007).
[115] Counsilman, *Science of Swimming*, 231.

head coach a year later. During his tenure at Indiana he took the "Hoosiers" to twenty consecutive Big Ten wins, six consecutive NCAA wins, and twelve national AAU titles. He capped an illustrious career as head swimming coach of the two most successful Olympic men's swimming teams at the 1964 Tokyo and 1976 Montreal Olympics. In 1976, the USA men's swimming team won twelve of a possible thirteen gold medals contributing to over two-thirds of the total US medal tally.[116]

By far Counsilman's most celebrated pupil was Mark Spitz, who in 1968, after a disappointing individual Olympics (where he won two gold medals in the relays) entered Indiana University to train under the guidance of Counsilman. At the 1972 Olympics in Munich, Spitz won seven Olympic gold swimming medals, a feat still unequalled by any other athlete in a single Olympiad. Furthermore, Spitz set a new world-record in each of the seven events (the 100-meter freestyle, 200-meter freestyle, 100-meter butterfly, 200-meter butterfly, 4 x 100-meter freestyle, 4 x 200-meter freestyle and the 4 x 100-meter medley).[117]

In 1968 Counsilman published his seminal work, *The Science of Swimming*.[118] A meticulous text, composed of 466 pages (published in twenty languages) that included chapters on general and specific stroke biomechanics; principles of training; training techniques (including an eight-page appraisal of track techniques applicable to swimming); teaching and learning of swimming skills; organization of practice; and the training schedules of champion swimmers such as Dawn Fraser—the Olympic champion

116 "Doc Counsilman: Making Waves."
117 "Mark Spitz."
118 Counsilman, *Science of Swimming*.

in the 1956, 1960 and 1964 100 meters, and Don Schollander—winner of four gold medals at the 1964 Olympic Games.[119]

For Counsilman, conditioning represented "the sum total of all the physiological, anatomical and psychological adaptations made by an organism to the stress of the training program."[120] Using track techniques popularized during the 1950s, Counsilman was responsible for the introduction of interval training to swimming which he felt was one of the most important single factors responsible for the continued improvement of competitive swimming times during his era.[121]

Chapter Nine of *The Science of Swimming* was specifically devoted to **"**Planning a Season's Swimming Training Program." Before commencing training, Counsilman advised considering three key factors necessary to maximize performance. They were maximum adaptation to stress, progression, and motivation.

Counsilman was heavily influenced by the work of Hans Selye, the famous Austrian physician and endocrinologist who was responsible for the introduction of the theory of stress in the mid 1950s.[122] For Counsilman, maximum adaptation to stress referred to the maximum levels of adaptation achieved through optimal levels of training stress. If a swimmer trained too little, they would fail to reach maximal levels of conditioning. Conversely, if they trained too much, the swimmer would fail to continue to adapt and further training would cause more harm than good. In an effort to monitor optimal levels of stress and adaptation Counsilman employed a multitude of objective

[119] Ibid., 378-394.
[120] Ibid., 200.
[121] Walton, *Beyond Winning*, 80.
[122] Selye, *The Stress of Life*.

physiological markers such as pulse rate, electrocardiogram, hemoglobin levels, urine analysis and blood pressure. After carefully monitoring the training response of thousands of athletes, Counsilman came to a conclusion that disagreed with the general belief at the time—that swimmers should be fully recovered prior to recommencing training. Counsilman believed, to the contrary, that athletes should at times "experience a feeling of general fatigue for several days."[123]

Counsilman opposed predetermined workloads, in favor of a more general pattern of training. A typical week (when an athlete was not preparing to peak), included three hard back-to-back workouts from Monday to Wednesday. Thursday and Friday's workouts were adjusted dependant upon how the swimmers performed in the two previous days' workouts and Saturday's workout was usually easier, with decreased level of intensity but maintained volume (total distance swam). Sunday was reserved for rest or some easy distance swimming to aid recovery.[124] To avoid the pitfalls of overtraining, Counsilman reduced workload whenever the whole team showed signs of underperformance.

Counsilman's "Indiana System" was based on a steady progression of workload until the end of the season when a tapering period was employed. The increased workload was manipulated in the following ways: 1) An increase in the total distance swum in each workout; 2) an increase in the intensity of the distance swum; or 3) an increase in the total number of workouts per week. Early season training involved a greater relative amount of

[123] Counsilman, *Science of Swimming*, 235.
[124] Ibid., 238.

endurance work, but as the season progressed, more speed work in the form of repetition training, sprinting and dry land simulation was introduced. In addition to the physical demands of training, Counsilman acknowledged that motivation was a key variable in performance and with all factors being equal, a coach who was a good psychologist would have a distinct advantage.[125]

The training schedule was designed to achieve two peaks (double-peak) in performance, one in March and April at the end of the indoor season and one in July and August at the culmination of the outdoor season. The swimming season was divided into four phases: pre-season training, the preparatory phase, the hard training phase, and the tapering phase. Pre-season training was a precursor to more vigorous training and included cross training in the form of running, cycling, participation in team sports, mild swimming, and education in various aspects of swimming, such as diet and correct swimming technique. The preparatory phase began in October or November and extended through November or December. During the preparatory period most of the swimmer's workouts consisted of over-distance training, *fartlek* training, and interval training. Very little repetition training, sprinting or simulators were used.[126]

The hard training phase lasted eight to twelve weeks. This included a period from December through February for the indoor season and from June to the early part of August for the outdoor season. It was during this phase that the hardest training took place

[125] Ibid., 240.
[126] Ibid., 253.

both in volume (distance) and intensity. Detailed sample workouts were included for a typical week's workout in the preparatory, hard training, and tapering phases.[127]

The final phase was the tapering phase. This was a crucial phase as "the success of an entire season can depend largely upon this relatively short phase of the season."[128] It consisted of a smooth transition from the previous phase and lasted two to four weeks. The general purposes of the tapering period were 1) to permit the swimmer to be completely rested for the big meets, 2) to sharpen up on stroke mechanics, starts and turns, 3) to work on pace and speed, 4) to do enough training so as not to lose any conditioning gained in the previous phase, and 5) to prepare the swimmers psychologically for the big competition. To achieve these goals Counsilman advocated 1) reducing the total distance swum from the previous phase and to do fewer repeat swims, 2) decreasing the relative amount of kicking and pulling training, where the arm and legs were trained separately, and 3) increasing the interval of rest between the repeat swims and to increase the speed of the repeats. To validate the inclusion of specific training practices, Counsilman utilized laboratory research that demonstrated a finely trained endurance athlete showed signs of detraining in as few as four to six days.[129]

To counter the effects of detraining, Counsilman advocated what he called a *variable taper* that consisted of combining three different types of workouts performed on

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[127] Ibid., 257.
[128] Ibid., 264.
[129] For a time course of the effects of detraining on endurance related exercise see: E. Coyle et al, "Time Course of Loss of Adaptations after Stopping Prolonged Intensive Endurance Training," *Journal of Applied Physiology* 57 (1984): 1857-1864; C. Petibois and G. Deleris, "Effects of Short- and Long-Term Detraining on the Metabolic Response to Endurance Exercise.," *International Journal of Sports Medicine* 24, no. 5 (July 2003): 320-325.

alternating days. These were classified as hard, moderate and easy days. They could be used in a variety of combinations, for example two easy or two moderate days could be used in succession depending on how the athlete felt. The hard days were designed to maintain the conditioning level of the swimmer, the easy days allowed them to rest and the moderate days provided a combination of both. Finally, if there was a lapse of two weeks between swimming meets; Counsilman advocated returning to the hard-training regimen for a period of three to four days prior to tapering off.[130]

In conclusion, Counsilman offers by far the most sophisticated and scientific approach to training up to this point. As an exercise scientist he realized that at the very heart of the training response was the question of what levels of stress are required to achieve optimal gains in adaptation and performance. To this end he kept detailed physiological data and training logs that could be used to monitor progress, analyze trends and adjust workouts. Although Counsilman was a strong advocate of a scientific approach to swimming he still reached the conclusion that "there was no specific, easily administered and evaluated predictor of when the point of optimal stress had been reached."[131] Despite this limitation, Counsilman has been acknowledged by many

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[130] Counsilman, *Science of Swimming*, 275. Dan Pfaff, who was track coach to Donovan Bailey, the 1996 Olympic gold medalist in the 100 meters and former 100 meter world-record holder uses a similar competition rollover cycle for sprinters that varies slightly, depending on the distance of the athlete's event. It involves alternating different types of workouts, including acceleration, speed development (forty to seventy meters) and special speed endurance runs (90 to 250 meters), with different combinations of rest days. Information taken from author's personal monthly workout schedules, distributed by Coach Dan Pfaff at the University of Texas at Austin (2000-2003).

[131] Ibid., 235.

authorities for his outstanding contributions to swimming and human performance, earning him the ultimate accolade—the "Father" of swimming.[132]

EMIL ZÁTOPEK: THE CZECH LOCOMOTIVE

> The athlete of today is not an athlete alone. He's the centre of a team—doctors, scientists, coaches, agents and so on. My running was very simple; it was out of myself. Perhaps sometimes I was like a mad dog. It didn't matter about style or what it looked like to others; there were records to break.[133]

While the accolades heaped on Roger Bannister's breaking of the four-minute mile barrier certainly put him in the spotlight, there were a number of other athletes during this time frame who also pushed the barriers of human will and endurance to achieve extraordinary levels of human accomplishment. For example, Emil Zátopek, the Czechoslovakian army officer who began the trend towards "heavy" training loads would claim all three long distance titles (5,000 and 10,000 meters and the marathon) at the 1952 Helsinki Olympic Games.

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[132] Cecil Colwin, "A Giant Has Fallen: Doc Counsilman," Swimming World Magazine, http://www.swimmingworldmagazine.com/lane9/news/6469.asp (accessed October 10, 2007).
[133] "Motivational Quotes," Oxford University Athletic Club, http://users.ox.ac.uk/~ouac/training/quotes.shtml (accessed July 28, 2006).

Figure 37. Emil Zátopek.[134]

Emil Zátopek was born on 19 September 1922 in Koprivnice, Czechoslovakia.[135] He began his illustrious Olympic career by winning the 10,000 meters at the 1948 London Olympic Games. Although Zátopek had never ran a marathon before, he achieved legendary status by winning the 5,000, the 10,000 and the marathon at the 1952 Olympic Games in Helsinki—a feat never before (or since) accomplished.[136]

In general, Zátopek trained on a daily basis throughout the entire year. He trained alone, without a coach or weight training program and never used a stopwatch.[137] In this his approach to training was much like that of the runners during the inter-war years. When he was stationed (as a Czechoslovakian Army Officer) in the country, he would run in the forest performing his own particular type of grueling interval or *fartlek* training. If based in a town or city, he took advantage of the location by training at a local running track. In the inaugural edition of Fred Wilt's *How They Train*, Zátopek described

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[134] Image located at: http://www.olympic.org/uk/athletes/profiles/bio_uk.asp?PAR_I_ID=4731 (accessed October 19, 207).
[135] Wilt, *How They Train: Half Mile to Six Mile*, 87.
[136] "Emil Zátopek the Hero of Helsinki," International Olympic Committee, http://www.olympic.org/uk/athletes/profiles/bio_uk.asp?PAR_I_ID=4731 (accessed February 23, 2007).
[137] Wilt, *How They Train: Half Mile to Six Mile*, 87.

the training schedule he used prior to the 1952 Olympics. It consisted of a single daily workout composed of twenty runs at 200 meters; forty repetitions at 400 meters, finishing with twenty repetitions of 200 meters. Each fast interval was followed by 200 meters of jogging. The time taken for the 400 meter intervals was between seventy-five and ninety seconds.[138] Zátopek's philosophy was to work as hard as possible in training so that come race time, he could comfortably lead and dominate races from the front. Wilt noted in *Track Technique*, "Before Zátopek, nobody realized it was humanly possible to train this hard. Emil is truly the originator of modern intensive training."[139]

It is clear from the preceding training schedule that Zátopek transcended the prior light to moderate levels of conditioning that characterized training for track and field prior to World War Two. This allowed him to dominate and be victorious in an unprecedented three Olympic, long distance events. Consequently, Zátopek's grueling year-round training program can be classified as a "heavy" level of conditioning and athletes who competed against him would have to match his work output or find alternate ways of training to equal or achieve better results.

In a postscript to Zátopek's running career, in 1968 as a lieutenant-colonel in the Czechoslovakian army, Zátopek signed the *2,000 Words Manifesto* to support the establishment of freedom in Czechoslovakia. In the same year, in response to the growing unrest, Soviet tanks moved into Czechoslovakia and crushed the call for

[138] Ibid.
[139] Ibid.

democratization.[140] For his support, Zátopek was expelled from the army and Communist Party and assigned to various manual labor occupations including working at a uranium mine. Seven years later, the Ministry of Sport took advantage of Zátopek's proficiency in languages by hiring him as a "sports spy" responsible for translating sports periodicals to glean cutting edge information from coaches around the world. Zátopek died in Prague on 22 November 2000 at the age of seventy-eight after a long illness.[141]

[140] "The Soviet Invasion of Czechoslovakia: August 1968," University of Michigan, http://www.lib.umich.edu/spec-coll/czech/pg1.html (accessed September 26, 2007). The two thousand word manifesto was a document written by dissident writer, Ludvik Vaculik. In the "Two Thousand Words," Vaculík asked that the public "demand the resignation of people who have misused their power" by criticism, demonstrations, and strikes. The document was signed by numerous famous Czechoslovakian writers, intellectuals and scholars. It came to be known as a symbol of the Prague Spring movement—the period of political liberalization in Czechoslovakia during the era of its Soviet domination after World War II.

[141] Wallechinsky, *The Complete Book of the Olympics*, 77; "Emil Zátopek," runningpast.com, http://www.runningpast.com/emil_zatopek.htm (accessed October 19, 2007).

PETER SNELL O.B.E., D.C.N.Z.M.[142]

Figure 38. Peter Snell.[143]

> I knew that if the intial foundation work was thorough, the final result must come logically.[144]

The best evidence of the success of Arthur Lydiard's methods can be found in the training and track successes of Peter Snell, the phenomenal middle distance runner from New Zealand. Snell was born on 17 December 1938 in Opunake, New Zealand.[145] As

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[142] O.B.E. refers to the Order of the British Empire and D.C.N.Z.M refers to Distinguished Companions of the New Zealand Order of Merit which was awarded to Snell for services to sport in the New Year Honours list of 2002**.**

[143] Image located at: http://www.petersnellinstitute.org.nz/ (accessed January 2, 2008).

[144] Snell and Gilmour, *No Bugles No Drums*, 170. Snell was referring to the completion of Arthur Lydiard's system prior to the 1964 Tokyo Olympics when he went on to win both the 800 and 1,500 meter titles.

[145] Ibid., 3.

Arthur Lydiard's greatest protégé, he is best known for winning three Olympic gold medals—one in the 1960 Rome 800 meters and two in the 1964 Tokyo Olympics for the 800 and 1,500 meters. He twice broke the world record for the mile in 1962 and 1964 with times of 3:54.4 and 3:54.1 respectively and in 1962 while running an 880-yard race broke the world record for the 800 meters.[146] In 1970, Cordner Nelson, founder and former editor of *Track and Field News*, honored Snell as one of the thirteen greatest track champions in the history of track and field.[147]

In his formative years Snell excelled in a number of sports, particularly tennis, where he reached the quarterfinals of the national under-seventeen tournament. However, at the age of eighteen, he ran the 800 meters in 1:54.1 and with the assistance of Arthur Lydiard focused his attention on running.[148] At first Snell struggled with the long distance running advocated by Lydiard. In a passage from Snell's autobiographical *No Bugles and Drums* Snell described one particular long distance workout that tested the limits of his mental and physical endurance. "I remember getting into Hendon Avenue, very close and yet so far from home. My legs were too sore to even walk and I draped myself over a fence and told myself I was going to make it at all costs…I wasn't going to let anyone down, least of all myself."[149] Eventually, however, he cut his time for a twenty-two mile course from three hours to two hours and forty minutes. A stress fracture hindered his preparations for the 1960 Rome Olympics, but just prior to the Olympics he had

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[146] Wallechinsky, *The Complete Book of the Olympics*, 36-37; Lawson, *World Record Breakers in Track and Field Athletics*, 64.
[147] Cordner Nelson, *Track and Field: The Great Ones* (London: Pelham Books, 1970).
[148] Nelson, *Track's Greatest Champions*, 152-153.
[149] "Arthur Lydiard: Running Man."

recovered enough in practice for Lydiard to declare, "This is going to be a test of stamina and you are probably the only athlete sufficiently prepared to stand four races in three days."[150] Almost true to Lydiard's words, Snell beat the reigning world record holder, winning the 800 meters in a time of 1:46.3—a new Olympic record. Snell's accomplishment was made even more remarkable by the fact that prior to the Olympics his best effort for the 880 yards was 1:49.2.[151]

Snell continued to progress and in November of 1961 ran Lydiard's twenty-two mile course in a time of 2:11 and completed a full marathon in 2:41. In 1962 Snell established world-record times in four events, including the mile in a time of 3:54.4, one-tenth of a second faster than Herb Elliott's previous best.[152] Snell by his standards ran poorly during the 1962-1963 season. However, by March 1964 Snell had settled down to serious training in preparation for the Tokyo Olympics. He began running twice daily—half an hour in the morning and half an hour at night aiming to reach the critical 100 miles per week as quickly as possible.[153] Snell had never before completed Lydiard's 100-mile schedule longer than a period of three weeks but now he was able to endure a full ten weeks. During the ten week period, Snell logged 1,012 miles—the greatest distance he had ever accomplished. Every Sunday he made sure that he covered the twenty-two mile "Waiatura" circuit. "That was the part of the training I couldn't afford to

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[150] Nelson, *Track's Greatest Champions*, 153.
[151] Wallechinsky, *The Complete Book of the Olympics*, 36. 880 yards is the equivalent of 804.67 meters where 1 yard = 91.44 centimeters. For details of metric to imperial conversions see *The Oxford Minidictionary*, 2nd ed. (Oxford: Clarendon Press, 1988).
[152] Lawson, *World Record Breakers in Track and Field Athletics*, 85.
[153] Snell and Gilmour, *No Bugles No Drums*, 168.

miss," Snell declared.[154] Next came the six weeks of hill training followed by track training and speed work which began sensationally when he completed twenty quarters in an average of 62.5 seconds. For the first time in his career, he had completed Lydiard's program the way it had been designed.[155] "I knew that if the initial foundation work was thorough, the final result must come logically."[156] True to his words, Snell's hard work paid dividends and at the 1964 Tokyo Olympics Snell won the 800 meters in 1:45.1 and the 1,500 meters in 3:38.1. He remains the only middle distance runner ever to win three Olympic gold medals.[157]

After running, Snell worked for a tobacco company before moving to the United States where in 1974 he enrolled at the University of California at Davis, earning a Bachelor of Science in Human Performance. He proceeded to complete masters and doctoral degrees at Washington State University in exercise physiology. After earning his doctorate, Dr. Snell was awarded a postdoctoral fellowship at the University of Texas Southwestern Medical Center, where as of 2008, he was employed as an Associate Professor and Director of the Human Performance Laboratory. Snell remained active by competing in orienteering events becoming a US champion for his age group.[158]

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[154] Ibid., 169.

[155] Nelson, *Track's Greatest Champions*, 161.

[156] Snell and Gilmour, *No Bugles No Drums*, 170-172. Snell was referring to the completion of Arthur Lydiard's system prior to the 1964 Tokyo Olympics when he went on to win both the 800 and 1,500 meter titles.

[157] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 46.

[158] Robert J. Corrigan, *Tracking Heroes: 13 Track & Field Champions* (Bloomington, Ind.: Author's Choice Press, 2003), 91-93. "Peter Snell," Peter Snell Institute of Sport, http://www.petersnellinstitute.org.nz/about-us/peter-snell (accessed January 12, 2008).

JIM RYUN: AMERICA'S BEST MILER

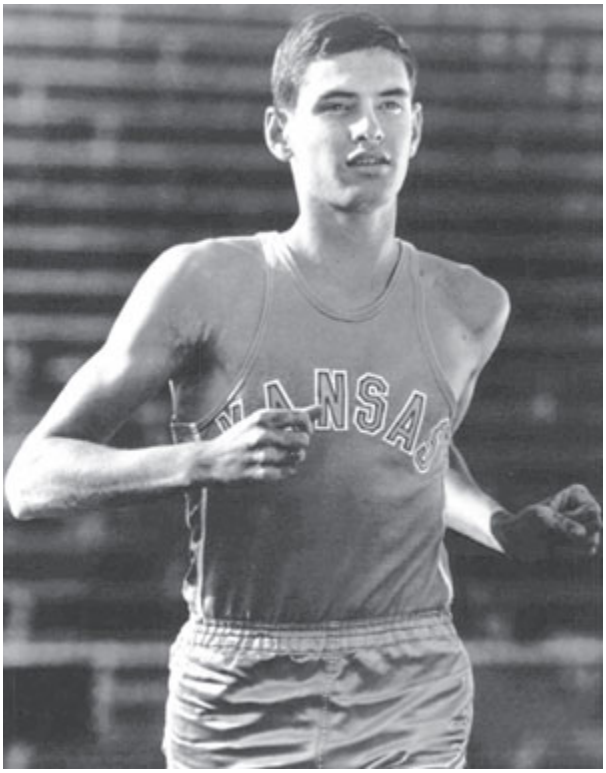

Figure 39. Jim Ryun (Associated Press).

Motivation is what gets you started. Habit is what keeps you going.[159]

James Ronald Ryun was born 29 April 1947, in Wichita, Kansas.[160] In the fall of 1962 Ryun attended Wichita East High School. There he tried baseball with limited success, was too frail for football, and too awkward for basketball. He, therefore,

[159] "Jim Ryun: Quote of the Day," The Final Sprint, http://www.thefinalsprint.com/tag/jim-ryun/ (accessed November 17, 2007).
[160] Cordner Nelson, *The Jim Ryun Story* (Los Altos, Calif.: Tafnews Press, 1967), 11.

gravitated towards running where he came under the guidance of cross-country and track coach, Bob Timmons. At his first attempt at the mile in the fall of 1962 Ryan finished fourteenth in a time of 5:38.[161] That fall he also participated in cross-country which would become a critical component of his future preparation for the mile. Although Ryun admitted that he was "never a front-runner" in the longer races, he acknowledged its benefits, "knowing the over-distance background was essential for my continued improvement."[162] Training consisted of running anywhere from ten to fifteen miles a day, usually with some form of interval training.

The distances ran and the intensity of Ryun's training steadily increased and he made rapid progress. On 6 June 1963, when he was just sixteen, Ryun decreased his mile time to 4:07.8. Realizing that the first ever high school sub four-minute mile was in sight, Timmons stepped up the intensity of Ryun's training in the fall of 1963. "So we worked nearly every day, most weeks containing at least one long run of fifteen to twenty miles as well as frequent interval work," Ryun commented. He further added, "By midwinter Coach Timmons had increased my mileage to 110 miles a week—sixteen miles a day."[163] As the spring 1964 outdoor season of Ryun's junior year approached, Ryun's afternoon workouts took on more the form of intervals—often in the shape of 440-yard repeats. Ryun recalled one early-season workout of forty repetitions of 440 yards, each one averaging sixty-nine seconds, with about ninety seconds rest between each run. "It was a killer! and so monotonous. The goal was everything. The magic

[161] Ibid., 7-8.
[162] Ryun and Philips, *In Quest of Gold*, 53.
[163] Ibid., 20.

number was permanently imprinted in my brain—4:00."[164] Cordner Nelson, inaugural editor of *Track and Field News*, noted how Ryun's training at the start of the 1964 outdoor season would have put some of the great milers of the past into the hospital. He elaborated on the grueling workout of forty repetitions of 440 yards that Ryun had briefly discussed above. After running three miles in the morning, Ryun began his afternoon workout with a series of ten repetitions of 440 yards, each one averaging seventy-one seconds. Each 440-yard interval during the workout lasted a total of three minutes, including rest. Between each set of ten repetitions of 440 yards there followed a period of active recovery that entailed lifting weights ranging from thirty-three pounds to seventy pounds. The second and third set of ten repetitions of 440 yards were performed in sixty-nine seconds while the final set of ten repetitions of 440 was run at a sixty-seven second pace. When combined, the sum total of forty repetitions of 440 yards in one workout equaled ten miles.[165]

The intense training and sacrifice paid dividends and after a stellar 4:01.7 at the California Relays in Modesto, Ryun became the first American high school athlete to run a sub-four minute mile in a time of 3:59.0 when he broke the barrier at Compton, California on 5 June 1964.[166] Ryun now had a realistic chance of gaining an Olympic place. After finishing third at the 1964 US Olympic Trials in the 1,500 meters, he

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[164] Ibid., 22.

[165] Nelson, *The Jim Ryun Story*, 44.

[166] E. Garry Hill, "Chronological Listing of U.S. Milers Who Have Broken 4:00 in the Mile," *Track and Field News*, http://www.trackandfieldnews.com/archive/ussub4s.html (accessed August 16, 2006). At the end of the race eight men had run the mile in under four minutes with Ryun placing eighth.

booked his place on the plane to the Tokyo Olympics. However, a virus hampered his chances of success and he finished a disappointing last in his semi-final heat in Tokyo.[167]

Ryun entered Kansas University in the fall of 1966 following in the tradition of Glenn Cunningham and Wes Santee before him. There, he once again teamed up with Coach Timmons who had left Wichita East High School the year before to be appointed assistant track coach—prior to being promoted to head track coach a year later.[168] Ryun continued his grueling schedule of training, competing in three separate sports—cross country, indoor track and outdoor track. After an arduous spring racing season Ryun prepared for his final summer meet of 1966 at Berkeley, California. In an effort to peak, Ryun tapered his training to light sprinting by the middle of the week and just a warm up by the end of the week. Come race time Ryun felt in "tip-top" shape and with the help of some informal pacing managed to lower the world record in the mile from 3:53.6 to 3:51.3. The world-record was back on American soil after a twenty-nine year hiatus. Glenn Cunningham had lost the record to Sydney Wooderson of the United Kingdom in 1937.[169] At the age of nineteen Ryun became the youngest man to break the world record in the mile and in doing so reaped the rewards "of more than four thousand hours of training" that preceded it.[170] On 23 June 1967, in Bakersfield, California, Ryun lowered his world record even further with a time of 3:51.1.[171]

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[167] Lawson, *World Record Breakers in Track and Field Athletics*, 94.
[168] Ryun and Philips, *In Quest of Gold*, 32.
[169] Nelson, *The Jim Ryun Story*, 236; Lawson, *World Record Breakers in Track and Field Athletics*, 85.
[170] Nelson, *The Jim Ryun Story*, 239.
[171] Quercetani, *Athletics: A History of Modern Track and Field Athletics (1860-2000)*, 422.

After 1967, having been competing for more than five years, Ryun struggled to maintain the inner drive that had propelled him to such outstanding success. He acknowledged, "Running was the only life I had known…but drudgery was gradually setting in. After some 15,000 to 20,000 miles and between 2,500 and 3,000 hours of running, it was no longer fresh and invigorating."[172] The one goal that eluded Ryun was an Olympic gold medal. As he put it, "before my career could be considered 'complete,' there was that one symbol of recognition known the world over that says, 'Among all men *you* are the best!'—the Olympic gold medal."[173]

As 1968 approached Ryun worked harder than ever. He continued to work twice a day but with greater intensity. "Where before I would have rested perhaps every other day, with a light ten-mile run, now I pushed myself to my maximum limit every day. Coming right off a hard previous day's workout and a six-to-eight-mile run that morning, I would crank up for twenty quarters in sixty seconds, or maybe thirty in sixty-five seconds. Every time I suited up I ran hard. Every chance I drove myself to the limit."[174] The training appeared to be working as planned in that during the winter Ryun "felt strong as a horse."[175] However, the very workouts that were designed to make him stronger, ultimately, broke him down. In March of 1968, Ryun pulled a hamstring performing some very fast 110-yard runs. After injury-imposed rest, he still complained of being tired. "I could feel myself dragging during workouts and suddenly the results

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[172] Ryun and Philips, *In Quest of Gold*, 66.
[173] Ibid.
[174] Ibid., 83.
[175] Ibid.

began to fall off badly and the fatigue worsened."[176] In late May, after a series of blood tests Ryun discovered that he had developed mononucleosis, an abnormal increase of mononuclear white blood cells in the blood that causes tiredness, fevers, a sore throat and swollen lymph glands.[177]

Ryun had become the victim of overtraining—an accumulation of training or non-training stress resulting in a long-term decrement in performance capacity. He acknowledged the cause in that he had "worked too hard, without sufficient rest, and my body could not take the stress."[178] The effects of overtraining continued to manifest themselves and although Ryun planned to run the 800 and 1,500 meters at the 1968 Mexico Games, at the US Olympic Trials his awesome finish in the 800 meters deserted him and he only succeeded in qualifying for the 1,500 meters. Perhaps hampered by the effects of altitude, Ryun placed second to Kip Keino of Kenya in the Olympic finals, running a time of 3:37.8—more than four seconds slower than his personal best.[179] Discouraged, but undaunted, he decided to give it one more shot and began training for the 1972 Munich Olympics. Again, however, misfortune prevailed. In the second round of the 1972 Olympic Games 1,500 qualifying heats with about 500 meters to go, Ryun tripped and fell heavily. Though he got up and finished the race, he was unable to make up enough ground to qualify. Realizing that his Olympic hopes were now behind him, Ryun joined the professional International Track Association (ITA) circuit and ran with

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176 Ibid., 84.
177 "Mononucleosis," Healthline, http://healthline.com/adamcontent/mononucleosis?utm_term=mononucleosis&utm_medium=mw&utm_campaign=article (accessed February 23, 2007).
178 Ryun and Philips, *In Quest of Gold*, 85.
179 Wallechinsky, *The Complete Book of the Olympics*, 46-47.

varied success until 1976. With his running career over, Ryun founded Jim Ryun Sports, Inc., a public relations company where he ran sports camps, and worked as a motivational speaker for corporations and Christian groups around the United States. In 1996 Ryun was elected to the US House of Representatives as a republican for the second Congressional District of Kansas, a position he held for ten years.[180] He continues to conduct running camps every summer for high school athletes that have inspired athletes such as Ryan Hall, the US Olympic marathon runner and the next generation of runners to come.[181]

Analysis of Ryun's preparation for the 1968 Olympics reveals the completion of extremely heavy workloads both in terms of the volume and intensity of training with no-or-limited allowance for recovery. Ryun pushed the barriers of human endurance seemingly unaware that there was an upper limit on human performance. In doing so, he paid the ultimate price. From the available information, Ryun appears to have made only limited use of science and its potential to help enhance performance and avoid overtraining. In spite of a lack of an Olympic gold medal Ryun is still regarded as greatest American miler of all time and his 1967 mile record stood for almost a decade.[182]

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[180] "USA Track and Field Hallof Fame: Jim Ryun," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=142 (accessed November 12, 2006); "About Jim Ryun," Ryunrunning.com, http://www.ryunrunning.com/ryun/aboutjim.asp (accessed March 12, 2008).

[181] Ryan Hall, an elite marathon runner paid tribute to Jim Ryun on Jim Ryun's website www.ryunrunning.com. He stated, "The Jim Ryun running camp was one of the greatest running experiences of my life. Who I am as a runner and an individual directly stem from my time at the camp." Ryan Hall won the U.S men's Olympic marathon trials in December 2007 in New York to earn a place in Beijing for the 2008 Olympics. Recently on 13 April 2008 he shaved just over two minutes from his personal best time to place fifth in the London Marathon. Hall's time of 2 hours, 6 minutes, 17 seconds was the third-fastest by an American.

[182] Lawson, *World Record Breakers in Track and Field Athletics*, 85.

TRAINING FOR THE SPRINTS: BOBBY MORROW—WHITE HEAT

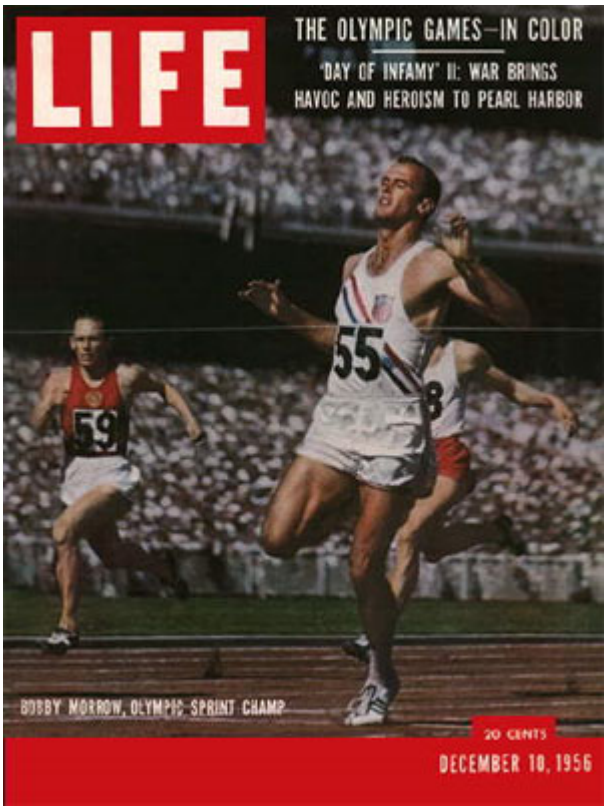

Figure 40. Bobby Morrow on the front cover of the 10 December 1956 issue of *Life* magazine.[183]

> Whatever success I have had is due to being so perfectly relaxed that I can feel my jaw muscles wiggle.[184]

[183] Image located at: http://www.life.com/Life/ (accessed October 23, 2007).

[184] "100 Meters: Morrow Wins Easily in 10.5," *Track and Field News* 9, no. 11 (December 4, 1956). Morrow was commenting on how he had won the 100 meters at the 1956 Melbourne Olympic Games. He realized he could win when he reached the fifty-meter mark. After that point he never had any doubt and finished a good two feet ahead of his rivals in a time of 10.5 seconds.

Although this chapter has primarily focused on the training for the middle (and long) distances, the paradigm for sprint training was also shifting in this era. The dominant sprinter of the 1950s was the elegant Bobby Joe Morrow who attended Abilene Christian College (ACC) in Texas. Morrow born on 15 October 1935 in Harlingen, Texas, first attracted national attention in 1955, when as a 6' 2," 173-pound freshman he won the Amateur Athletic Union (AAU) 100-yard dash in a time of 9.5 seconds.[185] The following year, he started off by claiming both the national collegiate 100-and 200-meters sprint titles, followed by the AAU 100-yard dash title for the second straight year. Later, in November of 1956 at the Melbourne Olympics, Morrow won three gold medals, claiming the 100 and 200 meter double and anchoring the 4 x 100 meter winning relay team. His winning time of 20.6 seconds in the 200 meters was a new world-record that eclipsed Jesse Owens's time of 20.7 seconds set twenty years earlier.[186] For his endeavors Morrow was voted the 1956 *Sports Illustrated* Sportsman of the Year.[187]

The training Morrow undertook to achieve Olympic glory was outlined in the second edition of Wilt's *How They Train*: *Sprinting and Hurdling* published in June of 1973.[188] Morrow trained once a day at 3.00 P.M. in the afternoon for approximately ninety-minutes with Abilene track coach, Oliver Jackson. Jackson taught Morrow the

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185 "USA Track and Field Hall of Fame: Bobby Morrow," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=114 (accessed November 13, 2006). *Track and Field News* 8, no. 6 (July 2 1955): 2.
186 Wallechinsky, *The Complete Book of the Olympics*, 9.
187 "Bobby Morrow," *Sports Illustrated*, http://sportsillustrated.cnn.com/features/1998/sportsman/1956/ (accessed July 28, 2006).
188 Wilt, ed., *How They Train: Sprinting and Hurdling*, 30-32.

value of relaxation—a trademark of Morrow's smooth running style.[189] To ensure he stayed relaxed Morrow practiced waggling his jaw muscles, especially as he came off the turn in the 200-meter run where many athletes tend to tighten up. Another area that Coach Jackson stressed was the use of barefoot running. Indeed, "Most of my work was done barefoot on the grass," Morrow recalled. "In fact I hardly got on the track before the season began and then only to get conditioning for the 200 meters. We always concentrated on relaxation. We trained so our cheeks would bounce up and down when you ran, making sure your arms were relaxed and we worked on that every day of the week."[190] Unlike the milers and marathoners previously discussed, Morrow's workouts were of much shorter duration and he relied more on resistance training. In the fall, Morrow primarily ran cross-country, but wore two-and-one-half pound ankle-weights to build greater strength. Although he did no sprinting, per se, he did run the stadium steps, but again, added extra resistance by strapping on ankle-weights. His stadium steps work outs were relatively brief—lasting only ten to twenty minutes three times weekly during the fall. In January however, having conditioned himself with the fall workouts, Morrow began a new and more intense phase of training.[191] According to Wilt the new routine consisted of the following:

> **Monday:** 3 miles cross-country run on the road. First one and one-half miles at a continuous steady pace. The final one and one-half miles performed by

[189] Duncanson, *The Fastest Men on Earth*, 107.
[190] Ibid.
[191] Wilt, ed., *How They Train: Sprinting and Hurdling*, 30-32.

alternating sprinting 75-150 yards and then jogging 75-150 yards, Then 6-8 x 220 yards were performed in 26-28 seconds.

Tuesday: 3-5 x 110 yards acceleration runs on the grass, reaching three-quarter speed at the end of each. Walk 110 yards after each run. Then 5-10 x 30-50 yard sprint starts from the blocks on grass at half to three-quarter full effort. Then 4 x 220 yards on the curve in 24-26 seconds with a walk recovery of 220 yards after each run.

Wednesday: If the weather was cold Monday's workout was repeated. If the weather was warm 2 x 300 yards in 33-35 seconds were performed with a 5 minute walk recovery after each run. 6-10 x 100 yards were then performed on the grass at three-quarter speed using high knee lift with a 100 yard walk recovery after each run.

Thursday: Repeat Monday's training if the weather was cold. Otherwise 440 in 58, 300 in 34, 220 in 25, and 110 in 11.5 with a jog recovery of 440 yards after each run.

Friday: 2-3 x 100 yards acceleration runs using high knee lift, reaching ⅞ full speed at the finish of each with a 100 yard walk recovery after each run. Then 2 x 300 yards in 31-32 with a walk and 5 minute jog between the runs. Then 15 minutes walking and jogging, followed by 10 x 100 yards fast striding on the grass with a 100 yard walk recovery after each run.

Saturday: 10 x 30-50 yards sprint from the blocks using three-quarter effort on each. Then 4 x 220 yards on the curve with a 220 yard walk recovery after each run.

Sunday: Rest

In addition to the above, at least twice a week Morrow practiced baton exchanges with the sprint relay team at half to three-quarter full sprinting effort for 15-30 minutes.

In March, as the competitive season began, Wilt reports that Morrow's training switched to the following regimen.

Monday: 6-8 x 220 yards in 24-26 with a 220 yard walk recovery after each run.

Tuesday: 20 minutes baton exchanging practice, running 50 yards at ¾ full effort with each exchange. Then 10-12 x 30-40 yards sprint starts from the blocks with a gun. Then 2 x 220 yards on the curve in 22-23 seconds with a 5 minute walk recovery between each run.

Wednesday: 10 minutes baton exchange practice on the grass. Then 3 x 150 yards in 14.5-15 second with a 5 minute walk recovery between each run.

Thursday: 6-10 x 30-40 yards sprint starts from the blocks at ½ to ¾ full effort with a walk recovery back to the starting line after each run. Then 10-12 x 80-100 yards acceleration runs at ½ to ¾ full effort with a 80-100 yard walk recovery after each run.

Friday: rest or 15 minutes alternately walking and striding using high knee lift.

Saturday: Competition

Sunday: Rest

In the late competitive season Morrow rested two days prior to the competition. Directly after each warm-up, Morrow spent 10 minutes running 6-8 x 80-100 yards acceleration runs on the grass, using high knee lift, reaching ¾ to ⅞ full speed at the end of each run and walking briefly for recovery after each run. All workouts were concluded with 10 minutes of easy warm-down jogging.[192]

Overall, analysis of Morrow's training reveals a well–rounded program that included accelerations, over-distance work (running distances longer than the length of the races in competition), structured warm ups and cool downs, and the inclusion of rest prior to competitions. The density (number of training sessions) and volume of work approximates today's training levels especially with regards to the adoption of a six-day program. However, two areas are of particular note. The first is the inclusion of cross-country running. In preparation for the competitive season Morrow ran cross-country in the fall and winter training periods. American Bob "Bullet" Hayes, winner of the 1964

[192] Ibid.

Tokyo Olympic 100 meters also participated in cross country running, with some runs as long as ten miles.[193] The use of cross-country running for sprinters has, as of 2008, been almost entirely discontinued. Instead, athletes prepare in the off-season with runs of much shorter distances. The principle of training specificity, which states that the body will adapt in specific ways to specific types of exercise has caused most modern trainers to forgo any sort of distance work.[194] Leroy Burrell, Head Track and Field Coach at the University of Houston and a former world record holder in the 100 meters, echoed these sentiments in an interview conducted by the author in August of 2006. He noted that when he was training in the early-to-mid 1990s the longest distance run at the commencement of training was 800 meters. However, by 2006, perceptions had changed and the sprinters he coached felt that even running a distance as short as 300 meters was too long.[195] Also of note is the relative lack of weight training in Morrow's program. Although he does use ankle weights in his fall training sessions, he did not include any exercises with free weights—no pulls, squats or other multi-joint exercises which are now considered foundational in fall training. Weight training has proven to be particularly beneficial as sprinters work to overcome inertia when accelerating out of the blocks. It now forms an integral part of a sprinter's year-round program—and most sprinters use weights up to six days a week during the fall preparation period.[196]

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[193] Bob Hayes and Robert Park, *Run, Bullet, Run: The Rise, Fall and Recovery of Bob Hayes* (New York: Harper & Row, 1990), 70.

[194] Johnathon K. Ehrman et al., eds., *Clinical Exercise Physiology* (Champaign, Il.: Human Kinetics, 2003), 106-107.

[195] Leroy Burrell, interview by author conducted on 24 August 2006 at the University of Houston.

[196] Author's personal training programs provided by Coach Dan Pfaff while the author was working at the University of Texas as a volunteer assistant track and field coach (2001-2003) and as an assistant track and

In conclusion, athletes in the post WWII era (1945-1975) vastly transcended the moderate training levels prior to WWII (1917-1945). Athletes such as Emil Zátopek, Peter Snell, and Jim Ryun pushed the barriers of human endurance to arrive at new "heavy" workloads characterized by substantial mileages and intense intervals. Ultimately, however, and as Ryun found to his detriment, there were limits to how far the human body could be pushed without exhibiting signs of overtraining. Coaches, researchers and athletes realized that the *quality* of training was a critical component that needed to be balanced with the correct *quantity* of training. Roger Bannister as early as 1954 confirmed this supposition by demonstrating that planned, quality training, performed in as little as half an hour a day, could be as important, if not more so, than the quantity, or volume of training undertaken.

The failure of Jim Ryun's quest for gold highlights the potential role of science in monitoring adaptation, preventing overtraining, and enhancing performance. In May 1968, after a fall-off in performance, blood profile analysis revealed Ryun had developed mononucleosis—a condition that severely affected his preparation and ultimately his success at the 1968 Mexico City Olympic Games. While there are no definitive measures of overtraining it is feasible that more careful monitoring of training could have indicated that Ryun required more rest or at least needed to include more efficient restorative methods.[197]

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field coach to a number of elite track and field athletes in North Carolina, 2003-2004. For full coverage of the evolution of the use of weight training to enhance running and athletic performance see Chapter Six.

[197] While there are no definitive measures of overtraining, a variety of indicators may be used to monitor training stress. These include, body weight, length and quality of sleep, sensation of tiredness, willingness to train, appetite, and muscle soreness. More invasive analysis includes blood and saliva profiling. For full

In contrast, James “Doc” Counsilman at the University of Indiana employed a scientific approach to training by utilizing a variety of objective physiological markers such as pulse rate, electrocardiograms (tests that record the electrical activity of the heart), hemoglobin levels, urine analysis and blood pressure to monitor his athletes. Furthermore, while Ryun pushed himself to his limits everyday, Counsilman adjusted workouts dependant upon how his swimmers performed earlier in their weekly training schedule.

Ultimately, coaches, researchers and athletes realized that both the quality and quantity of training needed to be balanced.[198] They came to realize that there was a limit to the extent that volume could be increased without the risk of diminishing returns and damaging side effects. By 1970 it was clear that the nations of the Eastern Bloc had taken the science of training to new levels of sophistication. And, in an attempt to answer the Soviet challenge, the distance between the lab and the track would rapidly diminish in America.

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coverage of the monitoring and preventing of overtraining and overreaching see: David G. Rowbottom, David Keast, and Alan R. Morton, "Monitoring and Preventing of Overreaching and Overtraining in Endurance Athletes," in *Overtraining in Sport*, ed. Richard B. Kreider, Andrew C. Fry, and Mary L. O'Toole (Champaign, Ill.: Human Kinetics, 1998), 47-68.

[198] Jordan and Spencer, *Champions in the Making: Quality Training for Track and Field*, 2.

CHAPTER SIX

THE EMERGENCE OF SPORT SCIENCE AND ITS ROLE IN TRACK TRAINING: 1945-1975

> Those enamored of practice without science are like a pilot who goes into a ship without a rudder or a compass and never has any certainty where he is going.[1]

In an appraisal of coaching and the application of science to sport, Geoffrey Dyson, author of *The Mechanics of Athletics* and former Chief National Athletic Coach for the United Kingdom, alluded to Leonardo da Vinci's quote (above) when he wrote, "Those who approach physical education without science are sailing a ship without a rudder or compass."[2] Dyson was referring, of course, to the role that science can, and has, played in helping guide and enhance performance. Beginning with the early development of the field of exercise physiology, this chapter explores some of the major discoveries in the field of sport science that created greater understanding in athletes and coaches about the process of adaptation to training in the mid-twentieth century. Particular attention is paid in this chapter to Thomas Cureton's early analysis of the characteristics of champion athletes, and to Hans Selye's theories on stress and

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[1] "Leonardo Da Vinci," *Encarta Book of Quotations*, http://books.google.com/books?id=Af84fBmzmVYC&pg=PA559&lpg=PA559&dq=Those+enamored+of+practice+without+science+are+like+a+pilot+who+goes+into+a+ship+without+a+rudder+or+a+compass+and+never+has+any+certainty+where+he+is&source=web&ots=Fo55KJU8i_&sig=0tkFzcewmhAHhXkgPzROBenjakI&hl=en. (accessed April 15, 2008). The quote was made by Leonardo da Vinci (1452-1519) the Italian artist, scientist, engineer who has been described as an all-round genius whose paintings and inventions changed the world. For further information on Leonardo Da Vinci see: "Leonardo Da Vinci," British Broadcasting Company, http://www.bbc.co.uk/science/leonardo/ (accessed April 12, 2008).

[2] Geoffrey H. Dyson, "The Direction of Coaching," in *Sport Science in Athletics*, ed. Juris Terauds and George D. Dales (Del Mar, Calif.: Academic Publishers, 1978); Dyson, *The Mechanics of Athletics*.

adaptation, first introduced in his seminal book *The Stress of Life in 1956.*[3] The chapter also explores, however, the scientific advances which caused athletes to incorporate a new form of training—resistance exercise—in their regimens based on research conducted by sport scientist Peter Karpovich at Springfield College in Massachusetts, who finally put to rest the idea that weights made one "musclebound." The chapter also contains an overview of exercise physiology in its "formative years" (1963-1976) as the sport science sub-discipline attempted to offer insight into the complexities of the human body by applying its findings to exercise and sport. The practical application of these ideas is explored by an appraisal of training articles published in *Research Quarterly* and *Scholastic Coach* progressing to more sport specific journals such as *Track Technique* and *Track and Field Quarterly Review*. The chapter concludes with coverage of the application of biomechanics to sport and the contributory work of Geoffrey Dyson mentioned above.[4]

EXERCISE PHYSIOLOGY: THE "EMBRYONIC" YEARS (1946-1962)

Physiology—the study of how the cells and organ systems of the body perform their functions—is one of the most fundamental of the medical and biological disciplines.[5] As such, of all the branches of exercise science, exercise physiology perhaps has the greatest potential to help coaches and athletes (particularly in the endurance events) in their quest for improved performance. With its detailed knowledge of bodily

[3] Selye, *The Stress of Life*.
[4] Dyson, *The Mechanics of Athletics*.
[5] Martin, "Physiology: Its Role in Explaining Athletic Performance," 11.

systems (cardiovascular, respiratory, endocrine and musculoskeletal) along with the ability to obtain objective measurements of various physiological phenomena (such as levels of oxygen uptake and lactate production) exercise physiology is ideally positioned to provide strategic information to enhance performance and to validate new and previously un-used methods of training.

The period between 1946 and 1962 is referred to by historians John Massengale and Richard Swanson as the "embryonic years," during which exercise physiology began to establish itself as a separate academic discipline. Exercise physiology evolved into a distinct discipline during this period more because of curriculum requirements in physical education departments than because of specific course offerings by physiology departments.[6] Two key physical education professors who became known for their expertise in exercise physiology were Arthur H. Steinhaus, Ph.D., of George Williams College in Chicago, Illinois, and Peter V. Karpovich, M.D,. from Springfield College in Springfield, Massachusetts.[7] Both were highly respected for their knowledge of physiology and the related cognate sciences and both published numerous research articles in prestigious physiology journals.[8] They were also founding members (along with nine others) of the American College of Sports Medicine (ACSM), an organization

[6] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 399.
[7] Ibid., 400-401.
[8] Steinhaus, "The Chronic Effects of Exercise," 103-147; Peter V. Karpovich, *Physiology of Muscular Activity* (Philadelphia: Saunders, 1956).

that had a significant impact in establishing exercise physiology as an academic discipline in its own right.[9]

In 1948, as a consequence of expansion and specialization in the field of physiology, the American Physiological Society established the *Journal of Applied Physiology*. The journal focused on research related to the responses of humans (and animals) exposed to a variety of stressors and environmental conditions—including exercise.[10] Early articles that had the potential to be applied to track and field training included "Heart Rate Recovery from Severe Exercise," written by H. Herxheimer of the University College, London, and "The Relationship Between Resting Pulse Rate, Blood Pressure and Levels of Physical Fitness," written by H. Cullumbine of the Department of Physiology and Pharmacology in Ceylon.[11] However, unlike modern articles which are frequently written so that coaches and other researchers will be able to apply them, these two early pieces were largely observational in nature and failed to offer any objective data or advice that could be directly applied to the track or playing field.

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[9] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 401. The American College of Sports Medicine was founded in 1954 by eleven people who believed that members of various groups (medicine, physiology and physical education) should exist in a single organization to promote knowledge on subjects related to physical activity, the evaluation of athletic performance, the care and prevention of athletic injuries, the promotion of testing and achievement of physical fitness and various combinations thereof. In 1969 the ACSM established a new professional journal entitled *Medicine and Science in Sports* that focused heavily on exercise physiology related articles. For further information see Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 407; 417-418.

[10] "Foreword," *Journal of Applied Physiology* 1, no. 1 (July 1948): 1.

[11] H. Herxeimer, "Heart Rate in Recovery from Severe Exercise," *Journal of Applied Physiology* 1, no. 4 (October 1948): 279-284; H. Cullumbine, "The Relationship between Resting Pulse Rate, Blood Pressure and Levels of Physical Fitness," *Journal of Applied Physiology* 2, no. 5 (November 1949): 278-282.

Similarly, "Physiological and Performance Changes in Athletic Conditioning," published in 1950 sounds as if it would directly translate to the training of athletes.[12] However, closer examination reveals that instead of providing a blueprint for objective changes that occur as the result of training, this article simply evaluated performance tests that had previously been used as measures of cardiorespiratory and performance endurance. The authors examined a variety of tests including a 300-yard run, shorter runs of seventy-five yards and 150 yards, and a stool stepping test to exhaustion to see which measures were most responsive to training interventions.

It is revealing from the preceding (albeit brief) coverage, that although technically applied in nature, research emanating from physiology and physical education departments just after WWII had limited practical application to the training of runners—or any other athletes for that matter. During World War II, Karpovich and many other physiologists were asked to contribute to the war effort by conducting research on how the human organism responded to fatigue, extreme cold, and other conditions endured by soldiers in combat conditions.[13] However, after the war, many researchers continued to grapple with the basic tenets of physiology (blood pressure, pulse, and heart rate, etc.) as they applied to normal body movements and daily living. Research with direct application to track and field training was virtually non-existent.

However, in 1952, Professor Thomas K. Cureton, a pioneer in the study of physical fitness went some way to addressing the aforementioned deficit by publishing

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[12] F.M. Henry and W. E. Berg, "Physiological and Performance Changes in Athletic Conditioning," *Journal of Applied Physiology* 3, no. 2 (August 1950): 103-111.
[13] Todd and Todd, "Peter V. Karpovich," 213-220.

Physical Fitness of Champion Athletes.[14] It detailed the results of a variety of fitness tests that had been conducted at The Physical Fitness Research Laboratory at the University of Illinois, under his direction. The project was approved by the United States Olympic Committee and sanctioned by its Medical and Nursing Sub-Committee. Seventy-six athletes were tested from three sports—swimming and diving, track and field, and gymnastics.[15]

Figure 41. Thomas K. Cureton.[16]

[14] Thomas Kirk Cureton, *Physical Fitness of Champion Athletes* (Urbana, Ill.: The University of Illinois Press, 1951).
[15] Ibid., 4.
[16] Image located at: www.als.uiuc.edu/history/images/cureton.jpg (accessed April 12, 2007).

The aim of the project was to answer a number of fundamental questions pertaining to the fitness levels and characteristics of "champion" athletes. The key questions included: 1) In what respect do champion athletes differ from men of approximately the same age who are considered normal and healthy, and what significance may be attached to the differences? 2) How do athletes from various types of sports differ in tests of physical fitness? and, 3) What unusual characteristics do winning athletes possess?

The results were presented in three major sections in Cureton's book— physique, motor fitness, and cardiovascular/metabolic studies. The results of the physique studies revealed that typical track athletes were slight in their physical framework with relatively longer lower leg to thigh ratios, had longer legs to trunk length, but were exceedingly well muscled, especially sprinters like William (Bill) Mathis and Claude (Buddy) Young.[17]

Motor fitness analysis, which combined tests of balance, flexibility, agility (speed), strength, power and endurance, revealed that sprinters were relatively stronger and reacted faster than endurance swimmers.[18] Cardiovascular analysis discovered that the combined efficiency of the heart and blood vessels was a dominating factor in all of the endurance events. However, in a throwback to the turn of the twentieth century, Cureton alluded to the finding of enlarged heart sizes in swimmers but assured readers, "There is no evidence that such enlarged hearts deteriorate faster than normal…and the

[17] Cureton, *Physical Fitness of Champion Athletes*, 3.
[18] Ibid., 4.

reported claim that strenuous athletics produces marked pathological variations (in ECG patterns) is discounted."[19]

Cureton's analysis of the fitness of champion athletes was a commendable attempt to gain insight into a much understudied population. However, although extremely revealing in many respects, Cureton failed to correlate the results of his extensive data collection to performance, the key determinant for success of a coach and athlete. Furthermore, as Cureton himself conceded, no information was given on the athlete "at the top capacity of his performance."[20] As such, Cureton's work can be considered preliminary in nature. It did, however, validate a number of physiological and anthropometrical tests, and provided comparative data on athletes from different sports for many years to come. The preliminary nature of physical fitness research at the middle of the twentieth century was reflected in a prominent editorial in the prestigious medical journal, *The Lancet*, that featured doctor T. F. Fox who stated how "the physiologist and psychologist, on whom we must depend for clarification and systematization in this field, have as yet only stalked warily around the edges."[21]

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[19] Ibid.
[20] Ibid., xiv.
[21] T.F. Fox, "Research and Physical Fitness," *The Lancet* 255 (July 10 1948): 64. *The Lancet* is the world's leading independent general medical journal that started publication in 1823.

HANS SELYE AND THE "STRESS" OF LIFE

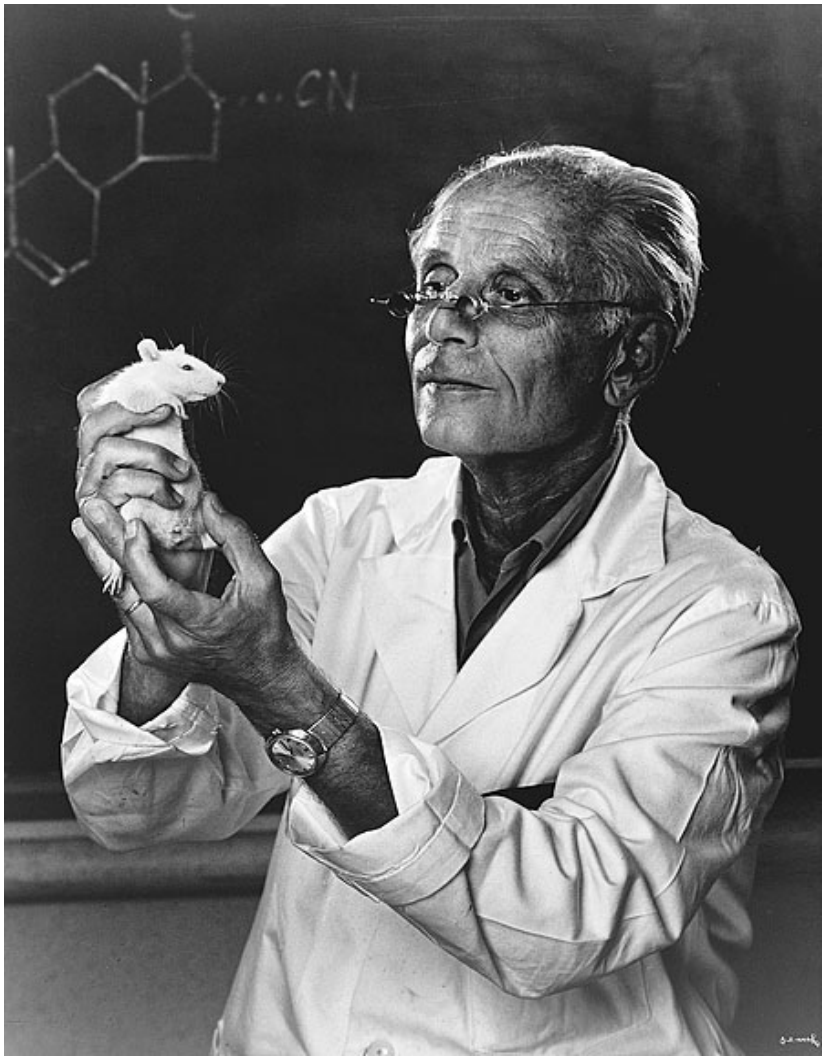

Figure 42. Hans Selye (Photo credit: Yousuf Karsh).

> The significance of this kind of research is not limited to fighting this or that disease. It has a bearing upon all diseases and indeed upon all human activities, because it furnishes knowledge about the essence of the STRESS OF LIFE.[22]

[22] Selye, *The Stress of Life*, 305.

Hans Selye was born in Vienna in 1907 and studied in Prague, Paris, and Rome. He received his medical degree from the German University of Prague in 1929 and two years later his Ph.D. at the same institution. He was then awarded a Rockefeller research fellowship that took him to Johns Hopkins University and later McGill University (Canada), where he became an Associate Professor of Histology. Later, Selye served as a professor and director of the Institute of Experimental Medicine and Surgery at the University of Montreal.[23]

In 1956, Selye published one of the most important books in the history of exercise physiology. *The Stress of Life* aimed to translate in a "generally understandable" language what medicine had learned about stress.[24] In the introduction Selye noted how it was impossible to live without experiencing some degree of stress. Crossing a busy street, exposure to a draft, or even the experience of sheer joy, he explained, could all activate the body's stress mechanisms. However, the same stress that made one person sick could be an invigorating experience to another. In our modern era, think for just a moment about how participating in an event such as the eight to nine hour Iron Man Triathlon would impact different individuals.[25] For Selye, stress was "essentially the rate of all the wear and tear caused by life," and life was seen as a process of adaptation to the

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[23] Ibid., 325.

[24] Ibid., vii. For an appraisal of Selye's pioneering and significant contribution to medicine see "Half a Century of Stress Research: A Tribute to Hans Selye by His Students and Associates," *Cellular and Molecular Life Sciences* 41, no. 5 (May 1985): 559-578; J. Kangilaski, "Hans Selye's Life a Tribute to Basic Research," *Journal of the American Medical Association* 248, no. 23 (December 1982): 3084-3085.

[25] The Iron Man Triathlon that takes place every year in Hawaii consists of a 2.4-mile ocean swim, followed by a 112-mile bike ride, and ending with a 26.2-mile marathon. For further information see: "Iron Man Triathlon," World Triathlon Corporation, www.ironman.com (accessed January 10, 2008).

circumstances in which we live.[26] The totality of the adaptive changes of an organism is what Selye termed the "General Adaptation Syndrome" or G.A.S. It was through the G.A.S. that the body's various internal organs, especially the endocrine glands (that secrete hormones into the bloodstream) and the nervous system adjusted to the constant demands of each individual organism.[27]

G.A.S. was divided into three progressive stages: 1) the alarm reaction; 2) the stage of resistance; and 3) the stage of exhaustion.[28] The alarm reaction was sub-divided into two stages: shock and counter shock. Shock represented the organism's initial sudden response to stimuli to which the organism was exposed. In exercise the main signs were a transient increase in heart rate and some cellular and chemical (i.e. lactate) changes in the blood. In the counter-shock stage the physiological changes of shock were generally reversed and the adaptive mechanisms of the body outweighed the destructive ones. In these circumstances adaptation referred to a state of the organism characterized by an increased resistance to stress through previous exposure to stress. Resistance to all forms of stress increased during this period.[29]

If stress continued more or less unchanged, the animal went into a state of resistance. In this stage the organism continued to resist the original stressing agent, but became more vulnerable to other stresses. The final period he explained, was the stage of exhaustion in which, although adaptation had occurred, it could not be sustained any

[26] Selye, *The Stress of Life*.
[27] Ibid.
[28] Ibid., 3.
[29] Ibid., 31-32.

longer. During this stage, resistance to all stressing agents was lowered and any additional stress precipitated a violent reaction of prolonged shock or death.[30]

Selye's research which led him to this theory had focused on experiments involving rats, rabbits, and guinea pigs. At first glance it would appear that such research was far removed from the world of track athletes trying to lower their race times. However, for the first time in the history of science, Selye was able to study and get to the very foundation of training—the nature of the adaptive process.[31] Training in its many forms (weight, interval, aerobic, anaerobic, alactic, continuous, *fartlek,* etc.) creates a variety of unique stressors on the body. How the body reacts and adapts determines what level of workload can be tolerated and ultimately how much an athlete can progress. Other factors need to be taken into account such as hereditary influences, of course, but a fundamental understanding of stress and the adaptive process is imperative to fully understand how to prescribe different workloads and exercises that are collectively termed training.

In 1960 Fred Wilt, editor of *Track Technique*, recognized in the journal's very first edition the importance of Selye's work. In an article entitled "Stress and Training," Wilt made reference to the gravity of Selye's contribution by noting, "Selye has indicated that the body has a finite quantity of adaptation energy."[32] To further expand on Selye's significant contribution, Wilt referenced the work of Forbes Carlile, a University of

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[30] Ibid.

[31] Ibid., 3. Selye acknowledged that in the twenty years that preceded the publication of his book, research into stress was handicapped because there were no objective measurable indices to assess it. However, with his work Selye discovered that stress caused certain changes in the structure of the body that could be accurately assessed.

[32] Fred Wilt, "Stress and Training," *Track Technique*, no. 1 (September 1960): 6.

Sydney physiology lecturer, Australian Olympic swim coach, and former marathon runner. In the September 1961 issue of *Track Technique*, Carlile began the first of a three-part series specifically devoted to "The Athlete and Adaptation to Stress."[33] He began his account with an enlightening appraisal of the state of training in sport. "The training of athletes for strenuous activity today is much an art and less a science. We lack too many basic facts about the effects of muscular exercise on the organism even for the most modern training regimes to be called scientific…The modern textbook on coaching tells next to nothing of a scientific nature of how to train the body functions for speed and endurance."[34] The lack of applied sport science was seen as an inevitable consequence of the complexity of the human organism with its countless physiological, psychological, and social factors all acting and interacting with each other. As a result it was difficult (and time consuming) to conduct well-controlled experiments that kept enough variables constant to derive any definite conclusions. While accepting the limitations of the state of training knowledge at the time, Carlile asserted that a basic philosophy was essential to help guide the teacher and coach. For this reason Carlile proposed the acceptance of Selye's General Adaptation Syndrome—to provide a theoretical framework for coaching and future scientific research.

In the second installment of "The Athlete and Adaptation to Stress," Carlile asked two important questions considered essential to train athletes: 1) What are the main stresses which affect the ability of an athlete to adapt? and 2) What signs and symptoms

[33] Carlile, "The Athlete and Adaptation to Stress," 156-158.
[34] Ibid.

are indicative of a failure of an athlete to adapt to stress?[35] The stresses involved in the everyday "wear and tear" of living included muscular exercise, dietary insufficiency, climatic conditions (heat and cold), bacterial infections and disease, emotional conflict and unrest, insufficient rest and sleep, and miscellaneous stress. Carlile commented that an athlete needed more rest than a non-athlete, but as far as he was aware, scientific information concerning optimum sleep requirement during strenuous exercise did not exist.[36]

In the third and final installment, Carlile outlined the signs and symptoms of an athlete in the stage of exhaustion in which they were unable to cope with any more stress. They included: chronic loss of body weight, joint and muscle pain not attributable to any particular injury, chronic intestinal upsets, swollen lymph glands (tonsils and inguinal glands), blocked nose and one-day colds (rhinitis), skin rashes such as hives (urticaria), psychic unrest, irritability, insomnia, general fatigue often referred to as staleness, and general muscular tenseness.[37]

Carlile felt that what was previously termed "staleness" had its genesis in the G.A.S. and was indicative that the athlete had reached the final stage of exhaustion, "it appears to be a sweeping over-simplification to say that staleness 'is only a state of mind' although, no doubt, nervous factors are involved."[38] The challenge for the physiologist was to be able to measure the amount of general and specific adaptations to stress and to

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[35] Forbes Carlile, "The Athlete and Adaptation to Stress," *Track Technique*, no. 7 (December 1961): 185-186.
[36] Ibid.
[37] Carlile, "The Athlete and Adaptation to Stress," 218-219.
[38] Ibid.

find reliable tests of how long an individual was able to resist a given stress. Fortunately, many astute coaches were able to detect the warning signs that an athlete was approaching the exhaustion stage, and by lightening their load, could reverse the trend. However, in the world of high performance sport, where athletes push their bodies to the physiological limit to gain a competitive edge, there was often a thin line between "training and straining."[39] Carlile, at the completion of his three part series, summarized his philosophy as follows: "Training of an athlete is a great responsibility because two of his very important personal attributes are being used—the athlete's time and his powers of adaptation to life stresses. Training him may be likened to bending a green twig. The body may eventually mould itself to the force of continuously imposed physical exercise, but a little too much and the body, like the twig, may show signs of strain. More stress and the breaking point may be reached."[40]

The possibility of exhausting an athlete's physical and mental capabilities was recognized by John Bowman, who in 1961 exclaimed, "Training Can be Overdone."[41] The author acknowledged that "in recent years the importance of hard physical training in preparation of an athlete has become generally recognized." However, Bowman was aware that each athlete had physiological and genetic limits to how much they could improve with training. It was essential therefore, that athletes recognized their own training limits, and were not misguided into following training regimes of athletes who had a greater capacity for physical work. He concluded that although athletes in the past

[39] Ibid.
[40] Ibid.
[41] John Bowman, "Training Can Be Overdone," *Track Technique*, no. 5 (September 1961): 147.

did not train enough, "we must certainly not go to the other extreme, for in the long run it will be just as bad."[42] This advice, if given to Jim Ryun in the spring of 1968, could well have prevented him from exhibiting some of the classic signs of exhaustion and overtraining (muscle strains and mononucleosis) that ultimately adversely affected his ability to prepare and perform at the 1968 Mexico Olympics.[43]

SCIENCE DISCOVERS STRENGTH

One area that significantly contributed to the marked improvements in track and field performances during this era (1945-1975) was the scientific acceptance of weight training. Harvey Newton, author of *Explosive Lifting for Sports*, notes how "most coaches and athletes today agree that resistance training creates stronger, faster athletes who are more resistant to injury."[44] However, this was not always the case.

The recorded history of the athletic application of strength dates back to the ancient Olympic Games. There, the Greek wrestler, Milo, famous for lifting a young calf and walking with it as it grew, applied his tremendous strength in winning six Olympic wrestling titles.[45] Despite records of sports participation between ancient Roman times and the eighteenth century, little data exists regarding types of sports preparation such as weight training. At the turn of the twentieth century, however, the common perception

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[42] Ibid.
[43] Ryun and Philips, *In Quest of Gold*, 84.
[44] Harvey Newton, *Explosive Lifting for Sports* (Champaign, Ill.: Human Kinetics, 2002), Back Page.
[43] Gardiner, *Greek Athletic Sports and Festivals*, 82-83.

was that weight training resulted in slow, uncoordinated, "muscle-bound" individuals.[46] This myth was perpetuated into the 1950s by a rather portly image of weight lifters that was far removed from the athletic physiques of modern athletes. However, because of new scientific discoveries, public opinion eventually turned in favor of the use of weight training to enhance athletic performance.

During the 1940s and 1950s three key developments occurred which turned the tide in favor of weight training. The first was the use of resistance training in the rehabilitation of World War II veterans. Orthopedic physician Dr. Thomas Delorme developed a program of resistance exercise in 1944 which helped restore muscle strength, decreased the need for hospital beds, and increased the speed of recovery of injured soldiers.[47] Delorme's work, reported in several medical journals, eventually formed the basis of modern weight training research.

The second development was the increased popularity of weight training and the use of heavy weights because of the boosterism of York Barbell Company owner, Robert (Bob) Hoffman (1898-1985). Hoffman was a magazine publisher, Olympic weightlifting coach, book author, barbell company owner, and high profile proponent of weight training for improved athletic performance. He began publishing *Strength & Health Magazine* in 1932 and used that publication to publicize Olympic-style competitive weightlifting and to argue for the benefits of weight training to athletics. In 1932 he wrote, "There was not a single athletic endeavor where correct dumbbell and barbell

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[46] Todd, "The Myth of the Muscle-Bound Lifter," 37-41; Al Thomas, "Reflections on Musclebinding," *Iron Game History*, no. 2 (April 1992): 1-3.

[47] Thomas DeLorme, "Restoration of Muscle Power by Heavy Resistance Exercise," *Journal of Bone and Joint Surgery* 27 (1945): 645.

training will fail to greatly improve the athlete at the sport in which he prefers to participate."[48] That same message was repeated again and again in his magazines over the years, and it was also preached from the stage whenever Hoffman spoke—as he frequently did—about the benefits of weight training.[49]

Jan and Terry Todd, sport historians at the University of Texas at Austin, highlight in the "The Conversion of Dr. Peter Karpovich," how a 1940 visit by Hoffman and the York barbell team to Springfield College in Massachusetts helped sway the weight of scientific opinion in favor of weight training and helped dispel the "muscle-bound" myth.[50] There, the eminent Professor of Physiology Dr. Peter Karpovich initially believed, as did most physicians, coaches and physical educators that weight lifting caused men to become "musclebound"—slow, inflexible and clumsy.[51] Karpovich watched in amazement as John Davis, the world weightlifting champion, and John Grimek, a future two-time Mr. America winner, both displayed agility, flexibility, and great strength. Commenting on the event in 1956, Karpovich wrote, "Both men had huge

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[48] Bob Hoffman, "How to Improve at Your Chosen Sport," *Strength and Health* (December 1932): 180. Through Hoffman's employment and financial support of athletes (he owned the world famous York Barbell Company), his promotion of the sport of weightlifting (via his editing and publication of the magazine *Strength and Health*), and his coaching (he coached the York Barbell Club and the US National Weightlifting Team), Hoffman was responsible for what has been called by sport historian John Fair as 'The Golden Age of American Weightlifting.' Hoffman's domestic team won the US championships every year from 1932 to 1954, with the exception of 1952. From 1946 to 1956 the US team captured seven out of eleven world team titles, coming in second to the Soviet Union between 1957 and 1960. For further information see John Fair, "Bob Hoffman, the York Barbell Company and the Golden Age of American Weightlifting," *Journal of Sport History* 14, no. 2 (Summer 1987): 164-188; John Fair, *Muscletown USA: Bob Hoffman and the Manly Culture of York Barbell* (University Park: Pennsylvania State University Press, 1999).

[49] Terry Todd, "Remembering Bob Hoffman," *Iron Game History* 3, no. 1 (September 1993): 28-31.

[50] Jan Todd and Terry Todd, "The Conversion of Dr. Peter Karpovich," *Iron Game History* 8, no. 4 (March 2005): 4-12.

[51] Jim Murray, "Weight Lifting's Non-Lifting Patron Saint," *Iron Game History* 4, no. 5&6 (August 1997): 3.

muscles and therefore should have been musclebound. But they were like the bumblebee who flies, although expert aviation engineers have proved mathematically that a bumblebee cannot fly. This anecdote only illustrates how strongly we may cling to our prejudices and pass on unfounded information."[52] Following this watershed event, Karpovich and a number of other exercise scientists began studying athletic performance and strength training in the late 1940s and 1950s. Their research, the third factor that helped weight training gain acceptance for sport training, proved that contrary to popular opinion, weight lifters were not slow, uncoordinated, or muscle bound.

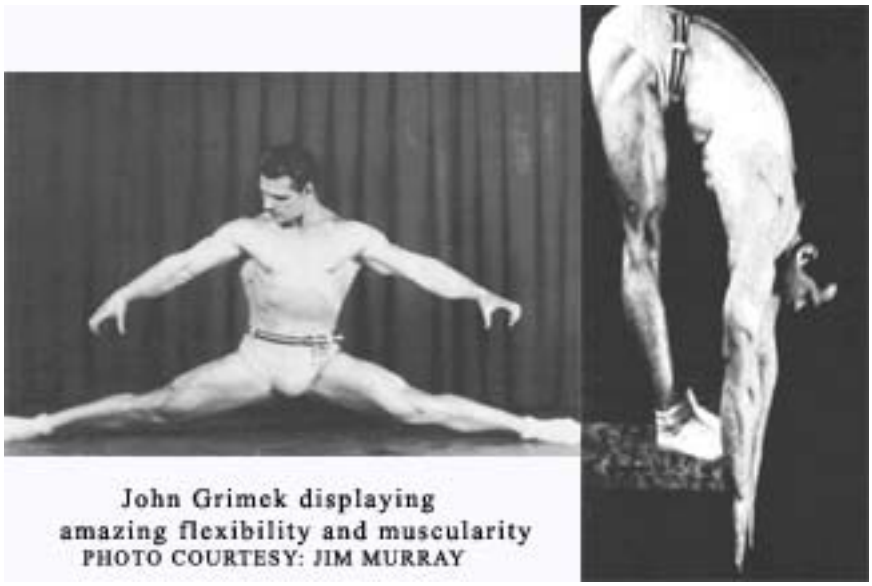

Figure 43. John Grimek

Having been enlightened to the unfounded myth of muscle-binding, Karpovich set out to test the next myth, that due to their heavy musculature (particularly in the upper

[52] Murray, "Weight Lifting's Non-Lifting Patron Saint." Jim Murray and Peter Karpovich, *Weight Training in Athletics* (Englewood Cliffs, N.J: Prentice Hall, 1956).

body) weight lifters were necessarily slow. Peter Karpovich and William Zorbas undertook a study examining the arm speed of six hundred people (aged between eighteen and thirty) in 1951 to test this hypothesis.[53] At the end of the study the authors were surprised to find that the weightlifters were significantly faster than the other two groups. Complimentary research by Bruce Wilkins in 1952 utilizing a rotary bicycle crank to measure arm speed confirmed that training in weight lifting did not decrease speed.[54] John W. Masley in 1953 at Pennsylvania State College also showed that compared to volleyball training, a greater increase in speed and coordination resulted from weight training.[55]

[53] William Zorbas and Peter Karpovich, "The Effects of Weight Lifting Upon the Speed of Muscular Contractions," *Research Quarterly* 22, no. 2 (May 1951): 145-148. The participants were divided into three groups, sedentary liberal arts students, physical education students and experienced weightlifters who had participated in weight lifting for at least six months. A special instrument was devised to test rotary arm speed. Arm movement was selected because it involved the large muscles of the chest, back, shoulders and arms and allowed precise measurement. The participants were instructed to complete twenty-four rotary movements as quickly as possible.

[54] Bruce Wilkins, "The Effects of Weight Training on Speed of Movement," *Research Quarterly* 23 (1952): 361-369.

[55] J.W. Masley, "Weight Training in Relation to Strength, Speed and Coordination," *Research Quarterly* 24 (1953): 308-315.

Figure 44. Dr. Peter Karpovich.[56]

In terms of power production, Edward Chui, in 1950, demonstrated that weight training for three months resulted in significant improvements in the vertical jump, running long jump and the shot put.[57] Dick Garth, a graduate student at Iowa State University, also studied power and wrote a thesis on "The Effects of Weight Training on the Jumping Ability of Basketball Players." At the end of the study the Hawkeye players' strength had improved by fifteen to twenty-five percent and their average vertical jumping ability improved by 2.7 inches.[58]

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[56] Photo featured in Murray, "Weight Lifting's Non-Lifting Patron Saint."

[57] Edward Chui, "The Effects of Systematic Weight Training on Athletic Power," *Research Quarterly* 21, no. 3 (October 1950): 188-194.

[58] These findings had obvious implications for any sport in which the expression of power is critical for athletic performance. For more information on explosive power training for sport see: Newton, *Explosive Lifting for Sports*.

Another reason why physicians and physical educators had objected to the use of weights was the belief that their use was potentially dangerous and produced a lot of injuries. Karpovich, now on a mission of scientific discovery, surveyed 31,702 men participating in weightlifting and found that the incidence of injuries was very low and that most injuries were minor, consisting of 'pulled' muscles and tendons. The incidence of hernias was twenty times lower than that found in the general population.[59]

The research produced by the aforementioned sport scientists helped sway public opinion by dispelling previous myths and providing weight training with scientific respectability. In addition, a number of practical textbooks were published which advocated the use of weight training in athletics. These provided excellent reference sources for eager coaches that could immediately be applied to athletes in the weight room. Examples of such texts include *Weight Training in Athletics* by Jim Murray and Peter Karpovich (1956), *Better Athletes through Weight Training* by Bob Hoffman (1959), *Progressive Weight Training* by Jack Leighton (1961), *Weight Training for Athletes* by Bob Hoffman (1961), and *The Manual of Weight Training* edited by George Kirkley and John Goodbody (1967).[60] In addition to discussing general weight training programs many authors also recommended specific weight training programs for different sports. The core content of many of the training programs bore a close resemblance to the track and field programs of today, with an emphasis on Olympic

[59] Peter Karpovich, "Incidence of Injuries in Weight Lifting," *Journal of Physical Education* 48 (1951): 81.
[60] Murray and Karpovich, *Weight Training in Athletics*; Jack Leighton, *Progressive Weight Training* (New York: Ronald Press Company, 1961); Bob Hoffman, *Better Athletes through Weight Training* (York, Pa.: Strength and Health Barbell Company, 1959); George Kirkley and John Goodbody, eds., *The Manual of Weight Training* (London: Stanley Paul, 1967).

weightlifting movements such as the clean and jerk, the squat, and the standing or bench press.

The increased scientific respectability, as a result of strength research and the continuing success of athletes who used weight training, resulted in an increased number of athletes incorporating weight training into their sports programs in order to enhance performance. The greatest experimentation and insight into the beneficial effects of weight training occurred in track and field during the early and mid 1950's. Men such as Bob Richards (pole vault), Mal Whitfield (middle distance running), McDonald Bailey (sprinter), Otis Chandler and Parry O'Brien (shot put), Fortune Gordien and Bob Backus (Hammer), and Al Cantello and Steve Seymour (Javelin), all demonstrated that weight training could significantly enhance the ability to run, jump, and throw.

"Marvelous" Mal Whitfield was a two-time Olympic gold medalist in the 800 meters. He, like Peter Karpovich, became interested in weight training as a means of improving his athletic ability in 1944 after witnessing John Davis and John Grimek exhibit their muscular prowess at a weightlifting demonstration. Whitfield used a maximum strength program of heavy weights and low repetitions during the off-season.[61] For example, in the squat he performed five sets of three repetitions with 255-270 pounds. He also used an exercise he called the "alternate arm drive" in which he swung dumbbells in an action that duplicated the movements of the arms while running.[62]

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[61] Murray and Karpovich, *Weight Training in Athletics*, 132.

[62] George R. Bruce, "Mal Whitfield: Iron-Muscled Running Champion," *Strength and Health* (December 1954): 40-42, 44.

Figure 45. Mal Whitfield.[63]

Another track athlete, McDonald "Mac" Bailey, the 1948 Olympic 100 meter finalist and world record holder in the 100 meters, was also a keen advocate of weight training to improve his performance. In 1955 Bailey was featured in a *Strength & Health* article aptly titled "British Empire Speedster Uses Weight Training."[64] Bailey's weight training was confined to the off-season where he trained with weights three times per week. His favorite exercises included the snatch (where in one motion the bar is raised from the ground to an overhead position), a leg raise/abdominal roll combination to condition the thigh and midsection, and the alternate press with dumbbells.[65]

[63] Image located at: http://www.usatf.org/halloffame/TF/showBio.asp?HOFIDs=181 (accessed January 10, 2008)
[64] Jim Murray, "British Empire Speedster Uses Weight Training," *Strength and Health* (March 1955): 11, 40.
[65] Ibid.

Figure 46. Coach Oscar State watches British sprinter McDonald Bailey weight training at Lilleshall on 3 May 1952. Bailey was in training for the forthcoming Olympics in Helsinki. (Photo by Charles Hewitt/Picture Post/Getty Images).

One area where the added strength and power from using weights was particularly advantageous was in the field events. Otis Chandler, world-class shot-putter and a lieutenant in the United States Air Corps, was an avid user and competitive lifter of weights. He was among seven shot-putters out of the top eleven in the world who in the early-to-mid 1950s used weights as part of their overall training program.[66] Bob Backus, another thrower, set records in the hammer and a world record in the thirty-five pound weight throw in 1953. In a letter to *Strength & Health* magazine he stated categorically,

[66] Murray and Karpovich, *Weight Training in Athletics*, 135.

"I'm quite anxious that it should be well known that the weight training principle was responsible for whatever success I've gained." He emphasized the use of heavy squats, cleans, and supine or bench presses.[67]

By 1958 the tide was truly turning in favor of weight training. George W. Ewing of Abilene Christian College in an article titled "Exercise by the Pound" wrote, "It seems that more and more coaches today are suddenly aware that the combination of about equal portions of athlete and iron will produce a better athlete."[68] Julian Stein, track coach at Wakefield High School in Arlington, Virginia, confirmed the reversal in philosophy in favor of weight training, "At present time it is known that a careful, intelligent, and well-planned program of weight training can be most beneficial to the athlete, whatever his sport." Stein proceeded to outline fourteen exercises (including a warm-up) that were used for all events in addition to specific exercises for shot putters, broad jumpers, high jumpers, and discus throwers. [69]

In 1961 John T. Powell of the University of Illinois demonstrated how far the use of weight training had evolved in an article in *Track Technique* by recommending the use of "Weight Training for Young Track and Field Athletes." Furthermore, Powell confirmed that weights should be used all year round, "There is no need to stop training with weights during the competitive season, although naturally the time available for this type of work will be reduced." Powell proceeded to comprehensively cover the use of a warm up, weight training progressions, and safety considerations. Also included were

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[67] Ibid., 137.
[68] George W. Ewing, "Exercise by the Pound," *Athletic Journal* XXXIX, no. 1 (September 1958): 84-89.
[69] Julian Stein, "Weight Training for Track Men," *Athletic Journal* XLI, no. 3 (November 1960): 46, 51, 57-58.

programs for schoolboy sprinters, high hurdlers, middle distance and cross country runners, high jumpers, broad jumpers, pole vaulters, shot putters, and discus throwers.[70]

The validated use of weight training to enhance athletic performance and prevent injury continued throughout the late 1950s and 1960s and spread to multiple sports.[71] As a testimony to the effectiveness and widespread use of weight training Gene Hooks, author of *Weight Training in Athletics*, noted that by 1974, "weight training has completely revolutionized all track and field training methods."[72] A new era of performance enhancing, scientifically validated weight training had truly arrived.

EXERCISE PHYSIOLOGY: THE "FORMATIVE" YEARS (1963-1976)

Massengale and Swanson refer to the period between 1963 and 1976 as the formative years—the era in which exercise physiology emerged as a separate academic discipline.[73] In 1963, former president of Harvard University, James Bryant Conant, published the "Conant Report" which provided a scathing indictment of the teacher training system in the United States.[74] The report encouraged an upgrade and modification of graduate programs to allow for more in-depth specialization, including

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[70] John T. Powell, "Weight Training for Young Track and Field Athletes," *Track Technique*, no. 3 (March 1961): 68-73.

[71] Al Roy, "Weight Training for Football," *Strength and Health* (August 1957): 21-22. In baseball, many major league ball players used weight training to varying degrees, the most notable being pitcher Bob Feller and batting champion Ralph Kiner. Golf champion, Frank Stranahan used weight training to his advantage and was a more than competent competitive lifter. He could clean and jerk 330 lbs, squat 400lbs and lift more than 500 lbs in the dead lift. Australian tennis champion Frank Sedgman used weight training as part of his overall training program to assist in power development and the conditioning of key areas such as the wrists and forearms. For further details and elaboration on the above information see Murray and Karpovich, *Weight Training in Athletics*, 126, 147.

[72] Hooks, *Weight Training in Athletics and Physical Education*,5.

[73] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 408.

[74] J.B. Conant, *The Education of American Teachers* (New York: McGraw-Hill, 1963).

the field of exercise physiology within physical education programs.[75] This report had a direct effect on the creation of new exercise physiology Ph.D. degree programs. In 1964 physical education and interdisciplinary programs in the Big Ten and Pac Ten institutions plus Pennsylvania State University began to implement comprehensive Ph.D. programs that emphasized exercise physiology, thereby resulting in a significant increase in the output of exercise physiology related literature.[76]

The *Journal of Applied Physiology* continued to generate information during this period (1963-1976) that had the potential to be used by coaches and physical educators alike. For example, in 1963, Rodolfo Margaria and colleagues at the Physiology Laboratory at the University of Milan, Italy, examined the energy cost of running at speeds up to twenty-two kilometers per hour.[77] From their data, the authors derived a nomogram for calculating the energy expenditure whenever the speed and incline of running were known. In 1967, Bengt Saltin, M.D. and Assistant Professor of Exercise Physiology at the Karolinska Institute in Stockholm, Sweden, and Per-Olof Åstrand of the Department of Physiology at the Swedish College of Physical Education, Stockholm, examined the average maximum oxygen uptakes for Swedish national team members in different sporting events including running (400 and 3,000 meters), bicycling, table tennis, cross-country skiing and weight lifting. They discovered that elite world-class middle distance runners and long distance runners had oxygen uptakes in the region of eighty milliliters per kilogram (body weight) per minute (ml/kg/min). Female athletes

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[75] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 408.
[76] Ibid., 409.
[77] R. Margaria et al., "Energy Cost of Running," *Journal of Applied Physiology* 18 (1963): 367-370.

that ran in the 400 or 800 meter events had maximum aerobic power levels of approximately sixty-five ml/kg/min. Cross country skiers achieved the highest oxygen uptake levels, averaging eighty-three ml/kg/min.[78] This information, similar to the work of Cureton in the early 1950s, could be used as a database for comparison with other elite athletes running the same events.

Elsewhere, Giovanni A. Cavagna and colleagues at the University of Milan gathered information on walking and running. The authors confirmed that when increasing running speed, the time spent in contact with the ground decreased markedly, whereas the time spent in the air first increases and then remains relatively constant. The increased step frequency with increased running speed was mainly due to a decrease in the time spent in contact with the ground.[79] This information had the potential to be used by astute track coaches who could cue their athletes to increase the rhythm of their foot contacts as they spend less time on the ground.

The early 1970s witnessed the publication of a number of key texts that illustrated the developmental stage of exercise physiology and the application of science to sport. Leading the way was Vaughan Thomas's *Science and Sport,* published in 1970. Thomas, a lecturer in physical education at St. Mary's College in Twickenham, England, had been British National Champion in both athletics and cycling. Thomas's book attempted to give specific information to sportsmen and coaches on how they could incorporate the latest scientific findings in their attempts to improve performance. The text covered the

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[78] B. Saltin and P.O. Åstrand, "Maximum Oxygen Uptake in Athletes," *Journal of Applied Physiology* 23 (1967): 353-358.

[79] G.A. Cavagna, H. Thys, and A. Zamboni, "The Sources of External Working Level Walking and Running," *Journal of Applied Physiology* 262 (1976): 639-657.

development of key biomotor abilities—strength, speed, stamina and skill—in addition to discussing sport psychology and the athlete's "soul." It also paid careful attention to the problem of sport injuries. In the introduction Thomas outlined the various sciences that he felt could contribute to a better understanding of sport when combined. Thomas argued that coaches needed to pay attention to the latest findings in anatomy, physiology, nutrition, neurology, psychology, sociology, medicine, mechanics, kinesiology (science of motion), physics, chemistry and statistics.[80] No one person could be an expert in all of the aforementioned fields, he conceded, while also admitting that it was unlikely that someone truly expert in one of these fields would also have a wide practical experience of sport. Therefore, if sport science was to play a useful part in the development of both sport and science, it was necessary to provide a coordinated approach utilizing multiple disciplines and a number of different branches of science to maximally help the athlete.

Thomas's laboratory had the capacity to collect a vast amount of information relating to the athlete, including data on circulation (blood pressure, blood glucose and hemoglobin levels), ventilation (vital capacity, oxygen uptake levels), excretion (sweat and urine analysis), power output (grip, leg and back strength, vertical and broad jump), anthropometry (body type), and personality (a battery of sixteen personality factor assessments).[81] Despite this impressive list of physiological, anthropometrical, and psychological information, Thomas acknowledged that "at this stage in our development we have not accumulated sufficient data to be able to decide the relative importance of

[80] Vaughan, *Science and Sport: How to Measure and Improve Athletic Performance*, 23-24.
[81] Ibid., 197.

each factor in the assessment of sports potential. The final assessment is and will be for some time, a mainly subjective one."[82]

Thomas was particularly concerned about the lack of coordination in sports research. "Because of the lack of central funding and organization the efforts put by many individuals into sports research is inefficiently deployed. Each sport scientist is involved in working on his own little brick, with little opportunity to join his with other bricks in building a soundly-organized structure of research. One would hope that a sports council or a Central Council of Physical Recreation, or similar body could undertake such organization—but inevitably funds are needed, and not forthcoming."[83] In making this statement, Thomas acknowledged two significant hurdles to the application of science to sport. The first was a lack of coordinated research at the highest level that could be efficiently disseminated to the coach and athlete, thereby avoiding any unnecessary duplication of work. The second was a lack of funding to allow detailed, comprehensive research to take place. As we shall see in Chapter Seven, the political milieu in the Soviet Union ensured that both of these hurdles were avoided.

In 1970, Per-Olof Åstrand, M.D. of the Department of Physiology at the Swedish College of Physical Education in Stockholm and Kaare Rodahl M.D., Director of the Institute of Work Physiology and Professor at The Norwegian College of Physical Education in Oslo, published the *Textbook of Work Physiology*.[84] Their classic text gained instant acceptance and usage by professors for both basic and advanced exercise

[82] Ibid., 198.
[83] Ibid., 200.
[84] Åstrand and Rodahl, *Textbook of Work Physiology*.

physiology courses.[85] The aim of the text was to "bring together into one volume the various factors affecting human physical performance in a manner comprehensible to the physiologist, the physical educator and the clinician."[86] Chapter Twelve was specifically devoted to "Physical Training" and included a brief section on "Year-Round Training." The authors confirmed that due to the increased level of competition that had evolved prior to 1970, year-round training was now a "necessity."[87] Furthermore, although it was possible in one month to develop a reasonable level of fitness, any improvements were reversible once training had been discontinued. The chapter contained a practical section on training for aerobic and anaerobic power but the authors' advice was general in nature and did not apply to specific track and field events.

Chapter Sixteen, however, was dedicated to the "Physiology of Various Sports Activities," including running. The authors offered insight into the energy cost and efficiency of running by reporting that the level of oxygen uptake was dependent upon stride length and in general, an individual's natural stride length was also the most economical one. As an example, the authors referred to Paavo Nurmi (featured in Chapter Three) the "Flying Finn," who, compared to similar distance runners of his era, had an unusually long stride length. The authors noted that a number of athletes had attempted to copy Nurmi's running style with reduced efficiency and results. This demonstrated the

[85] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 419.
[86] Åstrand and Rodahl, *Textbook of Work Physiology*, vii.
[87] Ibid., 393.

danger of generalization based on individual athletes and also emphasized the need for further physiological research.[88]

With reference to world-class middle and long-distance runners, the authors recommended a maximal oxygen uptake level close to, or preferably above, eighty milliliters per kilogram per minute (ml/kg/min). For women who ran the 400 or 800 meters, a maximal aerobic power of sixty-five ml/kg/min or higher was considered optimal.[89] However, due to the relative infancy of knowledge at the time, the authors failed to incorporate an analysis of lactate measurements and the concept of "anaerobic" or "ventilatory" threshold—the point at which there is a non-linear increase in the ventilation rate in relation to oxygen consumption.[90] In the 1960s and 1970s Wasserman and McIlroy developed the concept of the "anaerobic threshold" that indicates the intensity of exercise at which there is a disproportionate increase in oxygen uptake.[91] This measurement, along with analyzing the relative percentage of an athlete's maximal oxygen uptake while running, has shown to be a much better indicator of performance than maximal oxygen uptake alone. As Axel Urhausen and colleagues assert in their appraisal of the transition from aerobic to anaerobic metabolism, "performance

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[88] Ibid., 543.

[89] Saltin and Åstrand, "Maximum Oxygen Uptake in Athletes," 353-358.

[90] For detailed explanation of the concept of an anaerobic" or "ventilatory" threshold see**:** Axel Urhausen, Bernd Cohen, and Wilfred Kinderman, "Individual Assessment of the Aerobic-Anaerobic Transition by Measurement of Blood Lactate," in *Exercise and Sport Science*, ed. William E. Garrett and Donald Kirkendall (Philadelphia: Lippincott Williams and Wilkins, 2000).

[91] K. Wasserman and M.B. McIlroy, "Detecting the Threshold of Anaerobic Metabolism in Cardiac Patients," *American Journal of Cardiology* 14 (1964): 844-852.

diagnostics that only consider maximal indicators are insufficient and inappropriate for performance diagnosis and monitoring of training."[92]

In summary, Åstrand and Rodahls' contribution represented a significant advancement in the area of applied exercise physiology. It gave exercise physiology and physical education students detailed information regarding the physiological basis and workings of the body during exercise. However, the data presented did not give the coach, physical educator or athlete sufficient information to formulate detailed day-to-day, month-to-month, and year-to-year training programs necessary to enhance performance. What was needed was a more sport-specific approach to exercise physiology, especially tailored to track and field. Furthermore, the generation of physiological data highlights a number of inherent problems associated with exercise physiology and sport science research. In order to measure oxygen uptake and work output, authors invariably used treadmills or bicycle ergometers in the controlled setting of a laboratory. Although, these experiments generated valuable physiological data, the information gathered did not directly translate to the sporting environment where athletes had to propel their bodies around a running track.

In 1971, Donald K. Mathews, Professor of Physical Education and Physiology at the Ohio State University, and Edward L. Fox, Associate Professor of Physical Education at the same institution, were the first to author an exercise physiology text that was

[92] Urhausen, Cohen, and Kinderman, "Individual Assessment of the Aerobic-Anaerobic Transition by Measurement of Blood Lactate," 267.

specifically orientated towards physical education and athletics.[93] The authors' aim in the text was to allow the student or coach "to know the scientific or physiological reasons why he does certain things—not simply because his coach before him did it that way."[94] To achieve this goal the authors noted, "Today more than ever before it is necessary for the physical educator and coach to recognize the vital part SCIENCE plays in the successful conduct of physical education and athletic programs."[95] To facilitate an applied scientific approach, the authors sought to eliminate the more academic aspects of physiology and to focus on material that could be put to immediate use in the gymnasium and on the athletic field. The text covered a broad spectrum of topics including analysis of energy systems, muscular strength, endurance, flexibility and motor learning, diffusion, osmosis and drowning, heat balance, the cardiorespiratory system, physiology of scuba diving, and test and measurements (including power). An entire chapter was specifically devoted to interval training which was considered vital to training a variety of sports, including track and field, swimming and basketball.[96] Interval training had key advantages over other methods of training in that it: 1) allowed for precise control of stress; 2) could be incorporated into a systematic day-to-day approach to training; 3) allowed for more rapid improvement in energy potential than any other methods of conditioning; and 4) was a program of exercises that could be performed almost

[93] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 402; Mathews and Fox, *The Physiological Basis of Physical Education and Athletics*.
[94] Mathews and Fox, *The Physiological Basis of Physical Education and Athletics*, Preface.
[95] Ibid., 1.
[96] Ibid., 3.

anywhere, requiring no special equipment.[97] To validate their claims, the authors utilized research published in the *Journal of Applied Physiology* that compared energy sources during continuous and interval running.[98] The results demonstrated that during intermittent work, lactic acid accumulation was always lower than when an identical amount of work was performed continuously. As a consequence, running intervals meant more work could be performed before lactate concentrations reached exhaustive levels. The authors also provided a table that outlined the percentage of time spent in each of the three energy systems (alactate, anaerobic and aerobic) for various track events, ranging from the 100-yard dash to the marathon.[99]

In conclusion, Fox and Matthew's work represented a significant contribution to the applied aspects of physiology and as a result it gained wide usage as an undergraduate exercise physiology text.[100] With detailed coverage of the three energy systems and how they applied to each track event the book gave the coach sport-specific information on what areas (energy systems) to target during training. The scientifically supported recommendations to include interval training further validated and exposed to a wider audience, the ideas that Woldemar Gerschler and Dr. Herbert Reindell had discovered in the mid-to-late 1930s.[101]

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[97] Ibid., 85.

[98] Edward L. Fox, Sid Robinson, and David L. Wiegman, "Metabolic Energy Sources During Continuous and Interval Running," *Journal of Applied Physiology* 27, no. 2 (1969): 174-178.

[99] Mathews and Fox, *The Physiological Basis of Physical Education and Athletics*, 91.

[100] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 419.

[101] Betweeen 1935 and 1940 Woldemar Gerschler, a professor of physical education at Freiburg University in Germany, and Dr. Herbert Reindell, a celebrated German cardiologist, worked in tandem to provide scientific validation to the use of interval training. Interval training may be defined as a "training system which alternates measured runs (work) at a measured pace with easy recovery runs (rest) for a measured

RESEARCH QUARTERLY AND SCHOLASTIC COACH (1945-1975)

Two journals specifically aimed at coaches and physical educators continued publication between 1945 and 1975. First published in 1930 by the American Physical Education Association, *Research Quarterly* contained peer-reviewed manuscripts relating to physical education, health, and recreation. A few of these specifically focused on track and field. In 1952, Franklin M. Henry of The University of California at Berkeley examined the "Force-Time Characteristics of the Sprint Start."[102] The author used a pressure recording device connected to the starting blocks to examine the effect of varying foot placements on the efficiency of the sprint start. The author discovered that in comparison to the medium stance, the "bunch" start (the smallest of the distances between the two feet) resulted in quicker clearance from the blocks but with significantly slower times at ten-and fifty-yard marks. Henry concluded that the most efficient stance—in terms of consistently producing the best runs resulted from using the medium stance.[103] This information would clearly have been of great practical value to track coaches who may have mistakenly prescribed the use of a bunch start that appeared to give an athlete an initial advantage over their opponents.

Later research, published in 1959, examined the effect of a warm-up on the performance of the 440-yard dash. Donald K. Mathews and H. Alan Snyder of the State College of Washington came to the conclusion that a warm-up prior to performing the

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length of time." For more information on the use of interval training see Chapter Three of this dissertation along with Doherty, *Track and Field Omnibook*, 378.

[102] Henry, "Force-Time Characteristics of the Sprint Start," 301-317.

[103] Ibid.

440-yard dash did not significantly improve running times compared to running the same distance without a warm-up and that no injuries occurred as a result.[104]

In 1969, John Patrick O'Shea of the Physical Education Department at Oregon State University examined the most effective method of weight training for the development of muscular strength and endurance required for 400-meter running.[105] Thirty students were randomly assigned to three groups that performed sets of weight training exercises with varying repetitions: 1) four to five repetitions; 2) nine to ten repetitions; and 3) fourteen to fifteen repetitions. The results of the study revealed that all three groups made significant improvements in the 400 meters but there was no significant difference between the groups. O'Shea concluded, "That any method of short term progressive weight training involving the large muscle groups of the body is effective in improving performances in the 400 meter run."[106] This work validated the use of weight training for track athletes competing in the longer sprints.

Unfortunately, (at least for track and field coaches at the time) examination of *Research Quarterly* between 1945 and 1975 reveals relatively scant information relating to track and field training practices. The journal was only published quarterly and covered a vast array of topics related to physical education, health, and recreation. Furthermore, by focusing on research that was invariably conducted independent of the coach or athlete, the authors were unable to offer advice necessary to formulate practical

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[104] Donald K. Mathews and Alan H. Snyder, "The Effect of a Warm-up on the 440-Yard Dash," *The Research Quarterly* 30, no. 4 (December 1959): 446-451.
[105] John P. O'Shea, "Effects of Varied Short Term Weight Training Programs in the 400 Meter Run," *Research Quarterly* 40, no. 1 (March 1969): 248-250.
[106] Ibid.

training programs on a day-to-day basis. Track coaches would need to supplement the limited coverage with more practically applied information found in journals such as *Scholastic Coach*.

Scholastic Coach which began publication in 1931, continued to focus heavily on America's three major sports—football, baseball, and basketball during this period (1945-1975). The track and field articles that were published tended to concentrate on the more technical aspects of coaching and included such articles as: "The Two Second Hold in Track Starting" by Paul R. Keller; "Indoor Running Tactics" by Ken Gibson; "Arm Action in Running" by John Tansley; and "Three Points in Sprint Starting" by Al Wright.[107] A number of select articles did, however, focus on the training and conditioning for track events. One particular article, by Melvin "Mel" Patton, the then-reigning world record holder in the 100-yard dash and 1948 Olympic double-gold medalist in the 200 meters and 4 x 100-meter relay covered "Sprinting from Start to Finish."[108] Patton included detailed, practical advice on all three stages of competitive sprinting—the start, striding, and the finish. He also outlined a typical training week during the competitive season:

Monday Hardest work day of the week; warm-up, stretching, loosening and muscle-building exercises, easy jogging and light running, building up to a few starts; overdistance or maximum distance—300 yards or two repetitions of 220's

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[107] Paul R. Keller, "The Two Second Hold in Track Starting," *Scholastic Coach* 24, no. 6 (February 1955): 48-51; Ken Gibson, "Indoor Running Tactics," *Scholastic Coach* 40, no. 6 (February 1971): 28, 95. Tansley, "Arm Action in Running," 54-56. Wright, "Three Points in Sprint Starting," 48, 82.
[108] Mel Patton, "Sprinting from Start to Finish," *Scholastic Coach* 22, no. 7 (March 1953): 10-11, 68.

Tuesday	Warm-up; starts; one or two seventy-five yard dashes with a few twenty-to-thirty yard sprints
Wednesday	Warm-up; starts twenty-to-thirty dashes
Thursday	Light warm-up or complete rest
Friday	Competition[109]

In 1960, W. Harold O'Connor, coach at Concord High School in Massachusetts, addressed the issue of "Competitive Season Conditioning."[110] In his appraisal, the author noted the varying conditioning practices of distance runners during or at the end of the competitive season. Many runners switched focus to speed work over shorter distances using 100 or 220-yard repeats instead of 440 or 880-yard repeats. Other coaches and athletes advocated continuing regular season training without any serious interruption of their normal schedule. Finally, another group of athletes and coaches contended that if an athlete had conditioned himself properly, then there was little or no need to do any strenuous work during the competitive season. With such conflicting information, O'Connor came to the conclusion that training during the season should be based strictly on an individual basis and that "coaches should peg the in-season work for their middle and long-distance men almost exclusively upon their strength, mental attitude, daily jobs and school demands."[111]

In 1971 William H. Freeman of Springfield, Oregon and author of *Peak When It Counts: Periodization for American Track and Field*, examined what he called "The

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[109] Ibid.
[110] W. Harold O'Connor, "Competitive Season Conditioning," *Scholastic Coach* 29, no. 6 (February 1960): 34-35.
[111] Ibid.

Basic Elements of all Distance Training Programs."[112] For Freeman the future of distance training lay in Kenneth Doherty's concept of "holistic training"—a synthesis of the best elements of the various training systems, adapted to each athlete's needs and environment. Freeman outlined the different types of training necessary for a successful distance training program: interval training, *fartlek*, distance running, speed running and the Lydiard and Oregon Systems.[113] Freeman concluded his article by cautiously advising that scientific research had yet to determine "the best methods" for training distance runners and that coaches needed to continue like they had in the past, by following their noses and using what "seemed" to be the best system that worked for them.[114]

Finally, Richard D. Michaels, coach at Oberlin College in Ohio, examined the subject of overtraining in an article entitled, "Train Don't Strain Your Distance Runners."[115] Michaels had discovered the hard way that it was not possible to train distance runners the same way as middle distance swimmers—by giving them lots of high intensity intervals with ever-increasing workloads. This form of training was too demanding and only resulted in lots of leg and foot injuries and ultimately poor performances. Michaels preferred to use workouts that were challenging to his runners but not to the point of overworking them and breaking them down—hence "train not strain" was the motto.

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[112] William H. Freeman, "The Basic Elements of All Distance Training Programs," *Scholastic Coach* 40, no. 7 (March 1971): 62, 64, 110; Freeman, *Peak When It Counts: Periodization for American Track and Field*.

[113] For information on *fartlek* and interval training and the Lydiard and Oregon training systems see Chapters Three and Four.

[114] Freeman, "The Basic Elements of All Distance Training Programs," 62, 64, 110.

[115] Richard D. Michaels, "Train Don't Strain Your Distance Runners," *Scholastic Coach* 44, no. 8 (April 1975): 97-99.

Examination of the content of *Scholastic Coach* during this period reveals important information that could be used by the coach and directly applied to the track. The information was more practical in nature, including, on occasions, details of how to structure training throughout the course of the week or year. However, much like *Research Quarterly*, *Scholastic Coach* suffered from having to cover and appeal to a wide range of sports and needs. As a result, articles on track and field training were too few and far between, and were often only featured during the limited track season. What was needed was a separate journal that was specifically devoted to track and field.

TRACK AND FIELD JOURNALS AND RELATED LITERATURE

In the fall of 1960, *Track & Field News*, long considered the "bible of the sport" launched a new coaching quarterly titled *Track Technique—The Journal of Technical Track & Field Athletics*.[116] Fred Wilt—a member of the 1948 and 1952 US Olympic teams and winner of ten national championships at distances ranging from one mile to 10,000 meters—was named as the first editor.[117]

From the beginning, Wilt tried to make *Track Technique* the bridge by which laboratory research traveled to coaches and athletes who could then apply it in their training. Typical of this attempt to bridge the gap was Forbes Carlile's article specifically devoted to the "Scientific Trends in Training the Sportsman."[118] Carlile made the

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116 "Selected Technique Articles from Track Coach," Track and Field News, http://www.trackandfieldnews.com/technique/ (accessed November 11, 2008).
117 "USA Track and Field Hall of Fame: Fred Wilt," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=184 (accessed August 12, 2007).
118 Carlile, "Scientific Trends in Training the Sportsman," 84-88.

observation that "even the casual observers of modern training methods will soon come to the conclusion that science has played an important part in bringing about the amazing improvements in sport since World War II."[119] With "systematic" and "formulated" methods coaches and physical educators in many sports were adopting a more scientific approach, he explained. This process was facilitated (particularly in swimming) by the detailed, long-term documentation of training logs that provided an excellent opportunity to formulate theories, linking cause and effect. In a quest for knowledge, Carlile visited many of the world's leading swimming nations. He was staggered by the Soviet Union's mass participation and interest in sport. He discovered how the Russians had been vigorously attacking the problem of how to scientifically control the amount of training given to a sportsman for many years. To this end they employed a multitude of tests, including blood pressure and heart rate monitoring during a standardized "dose" of exercise. The electrocardiograph (ECG) and the brachial pulse wave (that detected changes in the pressure of the brachial artery) were used to assess overtraining and those subjects who performed poorly were not allowed to compete. In comparison, the United States, where Carlile had spent time visiting Los Angeles, Michigan, Yale University, and Professor Thomas Cureton at the University of Illinois did not fare so well. "Although the custom is now for physical education graduates to fill coaching positions at the universities," Carlile noticed that there was "practically no applied laboratory science as found in the Soviet Union."[120] Furthermore, Carlile made the valuable

[119] Ibid.
[120] Ibid.

comment that because of research and academic obligations, Cureton (like many university-based exercise physiologists) was unable to monitor an athlete's training on a daily basis. The author proceeded to outline a multitude of tests that were used at the Cotton Memorial Laboratory in Sydney in an attempt to scientifically control the training of swimmers and other athletes. Carlile finished his appraisal of the application of science to sport with the following statement, "I believe in the long run, the nations which apply the results of research in human physiology will give their sportsmen advantages thereby helping them to further international success."[121]

SOVIET VERSUS WESTERN TRAINING APPROACHES: THE COLD WAR DIVIDE

In 1965 the first edition of another track and field journal, *Track and Field Quarterly Review,* appeared. It was produced by the United States Track Coaches Association and "dedicated to the promotion of the world's oldest sport."[122] Article One, Section Two of the Association's constitution serves to illustrate the stage of development of track and field research in the mid 1960s. Among its outline of the key purposes of the Association it included: 1) To work for the betterment and growth of amateur track and field, and 2) To encourage a greatly expanded national program of research in track and field in both its performance and medical aspects.[123] In 1969, John Cooper and J. Kenneth Doherty (see Chapter Five) proposed the need for "A National

[121] Ibid., 88.
[122] *Track and Field Quarterly Review* 67 (March 1967): 1-2.
[123] "Track and Field Constitution," *Track and Field Quarterly Review* 67 (March 1967): 7.

Program of Research in Track and Field."[124] This desire was at least partially motivated by the Cold War rivalry with the Soviet Union. "The need is there and it is crucial," the authors wrote, "how unfortunate that awareness in terms of action requires a crisis, a riot, a fire, a defeat by the Russians."[125] Included among the suggestions offered, included the demand for one or more centers for the coordination of track and field research. "Our national research is now haphazard and unplanned so that unwarranted emphasis is placed on certain problems whereas others of greater importance are entirely neglected."[126] To assist this task, the authors recommended compiling a bibliography of all track and field related research that had been published in the United States and abroad, including the thousands of graduate degrees which had been produced but never gathered and coordinated. To promote research, the authors recommended a close alliance between the coach and scientist, and wherever possible, to use track athletes to gather data. Finally, reciprocal cooperation with other organizations was emphasized including extending full cooperation to the ACSM for future research. The preceding information clearly illustrates that much like in the United Kingdom, a more coordinated centralized approach to the gathering and dissemination of track and field knowledge was necessary for the advancement of track and field.

Two articles, both emanating from the former Soviet Union, that specifically addressed the structure of training, were published in *Track Technique* in the mid-to-late 1960s. The first, written by Professor Nikolay Ozolin, examined the number of training

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[124] John Cooper and Kenneth J. Doherty, "A National Program of Research in Track and Field," *Track and Field Quarterly Review* (June 1969): 55-59.
[125] Ibid., 55.
[126] Ibid., 57.

hours required to be successful, the distribution of training load over time, and the use of a three-day training cycle.[127] In the Soviet Union it was universally accepted that in order to excel, two to three hours of training each day were required in the endurance events and a minimum of one hour per day was needed in the explosive events. Ozolin confirmed that as the intensity of a given training load increased this would inevitably lead to an overall decrease in the duration of training. To facilitate ongoing improvement, a three-day cycle was recommended. On the first day the training was intense, but of short duration. The second day's intensity was described as optimal with a slightly increased load. The final day involved the lowest intensity of training, but was longer in duration. No mention was made by the author of specific rest days.

The second article, "Foundations of Training Planning" by V. Popov, is the first encountered by the author in *Track Technique* that was exclusively devoted to the comprehensive planning of training.[128] This represents a watershed moment that demonstrates how the planning of training and training theory began to be recognized (at least in the Soviet Union) as an independent discipline in its own right. Popov began by affirming that "the training of athletes is a process, forming a whole, and serving the purpose of improving the ease of movement, the development of functional possibilities of the organism, and the increasing of will-power."[129] Achieving this goal required the cohesive cooperation and planning of multiple team members including coach, athlete, doctor, and scientist.

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[127] Ozolin, "Specific Conditioning," 841.
[128] Popov, "Foundations of Training Planning," 1217-1220.
[129] Ibid., 1217.

According to Popov, the early stage of training involved a constant increase in both the intensity and volume of workload. However, increases in the volume (quantitative side) of training always preceded increases in intensity. Popov explained the structure of the training program which was broken into yearly, monthly and weekly cycles. A yearly, two-cycle training plan was recommended because it allowed for two peaks in performance during the indoor and outdoor season. However, before a concrete yearly plan was drawn up, it was important to consider the following details: 1) the competition schedule for the year ahead; 2) an accurate analysis of the previous season results; and 3) the aims and goals of the proceeding season. A monthly training cycle involved a two-to-three week period where the workload was gradually increased. In the following week the workload was decreased by thirty to fifty percent to allow for the "functional condition" of the athlete to recover and be ready for the next cycle. To illustrate the value of comprehensive planning Popov outlined, in detail, a typical program for an elite female long jumper whose aim was to achieve 10.6 to 10.7 seconds in the 100 meters, 7.45 to 7.55 meters in the long jump, and to be awarded the honor of "Master of Sport" at the Soviet Spartakiad.[130]

If one compares Popov's training plan with a similarly titled article, "How to Plan Training for Track and Field" written by Jess Jarver, editor of the Australian magazine *Modern Athlete and Coach,* the differences are striking.[131] Jess Jarver was also the editor

[130] "Master of Sport" is the highest accolade in the USSR Sports Ranking System. The Master of Sport of the USSR is an honorary award conferred for life. For further information see Riordan, *Soviet Sport Background to the Olympics*, 47-48.

[131] Jess Jarver, "How to Plan Training for Track and Field," *Track and Field Quarterly Review* 72, no. 1 (1972): 52-53.

of the highly regarded *Contemporary Theory, Technique and Training* series that he edited for *Track and Field News Press,* and as such, he may be considered distinctly westernized in his approach.[132] Jarver divided the year into two main phases: Preparation Phase and Competition Phase. He mentioned a Foundation Phase but did not elaborate on its content. During the transition from the Foundation Phase to the Preparation Phase the training load, in most cases, reached its highest level, after which it gradually decreased. However, the intensity of training continued to rise during the Preparation Phase. Fitness training during the preparation phase was gradually replaced by more skill-related training without allowing fitness levels to drop. A shift in emphasis from longer, slower type runs to shorter, faster runs occurred. The training focus during the preparation phase slowly transitioned from physical conditioning to preparation for competition. Jarver acknowledged that wise planning during this phase had a decisive influence on competitive performances while mistakes made during this phase were hard to rectify once regular competition took place.[133]

The Competition Phase overlapped with the latter stages of the Preparation Phase. As a mark of progress, early competitions were completed in such a way as to not interfere with training. Once the full competitive season was under way, longer periods of rest were introduced prior to competition and the number of training sessions reduced. If necessary, more intense workouts were placed at the early part of the week. Jarver also discussed a variety of training methods that could be used to improve selected

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[132] Jess Jarver, ed., *Sprints and Relays: Contemporary Theory, Technique and Training*, 5th ed. (Mountain View, Ca.: Tafnews Press, 2000); Jess Jarver, ed., *Middle Distances: Contemporary Theory, Technique and Training*, 4th ed. (Mountain View, Ca.: Tafnews Press, 1997).
[133] Jarver, "How to Plan Training for Track and Field."

components of physical fitness (strength, power, cardiovascular endurance, muscular endurance and speed.) He concluded with the advice that "gradual loading is based on frequent changes of efforts and recoveries. With stress on intensity rather than the quantity, the intervalization of training combined with the gradual rise of the working load is a good protection against fatigue."[134]

Analysis of Jarver and Popov's articles reveals contrasting approaches to the planning of an athlete's training. Popov's plan, and indeed the majority of the research and training theory that emanated from the Soviet Union during this period, represented a more scientific approach to training.[135] Popov's plan featured a sophisticated division of labor where training was broken up into specific yearly, monthly and weekly cycles—with precise weekly calculations of training load, adjusted every second to third week. Also included in the overall training plan was provision to peak on two separate occasions. This was facilitated by a coordinated team approach that included the coach, athlete, doctor and scientist. In contrast, Jarver's team primarily focused on the coach-athlete relationship. Finally, Popov outlined how, after appraisal of the previous year's accomplishments, new goals—precise and achievable—were drawn up for the athlete to work towards. Jarver's approach, in contrast, echoed the more Western seasonal approach to training, where the training year was broken up into more simplistic divisions of preparation and competitive phases. As we shall see in Chapter Seven, the Soviet

[134] Ibid.

[135] As an indication, Popov, like many other Soviet researchers, depersonalized their subjects, (just like in a scientific experiment on animals) by referring to athletes as "organisms."

scientific approach to training and in particular periodization, would have major reverberations on the training of athletes throughout the world.

In 1972, exercise physiologist Christian W. Zauner and Edwin Reese, an assistant swim coach at the University of Florida wrote an article on "Specific Training, Taper and Fatigue."[136] Although the information emanated from the world of swimming, some swim coaches, as demonstrated in the earlier discussion of James "Doc" Counsilman, were both influenced by the training methods that emerged in track and field during the 1950s and, conversely developed theories and approaches to training that had a reciprocal effect on track and field athletes. The information presented by Zauner and Reese is the first encountered by the author in track and field literature that specifically addressed the topic of tapering where, in an effort to peak, training volume is decreased prior to a major competition. Indeed, the authors made the observation that although tapering was fairly common in swimming, it was employed rather infrequently by track athletes.[137] The authors discussed the tapering strategy that they had found to be particularly effective which began three weeks before a major competition. In addition to decreasing workload the authors also manipulated their athletes' diet. For the first two weeks the

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[136] Christian W. Zauner and Edwin Reese, "Specific Training, Taper and Fatigue," *Track Technique*, no. 49 (September 1972): 1546-1550.

[137] Thirty-five years after Coach Reese had co-authored "Specific Training, Taper and Fatigue," Reese had become the head swimming coach at the University of Texas, leading them to nine NCAA team titles. In the process he was named NCAA Coach of the Year eight times and the Head Men's Olympic Swimming Team Coach three times. In a personal communication (email) on 4 December 2007, Coach Reese expressed that because the body was partially supported by water during swimming, swim training was less demanding on the body than track training. As a result he was able to train his athletes harder, resulting in greater overcompensation (see Glossary) and the need for longer tapering periods. For further information on Coach Reese and his accomplishments see: "Head Coach: Eddie Reese," University of Texas & Host Communications, http://www.texassports.com/index.php?s=&change_well_id=2&url_article_id=162 (accessed December 27, 2007).

athlete ate a high fat, low carbohydrate diet, returning to a high carbohydrate diet in the final week of training. The last three days prior to competition were complete rest days where the athlete had the option of either omitting practice entirely or restricting practice to a warm-up. Tapering is an extremely important area of training that if performed correctly can mean the difference between winning and losing. If the right stimulus is applied at the wrong time, or the wrong stimulus at the right time, the athlete will not adapt optimally resulting in a subpar performance.

A number of select coaches were able to combine advances in physiological research with the practical training of athletes. In 1972, DeLoss Dodds, head track and field coach at Kansas State University (1963-1977), published "Physiological and Practical Bases for the Planning of Middle Distance Training at Kansas State."[138] Dodds began his appraisal with an analysis of stress. According to Dodds there were two kinds of reactions to stress. The first was stress adaptation and the second was stress adaptation failure. Stress adaptation was best summarized by the body being able to adapt to each stress placed upon it and recovering sufficiently before the next stress was administered. Dodds also made reference to the work of James "Doc" Counsilman by stating that it was possible to go two to three days into the "valley of fatigue," but then rebound and recover with lighter training loads.[139] Stress adaptation failure resulted from the body not being able to adapt to the stresses placed on it. This was either a short or long-term phenomena.

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[138] Dodds, "Physiological and Practical Bases for Planning Middle Distance Training at Kansas State," 143-151.

[139] The "valley of fatigue" is what James "Doc" Counsilman referred to as the feeling of general fatigue for several days. This contradicted the general belief during the late 1960s that swimmers should be fully recovered prior to recommencing training. For further information see: Counsilman, *Science of Swimming*, 235.

A short-term decrement meant that the athlete was not recovering from workout to workout, and therefore, was able to do less work each day. As a result the athlete's resistance to stress was lowered, which made him more susceptible to ailments such as cold viruses and muscle strains. Long-term stress adaptation failure had more severe consequences resulting in, among others, stress fractures and mononucleosis.

In order to get the best out of their athletes coaches had to become experts at reading signs of stress adaptation failure.[140] To achieve this goal the coach had to determine: 1) what organisms of the body needed to be improved through training to allow an athlete to perform at his maximum level; 2) what type of work must be used to apply a specific stress to the organisms which have been determined to be important; 3) how long and when to apply, through work, the specific stress; and 4) the fine line between stress adaptation and stress adaptation failure. Dodds proceeded to explain the progression of the four types of workout—Overdistance, Interval Training, Repetition Training, and Sprinting—that were used throughout the course of the year. A period of active rest was included during the transition between the end and start of each training year. In conclusion, Dodds analysis represents an intelligent, insightful approach to the training of athletes. In combining a physiological and practical basis for training, he joins the likes of Counsilman and Carlile as coaches who deeply understood the role of physiology and science in sport.[141] Dodds later become the Athletic Director of The University of Texas at Austin and gave up coaching.

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[140] Dodds, "Physiological and Practical Bases for Planning Middle Distance Training at Kansas State."
[141] Ibid.

This era culminated in 1975, with the publication of Frank Dick's "Periodization: An Approach to the Training Year."[142] Although Arnd Krüger had introduced the basic concept of periodization in 1973, it was Dick, the former National Athletics Coach for Scotland, who wrote the first detailed, English-language overview of periodization for coaches to follow.[143] This pioneering method of planning an athlete's training was developed by Professor Lev Pavlovich Matveyev of the former Soviet Union—the precise details of which are covered in Chapter Seven.

BIOMECHANICS

Biomechanics—a term that combines biology and mechanics—is considered a science that investigates the effects of internal and external forces on the human body in motion and at rest.[144] As a science, it provides valuable information to the coach and athlete on what is the most mechanically efficient way to move. For example, in 1968 at the Mexico Olympics, Dick Fosbury showcased a revolutionary new high jump technique—the so-called "Fosbury Flop"—where he jumped head first with his back facing the bar. Biomechanists in the 1970s and 1980s were able to explain in scientific terms why this technique was superior to the old "straddle" or "scissor" styles of jumping.[145] Exercise and sport science historians, John D. Messengale and Richard A.

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[142] Dick, "Periodization: An Approach to the Training Year," 1968-1969.
[143] Krüger, "Periodization or Peaking at the Right Time," 1720-1724.
[144] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 321.
[145] Jesus Dapena, "Mechanics of Rotation in the Fosbury Flop," *Medicine and Science in Sports and Exercise* 12 (1980): 45-53; D. Fix, "Why the Flop Is Better," in *Contemporary Theory, Teaching and Training*, ed. J. Jarver (Los Altos, Calif.: Tafnews Press, 1981), 44-46; K. Kerssenbrook, "Fosbury's Run-Up," *Modern Athlete and Coach* 12, no. 1 (1974): 18-19.

Swanson, distinguish between two periods in the history of biomechanics—the "kinesiology" era (pre 1960) and the "biomechanics" era (post 1960).[146]

Biomechanics emerged as a subdiscipline within exercise and sport science in the early 1960s. Technological advances made it possible to film an athlete and then to view the movements of sport in slow motion during this era and during the 1970s several textbooks had been written addressing the application of mechanical laws to human motion.[147] A small number of books were specifically aimed at the coach, including John Bunn's *Scientific Principles of Coaching* and Geoffrey Dyson's sport-specific *The Mechanics of Athletics* which Tom McNab and colleagues labeled as "the most authoritative piece of writing on its subject in the English language."[148]

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[146] Massengale and Swanson, eds., *The History of Exercise and Sport Science*, 321-322. Kinesiology is of Greek origin. *Kine* means movement or motion, and *logos* means to discourse or to study, thus making kinesiology the study of movement.

[147] For examples see Marion R. Broer, *Efficiency of Human Movement* (Philadelphia: Saunders Co., 1960); B.J. Hopper, *The Mechanics of Human Movement* (Great Britain: Fletcher & Sons, 1973); Jeremy Barham, *Mechanical Kinesiology* (St. Louis: Mosby Books, 1978); James G. Hay, *The Biomechanics of Sports Techniques* (Englewood Cliffs, N.J.: Prentice-Hall, 1973).

[148] John W. Bunn, *Scientific Principles of Coaching* (Englewood Cliffs, N.J.: Prentice-Hall, 1972); McNab, Lovesy, and Huxtable, *An Athletics Compendium*, 105; Dyson, *The Mechanics of Athletics*.

Figure 47. Geoffrey Dyson.[149]

As Chief National Coach of the United Kingdom's Amateur Athletic Association from 1947-1961, Dyson was ideally placed to disseminate biomechanical knowledge that had been directly applied at the track and field. In 1962 Dyson published *The Mechanics of Athletics,* which by 1986, was in its eighth edition. Dyson was keenly aware of the impact of science to sport. Quoting Leonardo Da Vinci (1942-1519) who wrote, "Those enamored of practice without science are like a pilot who goes into a ship without a rudder or a compass and never has any certainty where he is going," Dyson added, "Those who approach physical education without science are sailing a ship without a rudder or compass."[150]

[149] Image located at: http://www.sportscoachuk.org (accessed April 21, 2008).
[150] Dyson, "The Direction of Coaching," 25-29.

In keeping with a scientific approach to sport Dyson professed that "For human motion, with its boundless variability obeys the laws of all motion, and athletic skill at the highest level always applies these same principles to the utmost advantage."[151] Although all motion was ultimately reduced to the laws of physics, Dyson was quick to acknowledge the importance of balancing the more artistic side of coaching. Therefore, because athletes ultimately learned their skills through sensation, translating instructions into efficient motion was invariably preferable to athletes understanding the precise meaning of mechanical jargon. Moreover, and generally speaking Dyson felt that "all athletes are best left unaware of the exact nature of their movements and need only sufficient detail to correct faults, satisfy curiosity and inspire confidence."[152]

Chapter Six of *The Mechanics of Athletics* was devoted to "The Mechanics of Running." Dyson analyzed the precise mechanics of running but interspersed key practical information that could be applied by the coach. For example, a logical way for an athlete to improve the distance that they covered would be to increase the length of their stride. However, Dyson warned against a strategy of overreaching with the lead foot in an attempt to cover more distance. Instead, efficient stride length was the product of driving the whole body forward and not just the foot.[153] Finally, Dyson acknowledged that mechanical principles were but one piece in the examination for improved performance. In order to complete the picture it was necessary to consult with other sciences which provided their own unique methods and insights into the world of athletic

[151] Dyson, *The Mechanics of Athletics*, 9.
[152] Ibid.
[153] Ibid., 99.

performance.[154] "Thus to the physiologist, athletic performance is a phenomena of cells, humours, tissues and nutrient fluids obeying organic laws. The psychologist sees the athlete as a consciousness and a personality, while, to the physicist, he suggests a machine unique in its organization, adaptiveness and complexity."[155] It was the coordinated efforts of the coach, athlete and all of the sport sciences that would ultimately get the best out of the athlete.

In conclusion, Dyson confirmed the importance of the contribution of the different sub-disciplines of science as they apply to sport. It is only by using an integrated approach that athletes can fully achieve their potential and the sum of the parts can become greater than the whole. Coverage of all the different sub-disciplines of sport science (sociology, pedagogy, philosophy, motor behavior, and psychology) is beyond the confines of this dissertation.[156]

CONCLUSION

By 1975 a number of factors were responsible for a lack of applied training science in the United States. One of the key factors was the prevailing political climate. The political milieu in the United States and amateur track and field throughout this era (1945-1975) meant that an all-out effort to maximize gold medal production was never

[154] Ibid., 11.

[155] Ibid., 9. The enduring affect of Hippocrates and Galen's contributions are evident as Dyson makes direct reference to humours (or humors). The philosophical heart of both Hippocrates (ca. 480-?B.C.) and Galen's work (A.D. 129-200) was what came to be known as "humoral theory" or the idea that the body possessed four humors—blood, phlegm, bile (chole) and black bile (melaina chole) and that as these circulated in the body they determined a person's mood, health and character. The best book on the history of humoral theory is: Arikha, *Passions and Tempers: A History of the Humours*.

[156] For full coverage of the histories of each of these branches of exercise science see Massengale and Swanson, eds., *The History of Exercise and Sport Science*.

considered a priority. While Soviet athletes benefited from preferential state-supported occupations that allowed them time to train, most elite trackmen when they graduated from college competed for a year or two, then got a job, got married and duly retired. While a few big track meets paid under the table appearance money, track was no way to make a living.[157] The amateur system prevailed as making money out of running track was strictly against IAAF regulations.

Perhaps the greatest direct influence on the assimilation of training science during this era was a lack of knowledge of periodization. By 1975 coaches had four new sciences they could rely upon for help in the training of athletes. Two of these new sciences—exercise physiology and biomechanics—became part of the recognized sub-disciplines of nearly all physical education departments in American universities; they became part of the "academy" and recognized as legitimate academic areas of research. The science of resistance training, however, is only now finding true academic acceptance. That recognition has come from the efforts of the professional association known as the National Strength and Conditioning Association (NSCA) and the valuable role that group has played in promoting academic research and practical training in the field.[158] However, the final science that emerged during this era, is still not recognized as a discrete academic discipline in the United States. Nonetheless the science of training organization—the methods by which training programs are organized with consideration

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[157] James Dunaway, "Five Game-Changers, Track & Field," *Scholastic Coach*, http://www.scholastic.com/coach/article.asp?ItemID=295 (accessed August 10, 2006).

[158] For information on the history of the NSCA see: Scott A. McQuilkin and Ronald Smith, *The World's Source for Strength and Conditioning: A History of the National Strength and Conditioning Association (1978-1993).* (Unpublished) Available at the Todd-McLean Physical Culture Collection in the H.J. Lutcher Stark Center for Physical Culture at the University of Texas at Austin.

of the calculation of load and intensity and time and recovery, and so on—would become in the era after 1975 one of the most significant "sciences" in all of sport training.

In contrast, in the former Soviet Union, the science of training organization has been recognized as a distinct academic discipline worthy of considerable study. Coaches have spent hundreds of hours learning about the general theory of sport and the fundamentals of sports training, and scientists there have worked in tandem with coaches and athletes to practically apply their research—all in an effort to achieve world sporting domination.

This attention to the organizational aspects of training—to studying stress and adaptation—no doubt helps explain why Eastern European athletes in many cases looked fitter than their American counterparts in the post-war years. They often seemed to have greater muscle density, greater cardiovascular capacity, and they seemed to arrive at contests in optimal condition. Although many Americans and Western Europeans were quick to suggest that the changes being seen in Soviet, East German, and other Eastern Bloc athletes came from their suspected use of ergogenic drugs, steroid use does not totally account for the Eastern Bloc's new success. What does explain it, the author contends, is the Eastern Bloc's adherence to a new methodology of training—called periodization—in which athletes were prepared for competition using a highly sophisticated system involving training cycles and a variation in the volume and intensity of workouts. Although many Americans and Western Europeans knew that the Soviets and others were doing something different, it was not until 1975, when Frank Dick translated and then published an English-language overview of periodization based on the

ideas of Lev Pavlovich Matveyev of the Soviet Union that the Americans began to fully understand and subsequently use for themselves this important training breakthrough.[159]

[159] Dick, "Periodization: An Approach to the Training Year," 1968-1969.

CHAPTER SEVEN

THE RISE OF THE BIG RED MACHINE: SOVIET SPORT SCIENCE AND THE ADVENT OF MODERN-DAY PERIODIZATION

> Sport as a social phenomenon is organically included in the system of social relations and is conditioned in its development by social, economic and related factors. That is why the level of sporting achievements in this or that country depends in the final analysis on the conditions of material life of a society.[1]

In the decades after World War II, American sport science grew in what might best be described as "fits and starts." There were periodic bursts of activity—new discoveries made that were quickly translated into layman's language and published in coaching journals—followed by quiet times with seemingly no new innovations for a period of years. With no state support for research, and no Olympic-driven private funding of research, most American track and field coaches continued to rely on "art" as well as science in their training prescriptions. Times improved, shots and disci were thrown further as the years advanced, but none of the training methods discussed in earlier parts of this monograph should be regarded as a "watershed" in track and field training. In truth, most coaches continued to work alone, often even somewhat secretly, creating their own systems and methodologies for training athletes. There was no unified

[1] Matveyev, *Fundamentals of Sports Training*, 11.

approach. Many American runners continued to do well, but by the 1960s the USA was no longer dominating the Olympic Games or the large world meets.

Meanwhile, behind the Iron Curtain an entirely different approach to the training of athletes was evolving. There, a systematic, nationally funded sport science program emerged that aimed at increasing Olympic performance in *all* sports. Unlike America where coaches often had to *extrapolate* how certain conditions would affect training from articles on military fitness or medical rehabilitation, Eastern Bloc coaches had researchers working hand-in-hand with them, studying the very athletes who would participate in the Games. Further, instead of just looking at the physiological responses to exercise, Eastern Bloc researchers took a more holistic view. As Professor Lev Pavlovich Matveyev of the Central State Institute of Physical Culture in Moscow, put it, sport and sports training had to be understood within the wider context of physical culture and society. That broader view and the funding and state support that came with that view, allowed Eastern Bloc nations—particularly the Soviet Union and East Germany—to reach new heights of athletic performance. It also, as the discoveries made in Eastern Bloc labs leaked out, revolutionized sport training around the world.

THE SOVIET BLOC AND THE COLD WAR

During World War Two, the Soviet Union penetrated Central and Eastern Europe and created ten Soviet-aligned states (it added China in 1949).[2] The rest of the European nations' political, military, and economic strengths were severely debilitated by the

[2] Riordan, "Rewriting Soviet Sports History," 247-258.

effects of the war. Consequently, the balance of power in Europe (and globally) radically changed. The Soviet Union was left as the sole military and political force capable of matching the United States. After the war, the desire for "peaceful coexistence" between the Soviet Union and the United States meant the sporting arena assumed greater political significance. Sport symbolized the ideological power struggle between the two nations. Peripheral to international politics, sport became the ideal setting for the Soviet Union to exert its influence over the United States because it was a place where American athletes could be defeated without fear of immediate military reprisal.[3] The desire for increased global power and influence prompted a 1948 Soviet decision by the Central Committee of the Communist Party to divert its emphasis away from co-operative mass physical culture, towards the full-scale mobilization of resources necessary for the attainment of world sporting supremacy.[4] As one historian explained this transition, "The Central Committee of the party…[found] that the main tasks in the field of physical culture work are the promotion of a physical culture mass movement in the country and the raising of the level of athletic achievements, and, on that basis, the winning by Soviet athletes within the next few years of world leadership in the major sports."[5]

The 1948 decision by the Central Committee was part of a wider Soviet strategy to participate in national organizations such as the United Nations.[6] James Riordan, former

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[3] David B. Kanin, "Superpower Sport in Cold War and Détente," in *Sport and International Relations*, ed. B. Lowe (Champaign, Ill.: Stipes, 1978), 249-262.
[4] Allen Guttmann, "The Cold War and the Olympics," *International Journal* 43, no. 4 (1988): 554-568.
[5] Henry Morton, *Soviet Sport* (New York: Collier, 1963), 37.
[6] Allison Lincoln, "The Olympic Movement and the End of the Cold War," *World Affairs* 157, no. 2 (Fall 1994): 92-97.

professor of Russian Studies at the University of Surrey, felt that the Soviet sports policy served five specific aims: 1) The promotion of relations with pro-Soviet and potentially sympathetic groups abroad, thereby undermining 'bourgeois' and social democratic authority; 2) The promotion of good-neighborly relations with states bordering the USSR, thereby demonstrating the progress made by kindred people under socialism; 3) Winning support for the USSR and its policies among developing states in Africa, Asia and Latin America; 4) Maintaining and reinforcing the unity of the socialist community and the Soviet "vanguard" position within it; and 5) Attaining world sporting supremacy as a nation state, particularly through the Olympics, thereby enhancing the status of the USSR and Soviet communism abroad.[7]

The 1948 decision by the Central Committee resulted in the mobilization of vast resources in a nationwide search for sporting talent and the systematic development of athletes necessary to attain world sporting domination.[8] After an initial period of deliberation, the USSR was formally admitted into the International Olympic Committee (IOC) in May of 1951.[9] The Soviet decision to participate in the 1952 Helsinki Olympic Games marked a significant turning point in Olympic history. Most significantly, Soviet participation marked a re-introduction of politics to the Olympic movement after the 1936 "Nazi" Olympics and the emergence of the controversial "state amateur." Technically, Soviet athletes fulfilled IAAF amateur regulations. However, in reality

[7] Riordan, "The Role of Sport in Soviet Foreign Policy," 569-595.
[8] "Muscles Pop through Iron Curtain," *Life* 28 July 1952, 15-19.
[9] Guttmann, "The Cold War and the Olympics."

financial incentives and preferential job allocations (that gave athletes sufficient time to train) meant that Soviet athletes were effectively paid professionals.[10]

The Soviet Union's debut at the 1952 Olympics was dramatic, particularly in light of their lack of experience against world-class opposition. Although the USSR gained fewer overall gold medals than the United States (twenty-two versus forty), they gained more silver (thirty versus nineteen) and bronze medals (nineteen versus seventeen). They also tied with the United States in an *Olympic Bulletin* scoring system that allotted points for the first six places.[11] Four years later, at the 1956 Melbourne Olympic Games, the Soviets had progressed so rapidly that they increased their gold medal production by a staggering forty percent and convincingly displaced the USA from the top of the unofficial medal table.[12]

[10] L. Maxwell and Reet Howell, "The 1952 Helsinki Olympic Games : Another Turning Point?," in *The Modern Olympics*, ed. P.J. Graham and H. Ueberhost (West Point, N.Y.: Leisure Press, 1976), 187-188.
[11] Riordan, "The Role of Sport in Soviet Foreign Policy," 588.
[12] Wallechinsky, *The Complete Book of the Olympics*, xv.

Figure 48. A portrait of Stalin is attached to one of the buildings at the Soviet athletes' quarters at Otaniemi camp, Helsinki, four days before the start of the 1952 Olympic Games, 15 July 1952 (Photo by Keystone/Hulton Archive/Getty Images).

The USSR proceeded to dominate the winter and summer Olympic Games up until the dissolution of the USSR in 1991 and even after in 1992 when the independent countries competed as a unified team at the Barcelona Olympics. The only exceptions included second place finishes to Norway in the 1968 Winter Olympics, to the United States in the 1964 and 1968 Summer Olympics, and to the German Democratic Republic

in the 1980 and 1984 Winter Olympics. In doing so the Soviets amassed a total of 395 gold, 319 silver, and 296 bronze medals.[13]

The 1956 success of the Soviet team was treated with a mixture of reverence and indignation by American officials, team members, and journalists. As a 1956 *US News Report* stated, "The newest Soviet offensive in the Cold War is being waged by Russian athletes…and they've gone about it with the large-scale efficiency of a nation preparing for war."[14] American antagonism was fuelled by propaganda emanating from *Pravda*, the leading newspaper in the Soviet Union which stated, "It is our task ceaselessly to develop sport…to struggle for new world records and championships for our loyalty to the Communist Party…and our confidence in the victory of our cause."[15] In a similar vein, Soviet journalists often wrote "each new victory is a victory for the Soviet form of society and the socialist sport's system; it provides irrefutable proof of the superiority of socialist culture over the decaying culture of the capitalist states."[16]

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[13] Ibid., xv-xvi.
[14] "If Russia Wins Olympic Games," *US News and World Report* 10 February 1956, 35-36.
[15] John Grombach, "The Cold War in International Athletics," *American Mercury* 90 (19 June 1960): 30.
[16] Senn, *Power, Politics and the Olympic Games*, 90.

Figure 49. A prime example of Soviet propaganda. The Soviet poster reads: USSR is a mighty sports power! (B. Reshetnikov, 1962).[17]

Elsewhere, the American response was more damning. In 1956, Senator John Butler, reacting to the damaging effect of the Soviet team's success at Helsinki to America's prestige, called for the immediate expulsion of the Soviet Union from Olympic competition on the grounds that, "the Soviet athlete is a paid propaganda agent of the USSR and as such has no right to participate in the Olympic Games."[18] Other

[17] Image available http:/sovietposter.blogspot.com. (accessed March 12, 2008). In Cyrillic (the Russian alphabet), the Roman 'S' and 'R' are characterized as 'C' and 'P,' respectively. Thereby, 'USSR' means the same as CCCP. For further information see: http://www.merriam-webster.com/dictionary/cyrillic

[18] US Congressional Record, Senate 84th Congress. 17 May 1956, CII, 8335 quoted by Alan R Platt, "The Olympic Games and their Political Aspects 1952 to 1972" (Ph.D diss., Kent State University, 1976).

American accounts were more optimistic in their appraisal and extolled the virtues of the "winning tradition" of the American athletic system. A 1956 *US News Report* titled, "Red Supermen Lose," (referring to the track and field results and not to the overall medal tally) highlighted the potential of the American system to redeem itself by stating, "most of the Americans here are convinced that the 'competitive drive' that goes with the US system of amateur athletics is far superior to the methodical machine-like training that is inherent in sports that are Government controlled and subsidized as they are in Russia."[19]

The remarkable achievement of the Soviet Union and how the so-called "Big Red Machine" came to dominate Olympic sport at the expense of the United States was appraised in a 1976 *US News Report* titled "How Russia Wins Olympics."[20] It outlined the key factors responsible for Soviet success which included: 1) the early selection and training of Russia's future champions (starting at the age of five in sports such as swimming); 2) the use of special talent schools to develop athletic ability; and 3) state support of the majority of Soviet athletes. This contravened the fundamental amateurism rules of the IOC first extolled by the reviver of the modern Olympic Games, Baron Pierre de Coubertin. In contrast, the United States Olympic Committee (USOC) did not receive any financial subsidy from its government—instead relying on voluntary contributions and had no organized method of developing and peaking athletes for the Games. In fact, because there was no real understanding of training in many quarters of the United States, even the scheduling of events was often disadvantageous to real achievement. For

[19] "Red Supermen Lose," *US News and World Report* 41 (7 December 1956): 106-108.
[20] "How Russia Wins Olympics," *US News and World Report* 80 (28 June 1976): 56-57.

example, in 1960 the Americans qualified for the Olympic team at the US Olympic Trials held in Palo Alto on July 1-2. This left them only seven to eight weeks to recover from the trials and prepare for the Games—not nearly enough time to recover and go through what we would now call a "full" training cycle. In comparison, Soviet athletes manipulated their training by spending many months (and indeed years) preparing to peak at the Olympic Games.[21]

Figure 50. An example of the early selection and fostering of young talent as the Soviet women's gymnastics team won the team event at the 1972 Munich Olympics. Olga Korbut winner of four Olympic medals (three gold and one silver) is pictured third from the left.[22]

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[21] Ibid.

[22] Image available http://cache.viewimages.com (accessed May 12, 2008).

Other factors that contributed to Soviet success included their interest in training athletes for all Olympic sports, even those less popular ones such as rowing, weightlifting, wrestling and gymnastics. Yuri Brokhin, author of *The Big Red Machine,* a text that "outed" many of the myths of Soviet sport, summarized the targeting of specific sports by stating, "Olympic planning in Russia focuses not on a sport's popularity but on other countries' weakness in it."[23] The Soviets and other Eastern Bloc nations also focused on developing female athletes particularly in track and field events "where the US is the weakest," and where there was the greatest margin for improvement.[24] To illustrate the significant contribution of women to Soviet sporting success, James Riordan notes that of the seventeen track and field matches held between the USA and USSR between 1958 and 1981, the USSR women amassed a higher points total on thirteen occasions (one match being drawn, the US winning three). In contrast, the Soviet men won on only five out of seventeen occasions.[25]

[23] Brokhin, *The Big Red Machine*, 118.
[24] "Stalin's Iron Curtain for Athletes," *US News and World Report* 33 (25 July 1952): 42-44.
[25] Riordan, "The Role of Sport in Soviet Foreign Policy."

Figure 51. USA versus USSR held at Stanford University, 1962.[26]

Finally, the mobilization of huge resources devoted specifically for sports development played a very important role in this search for sporting domination. For example, the self-promoting book, *Soviet Sport—The Success Story*, claimed that in 1987 virtually ninety million people were engaged in various forms of physical activity and sport, with more than 350,000 full-time people employed in physical culture professions like coaching, physical education instruction, and sport science research. Moreover, Valery Kudryatsev, the editor-in chief of *Sovetsky Sport,* the leading USSR sports paper, declared that over 130 institutes were conducting research and developing projects in the sphere of physical culture, and that over two hundred specialized higher and intermediate

[26] Image located at: http://www.pbs.org/redfiles/sports/index.htm (accessed March 21, 2008).

educational institutions were training personnel for sports.[27] Such figures deserve close scrutiny, particularly in light of Yuri Brokhin's revelations regarding "The Myth of Mass Sport," and James Riordan's "Rewriting Soviet Sports History" that shed light on the darker side of communist sport.[28] For although "Sport for All" was a central tenet of the communist system, it was too costly and brought neither prestige nor glory to the party.[29] Furthermore, athletes, coaches, sports medics, officials, and journalists frequently had to over-inflate numbers and "lie through their teeth" in order to keep their jobs.[30] Despite these shortcomings, claims of such mass participation serve to illustrate the immense importance attached to Soviet sport.

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[27] A. Timofeyev and Y. Kopytkin, eds., *Soviet Sport-the Success Story* (Moscow: Raduga Publishers, 1987), 9-10.
[28] Brokhin, *The Big Red Machine*, 99-131; Riordan, "Rewriting Soviet Sports History."
[29] Riordan, "Rewriting Soviet Sports History."
[30] Ben Tabachnik and Rick Bruner, *Soviet Training and Recovery Methods* (Pleasant Hill, Ca.: Sport Focus Publishing, 1990), 20-21.

Figure 52. This Soviet poster reads: "If you want to be like me just train." (V. Korstskiy 1951).[31]

The sporting Cold War raged from the early 1950s until the dissolution of the (USSR) in December of 1991. It reached a sporting peak in 1980 when the US withdrew from the Moscow Olympics to protest against the Soviet invasion of Afghanistan in December 1979. US President Jimmy Carter duly informed the USOC in February of 1980 that he expected it to withdraw the US team from the forthcoming Olympics. The perceived gravity of the situation was further articulated by Vice-President Walter

[31] Image available at http:/sovietposter.blogspot.com (accessed April 18, 2008).

Mondale in his appeal to the USOC, "History holds its breath, for what is at stake is no less than the future security of the civilized world."[32] Four years later, the Soviet Union responded with a retaliatory "tit for tat" boycott of the 1984 Los Angeles Olympics, with the official reason being that they feared the Soviet athletes would not be safe in the anti-Soviet climate of the United States.

With the advent of *Glasnost* and Mikhail Gorbachev's revolutionary reforms in the 1980s, the fall of the Berlin Wall in November 1989, and the dissolution of the Soviet Union in 1991, the Cold War finally came to an end. At the turn of the twenty-first century, Russian track and field continued to be a formidable force in world athletics. At the 2001 World Track and Field Championships in Edmonton, Canada, Russia gained nineteen overall medals compared to the USA's seventeen.[33] Their fine showing was repeated at the 2004 Olympics where the Russian Federation won a total of ninety-two medals compared to the USA's winning team total of 102.[34] Fortunately, as James Riordan highlights in "Rewriting Soviet Sports History," the vast resources that were previously devoted to elite sport in order to promote political aims at the expense of casual sport, handicapped sport, and general social provision are now confined to the annals of history.[35] However, the diaspora of Soviet methods of training—particularly the principle of periodization—would revolutionize athletic performance throughout the world.

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[32] Kane Robert, "The Decision: No Go On Moscow," *Sports Illustrated* 52 (21 April 1980): 30-33
[33] "8th 2001 IAAF Word Championships in Athletics, Edmonton, Canada," International Amateur Athletics Association, http://www2.iaaf.org/WCH01/Results/Medaltable.html (accessed May 15, 2003).
[34] "Athens 2004: Games of the XXVIII Olympiad," International Olympic Committee, http://www.olympic.org/uk/games/past/index_uk.asp?OLGT=1&OLGY=2004 (accessed October 2, 2007).
[35] Riordan, "Rewriting Soviet Sports History."

LEV PAVLOVICH MATVEYEV AND THE ADVENT OF PERIODIZATION

Analysis of key American track and field texts around the middle of the twentieth century such as George Breshnahan and Waid Tuttle's *Track and Field Athletics* (1947) and Kenneth Doherty's *Modern Track and Field* (1953) reveals that the detailed division and composition of an athlete's training attracted little attention.[36] Indeed, Doherty failed to include a section on training and how an athlete's work should be divided over the course of the year. Breshnahan and Tuttle allotted no more than three to six months (mid-March to mid-June) to specific track and field preparation and competition.[37] The remainder of the year was devoted to complementary sports and activities such as football, basketball, and tennis. Jimmy Pedemonte in "Foundations of Training Periodization" noted that although by the end of the 1950s training for American track and field had extended to the whole year—the theoretical foundations of training were not treated with enough scientific vigor. Furthermore, the most important problem of what factors were necessary to induce the periodical changes associated with training, such as the optimal training load and the timescale of the adaptive response, had not been solved, identified and applied to sport.[38]

The political milieu in the Soviet Union however, was quite different. With the allocation of vast resources dedicated to the application of science to sport, researchers looked at all aspects of the problem of sport performance. Some focused on basic, applications such as foot placement or the proper position to hold the arms while

[36] Bresnahan and Tuttle, *Track and Field Athletics*; Doherty, *Modern Track and Field: Promotion, History and Methods*.
[37] Bresnahan and Tuttle, *Track and Field Athletics*, 46.
[38] Pedemonte, "Foundations of Training Periodization. Part I: Historical Outline," 62-65.

sprinting. Others, however, wanted to look at the larger story from a theoretical perspective. For track and field, the most important Soviet training theorist was Lev Pavlovich Matveyev.

Figure 53. Yuri Verkhoshanksky (left) and Lev Matveyev, the "Father" of periodization.[39]

After introducing his research in 1962, Matveyev published *The Fundamentals of Sports Training* in 1965—a book that was almost immediately translated into most of the languages used in the Soviet Bloc.[40] The first Western translation was into German by

[39] Image located at: http://www.verkhoshansky.com (accessed March 2, 2008).
[40] Matveyev, *Periodization of Sports Training*.

throwing coach, Peter Tschiene, in 1968, for the West German Sports Federation.[41] In 1971, Arnd Krüger, the former Olympian and the eleven-time West German Champion at 1500 meters, revised Tschiene's German translation and included an additional chapter on Matveyev's more recent periodization articles.[42] Kruger's version reached a much wider audience which facilitated the translation into a multitude of other languages.[43] By 2001 *The Fundamentals of Sports Training* had been translated into more than forty languages.[44] The first full edition in English of Matveyev's theory did not appear until 1981 when Albert P. Zdornykh translated it.[45] Because this book was published in Russia, and not the United States, however, it did not immediately have an impact here. Americans for the most part were still learning about periodization from articles published in coaching journals which will be discussed later.

To help formulate his ideas, Matveyev analyzed the athletic performances and training profiles of several thousand top athletes in events that could be easily quantified such as track and field, swimming and weight lifting. From the gathered data he derived a general theory of sport and training that guided the training process to facilitate ongoing

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[41] Lev Pavlovich Matveyev, *Periodisierung Des Sportlichen Training*, trans. Peter Tschiene (Berlin: Bartels & Wernitz, 1968).

[42] Lev Pavlovich Matveyev, *Periodisierung Des Sportlichen Training*, trans. Arnd Krüger (Berlin: Bartels & Wernitz, 1972). Although Krüger revised the German translation, it was not until 1972 that his edited version was published. For further information on Krüger see: "Arnd Krüger," Intellect Books, http://www.intellectbooks.co.uk/authors.php?author=158 (accessed March 10, 2008).

[43] Krüger, "Periodization or Peaking at the Right Time," 1720-1724. Examples of Matveyev translated articles include: L.P. Matveyev, *Periodizacion Del Entrenamiento Deportivo* (Madrid, Spain: Instituto Nacional de Educacion Fisica, 1977); L.P. Matveyev, "Principles of Training Planning During the Immediate Pre-Competition Preparation," *Sport Wyczynowy* 17, no. 7 (1979): 18-23; L. P. Matveyev, "De La Theorie De L'entrainement a La Theorie Generale Du Sport," *Teoria i Praktika Fiziceskoj Kultury*, no. 5 (1998): 5-8.

[44] Lev Pavlovich Matveyev, interview by Shanna Dorian of the University of Texas conducted at the Russian State Academy of Physical Culture, Moscow on 16 November 2001. Ms. Dorian was given a set of questions to ask Professor Matveyev by the author.

[45] Matveyev, *Fundamentals of Sports Training.*

progress and peaking at the right time. In a 2001 interview, conducted for this dissertation, Matveyev explained that his research was, "Mainly…in the field of comparative analysis examining the influences acting upon athletes during sports training and competition. Also, I looked at the reactions of the body of the athlete, taking into account as many systems of the body as possible. The research involved the laws and relationships between the stimuli which are organized in the process of sports training and how they are related. This was the mainstream of the research."[46]

Matveyev's general theory of sport was all encompassing. It included the philosophical and methodological aspects of sports theory, the social and psychological aspects of sport (sports history, sociology, aesthetics, and ethics), the biological aspects of sport (anthropometry, morphology, biophysics, biochemistry, physiology), sports medicine (trauma and therapy), and the metrological (measurement) aspects of sports theory.[47] However, Matveyev's defining contribution (at least how he has been perceived in the West) was the concept of periodization. Periodization refers to the division of an athlete's training program into specific periods or "cycles" of time. The term "cycle" is specific to the Soviet theory of planning. For example, four-year "cycles" were used for the execution of one state plan to the next. "Cycles" were also used in Soviet industrial production and in the description of the "life-cycle" of a product. Matveyev and other training theorists simply used the planning science of the Soviet government and applied

[46] Lev Pavlovich Matveyev interview.
[47] Matveyev, *Fundamentals of Sports Training*, 24.

it to the process of human sporting adaptation.[48] Specifically, periodization can be defined as a logical, phasic method of manipulating training variables in order to increase the potential for achieving specific performance goals, such as peaking at the right time.[49] Matveyev incorporated aspects of Selye's observations on stress and adaptation in his theory, but then went even further, arguing that with planning and proper execution, an athlete could be prepared so that he'd be at his maximal best for competition on a particular day. The coach or coaching system that could properly manage peaking would have a great advantage in sport competition.

Due to the gravity of Matveyev's work, an in-depth analysis and discussion of the contents of his groundbreaking text is essential. *The Fundamentals of Training* was divided into three main sections. The first section introduces the characteristics of sports training and the theoretical and methodological problems associated with sport. From the outset Matveyev placed sports training within a wider context, "Sports training is a component of a broader phenomenon—sport itself. It appeared, developed, and is developing at the moment in unity with other aspects of sporting activity. Therefore, to understand the problems of sports training it is important to have a general idea about the essence of sport as a whole."[50] Sport, in turn, was organically linked and affected by

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[48] Arnd Krüger, "Cycles," 30 April 2000, personal email (30 April 2001). Krüger is a sport history professor at the George-August University in Göttigen**,** Germany and former West German Olympic runner and National Coach. Kruger was responsible for revising Peter Tschiene's German translation of Matveyev's *Fundamentals of Sports Training* and as such is considered an authority on the history of periodization.

[49] Michael H. Stone, "The Concept of Periodization" (paper presented at the Leading Edge in Strength and Conditioning (National Coaching Foundation), Bisham Abbey, England, December 1998).

[50] Matveyev, *Fundamentals of Sports Training*, 6. For further information on the role sport in Soviet society see: Lev Pavlovich Matveyev, "The Formation of the General Theory of Physical Culture," *Social Sciences* 11, no. 2 (1980): 26-38.

social, economic, and related factors, to the extent that "the level of sporting achievement in this or that country depends in the final analysis on the conditions of material life of a society."[51]

The key starting point to the whole training process, according to Matveyev, was the calculation of optimal load and rest parameters necessary to ensure ongoing improvement. Training load referred to the additional stress introduced by the performance of training exercises, and rest was used to ensure restoration of work capacity. The direct aim of training was not rest, but rather the achievement of the optimal training effect. The dosage of rest, therefore, was always subordinated to the desired level of training.[52] Directly linked to training load, were the concepts of volume and intensity. Volume referred to the sum quantity of work performed during training and intensity referred to the level of difficulty of an exercise.[53] Volume and intensity could be increased to a certain limit, beyond which they exhibited an inverse relationship, where further increases in intensity necessitated a decrease in volume and vice versa.[54]

Part Two of *The Fundamentals of Training* covered the physical and mental aspects of training necessary to prepare an athlete for competition. It included psychological, intellectual, technical, and tactical training, along with the attainment of the physical attributes, such as speed, strength, endurance, flexibility and coordination.

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[51] Matveyev, *Fundamentals of Sports Training*, 11.
[52] Ibid., 53.
[53] Ibid., 48.
[54] Lev Pavlovich Matveyev, "About the Construction of Training," *Modern Athlete and Coach* 32, no. 3 (July 1994): 12-16; Matveyev, *Fundamentals of Sports Training*, 48.

Finally, Part Three of the book, for which Matveyev received the most acclaim, covered the fundamental structure of training, including the use of training cycles and how they were periodized over the course of a year. The smallest of the cycles were referred to as microcycles, typically one week in duration that included individual day-to-day workouts.[55] Each microcycle included at least two phases—a stimulating or cumulative phase which was connected with a certain training load and resultant fatigue, and a rehabilitating phase that consisted of a recovery session or complete rest. A weekly cycle consisted of, for instance, two cumulating phases (consisting of two to three sessions) separated by rehab sessions and finalized by a day of active rest.[56] Matveyev distinguished between different types of microcycles, the primary ones being Training and Competition microcycles. Training microcycles contained the rudiments of training and were divided into General Preparatory, Special Preparatory (depending on their objective), and Competition microcycles (designed to achieve maximal results in the competition period). Other types of microcycles included Rehabilitation microcycles that focused on recovery after a tough competition, Shock microcycles characterized by a greater density and intensity of training, and Introductory microcycles that preceded competition microcycles and were aimed at preparing an athlete for competition.[57]

Average training cycles, or mesocycles, consisted of three to six small microcycles that commonly lasted one month.[58] Once again, Matveyev distinguished

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[55] Matveyev, *Fundamentals of Sports Training*, 249.
[56] Ibid.
[57] Ibid., 251-252.
[58] L.P. Matveyev, "Modern Procedures for the Construction of Macrocycles," *Modern Athlete and Coach* 30, no. 1 (January 1992): 32-34.

between different types of mesocycles. Base and Competitive mesocycles were staple mesocycles that featured throughout the whole training process, while others (Involving, Control Preparatory, Pre-Competition and Rehabilitation) were introduced only during certain stages of training. Base mesocycles were the main type of cycle used in the preparatory training period and were either general preparatory or special preparatory in nature.[59]

The Annual or Semi-Annual macrocyles were the "big" training cycles. A Semi-Annual plan divided the year into two segments and was used for sports such as track and field, where it was often necessary to prepare and peak for two distinct seasons—indoor and outdoor, whereas an annual plan was literally that—a year in length. Macrocycles were composed of three main periods—a Preparatory Period of fundamental training, a Competitive Period involving the main competitions, and a Transitional Period that linked the two preceding periods.[60]

The Preparatory Period was divided into two main stages—General Preparation and Special Preparation. The General Preparatory Period consisted of the general enhancement of the athletes' biomotor abilities (strength, speed, flexibility, endurance) as well as supplementary motor skill development.[61] It was characterized by a gradual increase in volume and intensity, but with a preferential increase in training volume (amount of work performed).[62] The Special Preparatory Period, shorter than the General Preparation Period, aimed at the development of specialized training designed to master

[59] Matveyev, *Fundamentals of Sports Training*, 255-256.
[60] Ibid., 259.
[61] Ibid., 270; Matveyev, "About the Construction of Training."
[62] Matveyev, *Fundamentals of Sports Training*, 270.

"selected technical and tactical habits and skills in the form they will be used in the forthcoming main competition."[63] The Preparation Period lasted three to four months in a semi-annual plan and five to seven months in an annual plan.

The Competitive Period consisted of the main competitive exercises, regimes, and competitions around which the entire training process was planned. This period lasted one and one-half to two months in a semi-annual plan and four to five months in an annual plan.[64] The final stage, the transitory period involved three to six weeks of active recovery also termed "active rest." In this phase emphasis was placed on physical and emotional relaxation involving leisure pursuits that allowed the athlete to come back "fresh" for the following year's training. The inclusion of a modified level of activity, instead of complete rest, ensured continuity between the competitive and preparatory periods.[65]

The preceding synopsis of Matveyev's work has focused on the theoretical aspects of training. However, did the theory work in practice, and what clinical reasoning was behind such a detailed approach to training? To help answer this question we need to look no further than the 1960 Rome Olympics. Most expert observers in this era believed the United States had assembled its best ever track and field team and expected them to surpass the previous record of fifteen medals.[66] The favored group of track and field athletes included: 1) John Thomas, the reigning world record holder in the high

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[63] Ibid., 271.
[64] Ibid., 267.
[65] Ibid; Matveyev, "Modern Procedures for the Construction of Macrocycles."
[66] Ziewacz, *The Games They Played: Sports in American History, 1865-1980*, 289.

jump, who had cleared seven feet, thirty-seven times previously;[67] 2) Ray Norton, world-record holder in both the 100-and 200-meter sprints, who had been unbeaten for two years; and 3) Harold Connolly, the reigning Olympic champion in the hammer throw, who broke his own world record just two weeks prior to the Olympics.[68]

However, the American track and field favorites failed to live up to expectations. No one under-achieved more than Ray Norton, who finished sixth in both the 100 and 200 hundred meters. Norton was the clear favorite going into the Olympics, after sweeping both sprints at the preceding USA-USSR meet, the 1959 Pan-American Games, and the 1960 US Olympic Trials.[69] However, it appeared that he peaked too soon, as three of the four world records he broke or tied that year were set in March and April.[70] In the high jump John Thomas jumped 7' ¼" finishing third behind two Russians (one of whom had never jumped seven feet before), and Harold Connolly failed to make the finals of the hammer throw although two weeks earlier he had broken the world record.[71] Clearly, the Americans had misjudged their readiness for competition.

The precise details of how to increase the chances of peaking at the right time was a key motivating factor behind Soviet sporting inquiry. In 2001, Professor Matveyev reflected on the results of prior Olympic Games (including the 1960 Rome Olympics) and

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[67] "USA Track and Field Hall of Fame: John Thomas," USA Track and Field, http://www.usatf.org/HallOfFame/TF/showBio.asp?HOFIDs=168 (accessed September 19, 2007).
[68] Ziewacz, *The Games They Played: Sports in American History, 1865-1980*, 289. Wallechinsky, *The Complete Book of the Olympics*, 163.
[69] Wallechinsky, *The Complete Book of the Olympics*, 9.
[70] "Mount San Antonio College Hall of Fame: Ray Norton," Mount San Antonio College, http://ibm.mtsac.edu/relays/HallFame/Norton.htm (accessed September 19, 2007). The Mount SAC Relays opened its Hall of Fame in 1985 to honor athletes, coaches and friends who made significant contributions both to the Relays and the sport of track and field. Norton was inducted in 1996.
[71] Ziewacz, *The Games They Played: Sports in American History, 1865-1980*, 289; Wallechinsky, *The Complete Book of the Olympics*, 163.

observed that despite better season best performances, Americans often failed to peak at the right time. He noted that after analysis, only seven to ten percent of non-Soviet athletes who took part in the Olympic Games were able to produce their best performances when it mattered most, whereas the Soviet Union athletes peaked properly about eighteen percent of the time.[72]

For Matveyev, peaking at the right time meant one was able to make winners out of athletes with lesser talent. He noted that the American and the Soviet track and field teams had met many times over the years and that he believed the level of talent was actually higher among American athletes. The Soviets were able to win the majority of meets, however, because they prepared more scientifically.[73] Matveyev noted, "We were able to win because we were able to guide sporting results. The American record holder came to the meeting and could not win. They could not win because they could not guide."[74]

Arnd Krüger, who now teaches sport history, reached a similar conclusion regarding the relative lack of American success at the 1972 Munich Olympic Games. Krüger examined the top six Olympic performers in track and field at the Munich games. From his analysis he concluded that many American athletes recorded their season's best performance prior to the 1972 Olympics and that the major reason for their decreased

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[72] Lev Pavlovich Matveyev interview.

[73] Joseph Turrini, "'It Was Communism Versus the Free World': The USA Versus USSR Dual Track Meet Series and the Development of Track and Field in the United States, 1958-1985," *Journal of Sport History* 28, no. 3: 427-471. The USSR and USA met on nineteen occasions between 1958 and 1985. When the scores of the men and women were combined, the USSR won fifteen times, the US three times and the teams tied on the one other occasion.

[74] Lev Pavlovich Matveyev interview.

performance at the Olympic Games was an inability to reach a third peak in performance in the same year that they'd competed in the National Collegiate Athletic Association (NCAA) championships and US Olymic Trials in Eugene, Oregon.[75]

It is clear that in 1960 despite being favorites for their events, a number of American athletes failed to peak at the right time. Krüger offers a compelling explanation for American underachievement by noting how the pressure of having to perform at the highest level for two prior championships (NCAA and US Olympic Trials) had a detrimental effect on peaking at the Olympic Games. The ability to control the sporting calendar and guide results via improvements in performances over time is critical to being able to peak for major competitions. By planning the fundamentals of training Matveyev was able to increase the chances of Soviet success at the Olympics by peaking at the right time.

In summary, Matveyev's general theory of sport and in particular his concept of periodization represented the first comprehensive overview of the complete sports training process that could be applied to all sports. While certain coaches such as "Doc" Counsilman (see Chapter Five) in the United States developed detailed training programs for specific sports such as swimming, Matveyev was able to offer a multi-sport blueprint for the construction of training that extended from an individual workout to a four-year Olympic plan. When asked about the genesis of periodization and the differences between the application of periodization in the United States and the Soviet Union Matveyev replied: "I know one thing. I visited America and I had meetings with some of

[75] Krüger, "Periodization or Peaking at the Right Time," 1720-1724.

the specialists. I clearly know that in America no one was thinking about an entire theory of sports training, especially about the long-term training process. In America, they are busy solving single problems like which style of high jumping to use or how to hit the ground with the foot or how to move the arms. They carried out very good research in America, but as far as I know, the problem of an entire theory was not the center of attention of American researchers. It was not in the attention of specialists from North America and South America."[76]

THE INTRODUCTION OF PERIODIZATION TO THE UNITED STATES

William Freeman, author of *Peak When It Counts: Periodization for American Track and Field*, states that early articles containing aspects of periodized training first appeared in the United States in the late 1960s in track and field journals.[77] However, as early as 1961, *Track Technique* briefly mentions the use of weekly training cycles in an article on high jumping by Vladimir Dyatchkov, the Russian national high jump coach.[78] Dyatchkov, coach to the "cosmic jumper" Valeriy Brumel—1964 Olympic champion and former world record holder in the high jump—was ideally situated to be at the "cutting edge" of advancements in training theory. This is further substantiated by Dyatchkov's 1969 article that extensively details the technical and physical preparation of high jumpers in a special edition of *Track Technique* devoted to high jump training.[79]

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[76] Lev Pavlovich Matveyev interview.
[77] Freeman, *Peak When It Counts: Periodization for American Track and Field*, 4-5.
[78] Vladimir Dyatchkov, "Problems in the Training of Soviet High Jumpers," *Track Technique*, no. 5 (September 1961): 138-140.
[79] Vladimir Dyatchkov, "High Jumping," *Track Technique*, no. 36 (1969): 1123-1157.

In the late 1960s a number of articles relating to various aspects of periodization were published in American track and field journals. For example, Adam Bezeg, the National Coach for Poland, detailed the number of jumps performed by elite Polish high jumpers for each month of the year, but he did not mention any specific cycles of preparation.[80] A 1967 Czechoslavakian article by Milan Bures featured the training of female Czechoslovakian middle-distance runners and mentions the training cycle but does not break it down into specific meso or microcycles.[81] It does, however, detail the exact number of training units and the combination of different types of training that were required during specific months of the year. Vladimir Dyatchkov's 1969 article on high jumping specifically mentioned the "annual cycle and its separated stages and ending with weekly cycles and individual training exercises."[82] Pavel Glesk, also in 1969, described a yearly training schedule for Polish women sprinters that was divided into five periods each with a number of "microcycles."[83] The first article encountered by the author in *Track Technique* that exclusively addressed the theory of training was published in 1969 by V. Popov of the Soviet Union.[84] Popov proceeded to outline the fundamental principles of the training process without specifically addressing Matveyev's concept of periodization.

The first article that specifically referred to periodization in its title was published in 1973 by Arnd Krüger who aroused coaches' interests by referring to periodization as

[80] Adam Bezeg, "Improving Spring in the High Jump," *Track Technique*, no. 28 (1967): 895-896.
[81] Milan Bures, "Training of Czech Woen Middle-Distance Runners," *Track Technique*, no. 35 (1969): 1114-1118.
[82] Dyatchkov, "High Jumping."
[83] Pavel Glesk, "Training of Polish Women Sprinters," *Track Technique*, no. 38 (1969): 1200-1202.
[84] V. Popov, "Foundations of Training Planning," *Track Technique*, no. 38 (1969): 1217-1220.

"Peaking at the Right Time."[85] Although Krüger was the first to introduce the basic concept of periodization, his focus was on testing Matveyev's theory (by analyzing the results of the 1972 Munich Olympics) and not providing a detailed account of his work.[86] This situation was remedied in 1975 (ten years after Matveyev published his seminal work) when Frank Dick, the Scottish National Athletics Coach, introduced the first detailed, English-language overview of Matveyev's theory of periodization.[87]

In the December issue of *Track Technique,* Dick outlined his groundbreaking summary of "Periodization: An Approach to the Training Year." Dick's article introduced, in detail, periodization to Americans and English speakers who had never previously understood that the Soviets and other Eastern Bloc athletes employed a different training philosophy than was used in the West.

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[85] Krüger, "Periodization or Peaking at the Right Time."

[86] Ibid. Krüger's article was reproduced in *Modern Athlete and Coach* a year later: Arnd Krüger, "Peaking at the Right Time," *Modern Athlete and Coach* 12, no. 4 (July 1974): 18-23.

[87] Dick, "Periodization: An Approach to the Training Year," 1968-1969. See also: Freeman, *Peak When It Counts: Periodization for American Track and Field*, 4.

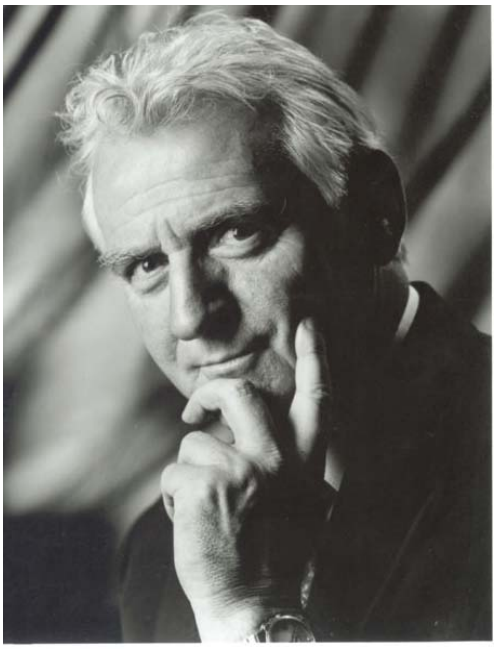

Figure 54. Frank Dick (O.B.E).[88]

The following summary represents Frank Dick's interpretation of Matveyev's work that also incorporated the contribution of East Germany's Dietrich Harre, who later edited *Principles of Sports Training*.[89] While the majority of the details covered by Dick represented a recapitulation of Matveyev's work, Dick differed in his basic description of the training year by choosing to divide the year into five different phases (I-V). Also, as the Scottish National Athletics Coach (and later Head Coach of the Great Britain Athletics Team) Dick was able to offer additional information such as precise performance expectations associated with the all-important competitive phase.

Dick began his overview with a definition of periodization, which he condensed into "the organized division of the training year" in pursuit of three main objectives: 1)

[88] Image located at: http://www.sfb.co.uk/speakers/frank_dick (accessed March 3, 2008).
[89] D. Harre, *Trainingslehre* (Berlin: Sportverlag, 1973); Harre, ed., *Principles of Sports Training*.

preparing the athlete to achieve an optimal improvement in performance; 2) preparing the athlete for a definite climax to the competitive season; and 3) preparing the athlete for the main competitions connected with that climax. Dick reiterated Matveyev's concept of periodization by outlining how the training year should be separated into three main periods—preparation, competition, and transition. The initial phase, termed Preparation I, was synonymous with Matveyev's General Preparation Period. Training during this period was more "general" in nature with limited specialized training that mimicked the athlete's event. This phase was summarized by Dick as "training to train."[90]

The second phase, termed Preparation II, was synonymous with Matveyev's General Preparation Period. This phase was designed to prepare the athlete for the forthcoming competitive season and was therefore viewed as "training for competition." The third phase, Phase III, was the first stage of the competitive period. The main task of this phase of the competition period was to "develop as fully as possible, and stabilize competitive performance."[91] Significant losses in fitness and strength could occur in as little as two to three weeks, therefore, it was important to include a general and specific strength training program, even during the competition period. During the competitive phase precise improvements in performance were expected. Ideally, after three competitions an athlete was expected to come within two-and-one-half percent of their personal best and after six to eight weeks surpass their all-time best.

[90] Dick, "Periodization: An Approach to the Training Year," 1968.
[91] Ibid., 1969.

If the competition period was prolonged, Dick advised the introduction of another competitive phase—Phase IV. In this period the proportion of competition-specific training was reduced, competitions were eliminated, and general and special training was increased. The inclusion of this phase was justified as it facilitated recovery from the emotional and physical stress of prior competition. The final phase, Phase V of the competitive period, involved blending competitions with competition-specific training. Improvements in performances were expected within three to four weeks after commencing this phase. Ideally, the major events of the athletic calendar (Olympics, World and National Championships, etc.) fell within this period. The final stage, the Transition phase, involved three to six weeks of active recovery that was covered earlier in the analysis of Matveyev's first English-translated edition.

In conclusion, Dick's overview of the theory of periodization represented a "watershed" moment in the history of training for sport. It was the first English-language summary of planning an athlete's training which had been so successfully employed by the Soviet Olympic teams of the 1960s and 1970s. Dick was able to convey in relatively simple language the theory of periodization, and his interpretation of Matveyev's theories allowed English-speaking coaches to begin incorporating this revolutionary new method of planning into the training of their athletes. It was a watershed moment in the evolution of track and field training.

Dick proceeded to outline the more detailed aspects of periodization, including units, microcycles, macrocycles, variations and adaptation, and loading in a series of articles in *Track Technique* from 1976 to 1977. In 1978, in his British Athletic Federation

booklet, *Training Theory,* Dick expanded upon his *Track Technique* articles to include the general principles of training.[92]

Due to a lack of unified training theory in the United States, it immediately became apparent to track and field coaches that Matveyev's work had the potential to offer a superior method of planning an athlete's training. The adoption of a new periodized approach was helped in large part by the sporting success of the Soviet Union and the East German national teams and by American desires to once again be competitive.[93] Coaches understandably sought to emulate aspects of training that they could see were more methodical, systematic, and scientific. However, as Thomas Kuhn, author of *The Structure of Scientific Revolutions* points out, only rarely do scientists (and coaches following in their path) become enlightened by new discoveries and openly adopt a new way of thinking.[94] While European coaches had the benefit of assimilating better translated (and therefore less diluted) versions of Matveyev's work at an earlier date, a number of obstacles (as we shall shortly discover) in the United States prevented the immediate translation of theory into practice. Elite distance coaches in the United States in the 1960s and 1970s continued to adopt a traditional seasonal pattern of training, as typified by the runner, Kenny Moore, of the University of Oregon.[95] Moore, who would go on to write for *Sports Illustrated* and was coached by Bill Bowerman, had

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[92] Dick, "Variations in Periodization," 2005-2006; Dick, "Units and Microcycles," 2030-2031; Dick, "Macrocycles," 2068-2069; Dick, "Training Theory: Adaptation and Loading," 2163-2164; Dick, *Training Theory*.

[93] Brokhin, *The Big Red Machine*; Doug Gilbert, *The Miracle Machine* (New York: Coward, McCann & Geoghegan, 1979).

[94] Kuhn, *The Structure of Scientific Revolutions*.

[95] Jerry Smith, "Ken Moore: How He Trains," *Track Technique*, no. 35 (1969): 1118-1119.

placed fourth in the marathon at the 1972 Munich Olympics. He trained almost continuously from one season to the next, with only a few days off between spring and summer, and summer and fall training. Moore's system didn't vary volume and intensity much at all. In fact, like most American-based athletes, his participation comprised of fall (or cross country), winter (or indoor track), spring (outdoor track) and summer (outdoor track or off-season) periods.

In his seminal work, *The Structure of Scientific Revolutions*, Kuhn notes that as more and more scientists are converted to the new paradigm, exploration increases, and the number of experiments, instruments, articles, and books based on the paradigm shift multiply. Such was clearly the case with periodization theory in the West where in the late 1970s, and particularly throughout the 1980s, dozens of articles appeared in sport magazines and research journals attesting to the superiority of the new method.[96] Research scientists also turned their attention to periodization. Dr. Michael Stone, then of Auburn University, helped to solidify periodization's reputation as a superior training method in a series of research studies that compared periodization's ability to produce strength and explosive power to other training methods formerly used in weight

[96] An exhaustive list of these is not included here but see, for example: M. Van Oort, "Periodization of Training at Dutch Rowing Clubs: The Case of Het Spaarne of Haarlem," *Roeien*, no. 31 (June 22 1977); V. Jagodin and V. Tshunganov, "Periodization in Pole Vault Training," in *The Jumps: Contemporary Theory, Technique and Training*, ed. Jess Jarver (Mountain View, Ca: Tafnews Press, 1981), 81-82; C. Burns, "Periodization Training: Part One," *Canadian Wrestler* 7, no. 3 (June 1983): 12-14; Hermes Riveri, "Discus Training Periodization," *Track Technique*, no. 96 (1986): 3058-3059; Bob Myers, "Periodization for the Heptathlon: A Practical Training Theory," *Track and Field Quarterly Review* 86, no. 2 (1986): 34-36; M. Burgener, "Year Round Periodization for High School Football," *National Strength & Conditioning Association Journal* 9, no. 4 (August-September 1987): 60-61; Bob Myers, "Periodization for the High Jump," in *The Jumps*, ed. Jess Jarver (Mountain View, Ca.: Tafnews Press, 1988), 46-49.

training.[97] Stone who, as of 2008, was the Head of Sports Physiology for the USOC, acknowledged the role of Frank Dick and Matveyev in the formulation of ideas that materialized in his research.[98]

As Kuhn also notes, professional organizations can play an important role in helping paradigms to shift, and periodization found an important ally in the newly formed National Strength Coaches Association. In many ways, periodization helped the NSCA justify its existence. Begun by strength coach Boyd Epley at the University of Nebraska in 1978, the National Strength Coaches Association, which renamed itself the National Strength and Conditioning Association in 1981, has grown into a multi-national organization with more than 30,000 members.[99] When it began, however, strength coaching was not recognized as a science—and so the NSCA's first goal was to establish the scientific basis of this new field. They did this primarily by publishing a series of articles on the biomechanics of different sports, including detailed exercise programs specifically designed based on the new biomechanical analysis, and by incorporating

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[97] Michael H. Stone, Harold O' Bryant, and John Garhammer, "A Hypothetical Model for Strength Training," *National Strength and Conditioning Association*, no. 21 (1981): 342-351. Stone's study was one of the earliest studies on the effectiveness of periodized resistance training. The authors trained college age males for a period of six weeks. This project compared a nonperiodized program of 3 × 6 (sets × repetitions per set) vs. a strength/power periodized program that progressed from high volume and low intensity to lower volume and higher intensity training. Both groups increased the resistance used during training at their own rate. The periodized group increased significantly more than the nonperiodized group in one repetition maximum (1 RM) parallel back squat and vertical jump power using the Lewis formula (4.9 × body mass [kg] × vertical jump [m]) but not in vertical jump ability (centimeters improvement). In addition, the periodized group demonstrated a significantly greater increase in lean body mass and decrease in percent body mass fat than the nonperiodized group as determined by hydrostatic weighing. For further examples of Stone's pioneering work see: M.H. Stone et al., "A Theoretical Model of Strength Training," *National Strength and Conditioning Association Journal* 4, no. 4 (1982): 36-39; T Stowers et al., "The Short Term Effects of Three Different Strength-Power Training Methods," *National Strength & Conditioning Association Journal* 5, no. 3 (1983): 24-27.

[98] Interview with Michael Stone conducted by the author at the National Strength and Conditioning Association Sport-Specific Conference in San Antonio, TX on 11 January 2002.

[99] Jan Todd interview with former NSCA president, Dan Wagman, March 1988, Columbus, Ohio.

literature about periodization into nearly every issue of their journal. Periodization had to be explained to coaches and the NSCA promoted it, in part, because by promoting it they also promoted themselves. The fact that training theory was now "scientific" and increasingly complicated meant that coaches would join the NSCA for help in understanding how to utilize the new system.[100] By the early 1980s, articles related to trends in Soviet strength and conditioning, training for young athletes, periodization of strength training in professional football, periodization and peaking, and periodization for baseball fastball pitchers were increasingly commonplace in the *National Strength and Conditioning Association Journal*.[101] They even featured a periodization roundtable in the mid 1980s with experts such as Dan Pfaff, Vern Gambetta, Michael Stone, William Kraemer and Harold O'Bryant.[102]

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[100] For information on the history of the NSCA see: Scott A. McQuilkin and Ronald Smith, *The World's Source for Strength and Conditioning: A History of the National Strength and Conditioning Association (1978-1993).* (Unpublished) Available at the Todd-McLean Physical Culture Collection in the H.J. Lutcher Stark Center for Physical Culture at the University of Texas at Austin.

[101] Michael Yessis, "From Macro- to Meso- to Micro-Cycles. Trends in Soviet Strength and Conditioning.," *National Strength & Conditioning Association Journal* 4, no. 4 (August-September 1982): 45-47; Michael Yessis, "The Soviet Sports Training System-the Yearly Cycle," *National Strength & Conditioning Association Journal* 3, no. 6 (December 1981-January 1982): 20-22; Jimmy Pedemonte, "Training the Young and Intermediate Athlete. Updated Acquisitions About Training Periodization.," *National Strength & Conditioning Association Journal* 4, no. 6 (January 1983): 54-55; Bruno Pauletto, "Periodization - Peaking," in *In Total Conditioning for the Special Olympian: A Coaches' Guide,* (Lincoln, Nebr.: National Strength and Conditioning Association, 1986); J.S. Climino, "Baseball: A One Year Periodization Conditioning Program Specific to Fastball Pitchers," *National Strength & Conditioning Association Journal* 9, no. 2 (April-May 1987): 26-30.

[102] A.Charniga et al., "Roundtable: Periodization," *National Strength & Conditioning Association Journal* 8, no. 5 (1986): 12-22. In 1986 Michael Stone was the Director of Research at the National Strength Research Center at Auburn University where he taught among other subjects, Strength-Power Training: Theoretical and Practical Aspects. He received his doctorate in exercise physiology from Florida State University. Dan Pfaff (M.Ed.) is currently the Head Coach and COO of Tiger Bar Sports, a nonprofit organization, dedicated to facilitating holistic sports performance training at the Olympic, youth, and master's levels to develop champion athletes. In 1986 Coach Pfaff was an assistant track and field coach at Louisiana State University. As of August 2006 Coach Pfaff had tutored athletes who have combined to earn 154 NCAA All-America honors while also guiding thirty-three Olympians who went on to earn seven medals. He was also the coach of Donovan Bailey who set the world record (9.84 seconds) and won the

However, carefully planned periodization did not begin to appear as a consistent training structure in track and field in the United States until the mid-to-late 1980s.[103] The greatest assimilation of periodized training, much like the initial use of weight training, occurred in track and field where a performance differential of as little as one to two percent can mean the difference between a world championship performance and non-qualification for an event.[104] In 1981, Andrew McInnis presented a condensed, but thorough, overview of periodization in *Track and Field Quarterly Review***,** while in 1989, Vern Gambetta, former editor of *Track Technique* referred to periodization as "planned performance training," making it more user-friendly to the North American coach.[105] Chris Walsh's appraisal of the Oregon School of Training that evolved in the 1950s and

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Olympic 100 meters gold medal at the 1996 Atlanta Olympic Games. Vern Gambetta (M.A.) is the founder of Gambetta Training Systems. In 1986 Gambetta was an Associate of Vermeil's Sport and Fitness Group, and served as a conditioning coach for professional baseball (Chicago White Sox) and basketball teams. With a background in track and field Gambetta edited track and field technical journals and coaching manuals for The Athletic Congress. William Kraemer (Ph.D) is currently a full professor in the Department of Kinesiology and the Human Performance Laboratory at the University of Connecticut. In 1986 Kraemer was the editorial supervisor of the National Strength and Conditioning Association. He was also the research physiologist for the Exercise Physiology Division for the US Army's Research Institute of Environmental Medicine.

[103] Freeman, *Peak When It Counts: Periodization for American Track and Field*, 4.

[104] Walsh, "Bowerman Oregon Distance Tradition Meets Bompa Training Theory: Periodized Mile and 5km Training," 12-20; R.W. Fry et al., "Biological Responses to Overload Training in Endurance Sports," *European Journal of Applied Physiology*, no. 64 (1992): 335-344; S. Levin, "Overtraining Causes Olympic-Sized Problems," *Physician Sportsmedicine* 19 (1991): 112-118; Ray Schaffer, "Periodzation of Cross Country Training for High School Women," *Track Technique*, no. 117 (1991): 3725-3727; Tudor Bompa, "A Model of an Annual Training Programme for a Sprinter," *New Studies in Athletics* 6, no. 1 (1991): 47-51; Jianrong Chen, "Load Variations of Elite Female Javelin Throwers in a Macrocycle," *Track Technique*, no. 119 (1992): 3788-3792.

[105] Andrew McInnis, "A Research Review of Systematized Approaches to Planned Performance Peaking with Relation to the Sport of Track and Field," *Track and Field Quarterly Review* 81, no. 2 (1981): 7-12; Vern Gambetta, "Planned Performance Training: The Application of Periodization to the American System," in *The Athletics Congress/USA Track and Field Coaching Manual* (Champaign, Ill.: Human Kinetics, 1989), 37-45.

1960s revealed that "Bowerman's System" contained many of the elements conducive with a periodized approach to training.[106]

Despite the potential for marked improvements in performance, the actual translation of periodization training theory into practice was a slow process. Istvan Balyi, Ph.D., eminent training theorist and resident sport scientist at the National Coaching Institute, Victoria, Canada, argued in a paper presented to the Australian Coaching Council Elite Coaches Seminar that the application of periodization by North American coaches was actually a slow process. Balyi contended that except for the early discussions found in Michael Yessis's *Soviet Sports Review,* that the translation and assimilation of Eastern European periodized literature took several decades to become widely available to Western coaches, athletes, and sport scientists.[107] Balyi further contended that even when the literature became available, understanding was often limited due to poor literary translations that obscured the meaning of the information. Further, in the climate of the Cold War, where Soviet coaches were under immense pressure to win to keep their jobs, Western coaches were often uncertain as to what information was legitimate and how much information was being held back and kept secret. Moreover, the Western socio-politico structure did not accord the same degree of importance to the role of amateur sport as it enjoyed in the Soviet Union. Balyi further explained that during the 1980s periodization was erroneously associated with the

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[106] Walsh, *The Bowerman System*; Walsh, "Bowerman Oregon Distance Tradition Meets Bompa Training Theory: Periodized Mile and 5km Training," 12-20.

[107] Istvan Balyi, "Beyond Barcelona: A Contemporary Critique of the Theory of Periodisation," *Queensland Pistol News* February 1993, 15-17; Istvan Balyi, "Beyond Barcelona: A Contemporary Critique of the Theory of Periodisation" (paper presented at the Australian Coaching Council Elite Coaches Seminar, Australian Institute of Sport, Canberra, November 27-29 1992), 9-10.

problem of performance-enhancing drug use by athletes of the Communist block. As a result, sport scientists, sports medicine specialists, coaches, and athletes questioned the relative benefits of a periodized approach compared to the effects of performance-enhancing substances. Boyd Epley, former Head Strength and Conditioning Coach at the University of Nebraska and founder of the National Strength and Conditioning Association (where he served as the President and Chairman for five years) confirmed the distrust. When asked what he viewed as the major difference between an American and a Soviet or Eastern European approach to periodization, Epley replied, "Well to be honest with you, I never really took much stock in the Russian or Eastern models because they were so tainted with steroid use…how would you know what works and what doesn't?"[108]

Despite the skepticism surrounding Soviet information, many US coaches recognized that even without the possible use of performance-enhancing substances periodization could offer a superior method of planning an athlete's training. Although extensive coverage of the impact of periodization after 1975 is beyond the limits of this dissertation, a number of studies have taken a retrospective analysis of this groundbreaking method of planning an athlete's training and therefore deserve (albeit brief) consideration. The use of periodization is synonymous with a scientific approach to training as coaches, scientists, and athletes attempt to gain maximal control over the variables affecting the adaptive process. Rod Fry and colleagues acknowledged this approach in their appraisal of the periodization of training stress in which the cycling of

[108] Interview with Boyd Epley conducted by the author at the National Strength and Conditioning Association Sport-Specific Conference in San Antonio, TX on 11 January 2002.

light, medium, and heavy periods of training was recommended in order to facilitate optimal adaptation, supercompensation, and the prevention of overtraining.[109]

While some authors have espoused the need for more systematic research to support or refute periodization, studies have typically found that periodized training elicits improved training responses in comparison to training groups that employ a constant load.[110] Thus, a consensus has largely been reached among researchers that periodized training offers superior results in strength, power, body composition, and other performance parameters.[111] This finding was validated by a meta-analysis of periodized versus nonperiodized strength and power training programs.[112] Matthew Rhea and Brandon Alderman concluded that after statistical review of the literature, periodized training was more effective than non-periodized training for men and women, individuals of varying training backgrounds, and for all age groups.

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[109] Rod W. Fry, Alan R. Morton, and David Keast, "Periodisation of Stress: A Review," *Canadian Journal of Sport Science* 17, no. 3 (1992): 234-240; Rod W. Fry, Alan R. Morton, and David Keast, "Periodisation and the Prevention of Overtraining," *Canadian Journal of Sport Science* 17, no. 3 (1992): 241-248.

[110] Paul Gamble, "Periodization of Training for Team Sports Athletes," *Strength and Conditioning Journal* 28, no. 5 (October 2006): 56-66.

[111] Steven J. Fleck, "Periodized Strength Training: A Critical Review," *Journal of Strength and Conditioning Research* 13, no. 1 (1999): 82-89; M.H. Stone et al., "Periodization: Effects of Maniplating Volume and Intensity. Part Two," *Strength & Conditioning Journal* 21, no. 3 (1999): 54-60; M.H. Stone et al., "Comparison of the Effects of Three Different Weight-Training Programs on the One Repetition Maximum Squat," *Journal of Strength and Conditioning Research* 14, no. 3 (2000): 332-337; D. Wathen, T.R. Baechle, and R.W. Earle, "Training Variation: Periodization," in *Essentials of Strength Training and Conditioning*, ed. Baechle and and Roger W. Earle (Champaign, Ill.: Human Kinetics, 2000), 513-527; D.S. Willoughby, "The Effects of Mesocycle-Length Weight Training Programs Involving Periodization and Partially Equated Volumes on Upper and Lower Body Strength," *Journal of Strength and Conditioning Research* 7, no. 1 (1993): 2-8.

[112] Matthew R. Rhea and Brandon L. Alderman, "A Meta-Analysis of Periodized Versus Nonperiodized Strength and Power Training Programs," *Research Quarterly for Exercise and Sport* 75, no. 4 (December 2004): 413-422. The studies examined included a variety of sports such as wrestling and tennis along with multiple weight training studies—some of which were exclusively devoted to women.

Thus, by the turn of the twenty-first century, the periodization of athletic training was a concept that formed the foundation "of most modern coaching theory and practice" and "the basis of every serious athlete's training."[113] The use of periodization spread from mainstream sports such as track and field, football, and swimming to virtually every conceivable sport seeking to gain a competitive edge including skating, mountain biking, golf, judo, body building, and synchronized swimming.[114]

[113] Rowbottom, "Periodization of Training." Bompa, *Periodization: Theory and Methodology of Training*, 499-512.

[114] C. Poe, D. Pitsos, and M. Provost-Craig, "United States Figure Skating Association: Periodization for Skaters," *Professional Skater* 31, no. 6 (November-December 2000): 26-27; C.M. Willis and M.T. Jones, "Implementing Resistance Training into the Macrocycle of a Competitive Mountain Biker," *Strength & Conditioning Journal* 21, no. 6 (December 1999): 33-39; P. Knight, "Periodisation for Golf," *Sports Australia* (October-November 2000): 72-74; Boris Blumenstein, Ronnie Lidor, and Gershon Tenebaum, "Periodization and Planning of Psychological Preparation in Elite Combat Sport Programs: The Case of Judo," *International Journal of Sport & Exercise Psychology* 3, no. 1 (March 2005): 7-25; T.C. Fritz, "One-Minute Lesson: The Stages of Success. How a Periodized Approach Can Get You Big and Ripped," *Joe Weider's Muscle and Fitness* 62, no. 4 (April 2001): 216; C. Flynn, "Periodization: Cycles Geared for Peak Success," *Synchro Swimming* (January-March 1993): 6-7.

Figure 55. Yuri Verkhoshansky pictured in Moscow 1978 as the Chief of the Scientific Laboratory of Training Programming and the Physiology of Sport Work Capacity.[115]

One area integral to the development of periodization and a record-breaking number of medals was the application of scientific research to sport. Matveyev provided testimony to this by noting that prior to 1970 improvements in training and results in sport had largely been empirical in nature. However, by the 1970s sport and the realm of

[115] Image located at: www.verkhoshansky.com (accessed February 10, 2008). Yuri Verkhoshansky is a Doctor of Pedagogy (the art, science or profession of teaching**)** and Professor in the field of theory and methods of sports training. He (along with Professor Matveyev) previously taught at the Central State Institute of Physical Culture in Moscow. He has published extensively in the theory and methods of physical and sports training. For further biographical information on Yuri Verkhoshansky see: "Short Curriculum of Professor Verkhoshansky," Yuri Verkhoshansky, http://www.verkhoshansky.com/Curriculum/tabid/71/Default.aspx (accessed November 12, 2007).

physical culture had progressed rapidly to become a sphere of "intensive application and production of scientific knowledge."[116] Examples of Soviet sports-science-related research were provided by the *Yessis Soviet Sports Review* which began publication in December 1966. Dr. Michael Yessis, Professor Emeritus in Kinesiology at California State University at Fullerton, was responsible for translating articles from some of the Soviet Unions' leading physical culture journals, including *Theory and Practice of Physical Culture, Sports Life in Russia, Pre-School Education, Physical Culture in the Schools, Track* and *Field and Physical Culture and Sport.*[117]

The research published in the *Yessis Soviet Sports Review* included virtually every branch of sport science and featured a multitude of topics such as the nature of the training load, training design, the development of specific biomotor abilities (such as speed, and strength and combinations thereof), general training information, biomechanics, individual sports, special populations (such as women and children), physical education and schools, nutrition, talent identification, psychology, socialist ideology, and the dissemination of knowledge to other socialist nations.

TRAINING LOAD

The first area to consider was what constituted an optimal training load, for as N. I. Volkov and V. M. Zatsiorski emphasized, "The question of choice and dosage of

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[116] Matveyev, *Fundamentals of Sports Training*, 26.

[117] It was common for the articles translated by Yessis to only provide limited information. For example, full first names were often omitted along with the author's titles and there was limited (if any) information regarding exactly where the research emanated from.

training loads is one of the central ones in the theory of sports training."[118] The authors proceeded to examine the effect of different training loads on competition results from a biochemical, physiological, and pedagogical perspective. In a similar vein, T.N. Makarova examined the influence of various loads on voluntary and involuntary bodily functions and concluded that in examining the "trainability" of different sports it was important to look at the various systems of the organism to see how they react to various loads.[119]

Other researchers used specific measurement tools such as electromyography (records the electrical output of muscles) to gain insight into the regulation of training loads. A. N. Vorobyev and G. A. Titov concluded that in order to increase the muscle power output in weightlifters it was necessary to alternate heavy, medium, and light physical loads.[120] This information allowed doctors and trainers to more accurately determine an athlete's response to training and thereby regulate optimal training loads. Bill Bowerman of The University of Oregon had reached a similar conclusion in the 1960s using intuition and trial and error. Soviet scientists, however, were able to use sport science to objectify training loads and turn Bowerman's "art" into hard facts.

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[118] N.I. Volkov and V.M. Zatsiorsky, "Several Questions on the Theory of Training Loads," *Yessis Soviet Sports Review* 1, no. 2 (September 1966): 64-69.

[119] T.N. Makarova, "The Influence of Adequate and Inadequate Loads on Somatic and Vegetative Functions," *Yessis Soviet Sports Review* 2, no. 1 (1967): 26-27.

[120] A.N. Vorobyev and G.A. Titov, "Regulated Training Loads of Heavy Athletes According to Lability of the Nerve-Muscle Apparatus," *Yessis Soviet Sports Review* 1, no. 4 (March 1966): 16-17. Translated from *Theory and Practice of Physical Culture* 71, (1963): 21-24.

TRAINING THEORY

In the realm of training theory, S. A. Sabin and P. I. Chudinov (in a similar undertaking to Matveyev) distributed questionnaires to 14,000 of the best sportspeople in the Soviet Union during 1961-62 to determine training composition and the principles upon which training was effected.[121] The sports selected were basketball, football, classical and freestyle wrestling, equestrian and sailing sports, swimming, riflery, and the 3,000 meter run. The questionnaire asked details about the athletes' year-round preparation, including a breakdown of the general and special physical preparatory periods. After evaluating the training associated with being successful at the second 1960 Spartakiad (internal Soviet sports competition), the authors concluded that the primary reason for sub-optimal performance was insufficient technical preparation and competition in association with a lack of physical, tactical, and individual preparation.[122] The authors noted that scientific investigation into the theory and methods of sports training and planning between 1957 and 1960 helped place it on a scientific track, but the process was slow. It was not until 1960 that two teams were the first in the history of Soviet sport to work out an acceptable four-year training plan (1961-1964).[123] Clearly

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[121] S.A. Sabin and P.I. Chudinov, "Generalizations and Analyzations of the Training of Qualified Sportsmen," *Yessis Soviet Sports Review* 1, no. 3 (June 1966): 41-44. Translated from *Theory and Practice of Physical Culture* 71, (1963): 21-24.

[122] "Red Files: Soviet Sports Wars-Phrases Appearing Throughout Red Files," Public Broadcasting Service, http://www.pbs.org/redfiles/sports/inv/sports_inv_voc.htm (accessed September 24, 2007). The word "Spartakiad" was derived from Spartacus, the name of a slave who fled from a school for gladiators to lead a revolt against Imperial Rome, 73-71 B.C. It was used to denote international multi-sport competition of 'workers' organized in Soviet Russia, Germany and Czechoslovakia in the 1920s that included military events. After 1956 Spartakiads became internal Soviet competitions.

[123] Sabin and Chudinov, "Generalizations and Analyzations of the Training of Qualified Sportsmen."

Matveyev was not working in isolation as multiple team members worked in a concerted effort to discover the "fundamentals of sports training."

More sport-specific, training-theory analysis of elite gymnasts by M. L. Ukran in 1964, revealed that the strongest Soviet gymnasts trained according to a four-year plan, built on basic, yearly cycles. Volume and intensity of work was calculated to gain insight into the strength development of individual gymnasts. Volume of training load was determined by the total number of separate gymnastic elements and/or combinations performed, while intensity was classified as the number of routines fulfilled with work of greater difficulty. The authors concluded that, "The steady growth of the volume and intensity of the loads made it possible to significantly raise the training of the gymnasts to such a level as to give them indispensable conditions for growth in mastery of their sport."[124]

RECOVERY

Soviet scientists realized early on that directly linked with the need to administer optimal training loads was the need for adequate rest and regeneration. Ben Tabachnik, former Head of Scientific Research for Sprinting for the Soviet Union track and field team, noted in *Soviet Training and Recovery Methods*, that without proper restoration it was impossible for an athlete to achieve their best results.[125] Indeed, if recovery was not optimized, further training could lead to excessive fatigue and ultimately overtraining (an

[124] M.L. Ukran, "Training Load Dynamics of the Strongest Soviet Gymnasts," *Yessis Soviet Sports Review* 1, no. 4 (March 1966): 10-11.
[125] Tabachnik and Bruner, *Soviet Training and Recovery Methods*, 152.

accumulation of training or non-training stress resulting in a long-term decrement in performance) and injury. For Tabachnik, recovery was achieved through a variety of means, including pedagogical (such as individualization of the design of the training program), physical (hydrotherapy, acupuncture and electrotherapy), pharmacological (i.e., proper sports nutrition such as the use of glucose polymers), and psychological.[126] M. A. Vilenski supported Tabachnik's claim by studying the comparative characteristics of the regeneration period after intense physical and mental work and concluded that significant individual differences in the ability to perform more work necessitated strict individualization in the planning of repetitive training.[127] Clearly, Soviet scientists were exploring every avenue in an effort to allow athletes to handle heavier and heavier training and competitive loads.

BIOMOTOR ABILITIES

Soviet researchers also realized that in order to enhance performance, specific biomotor abilities, such as speed, strength, endurance or combinations thereof (such as speed and strength to produce power) needed to be enhanced. B. Valik, in 1966, examined the optimal strength preparation of young track and field athletes and concluded that because of daily patterns in life, athletes of twelve to thirteen years of age possessed strong back, thigh, and flexor muscles, but had weak anterior abdominals,

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[126] Ibid., 153-155.

[127] M.A. Vilenski, "Comparative Characteristics of the Restorative Period after Intense Physical and Mental Work," *Yessis Soviet Sports Review* 7, no. 1 (March 1972): 26-27. For further coverage of the restorative process see: Michael Yessis, "Restoration: Or Increasing the Ability to Do More Voluminous and Higher Intensity Workouts," *National Strength and Conditioning Journal* 4, no. 3 (July 1982): 38-41.

posterior thigh, and arm extensors. To remedy the situation the author recommended the use of acrobatics that "outstandingly solves all problems of strength preparation in the many sided development of their musculature and widens their motor capabilities." The structured use of a barbell, traditionally associated with strength training was deemed unnecessary and reserved for a later stage in the athletes' development when they became stronger.[128]

Another key area of Soviet research that evolved in the 1960s which became synonymous with Soviet training methods involved the combination of speed and strength training, otherwise known as plyometrics. The term "plyometric" is commonly believed to be derived from two Greek words meaning "greater or longer" and "to measure."[129] Exercises considered plyometric in nature involve movements in which a rapid eccentric contraction (lengthening of the muscle or pre-stretching) is followed by a rapid concentric contraction (shortening of the muscle). Various types of jumps and hops that typify plyometric training may have not been new in nature, but it was the formalization and organization of this method of training that made it unique.[130]

Unfortunately, considerable confusion in the literature resulted from misinterpretation of early translated plyometric articles that invariably focused on depth jumping (dropping off a box or object and then jumping straight back up) which is at the

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[128] B. Valik, "Preparation of Young Track and Fielders," *Yessis Soviet Sports Review* 2, no. 3 (September 1967): 56-60.
[129] S. Zanon, "Plyometrics: Past and Present," *New Studies in Athletics* 4, no. 1 (1989): 7-17.
[130] Ian King, "Plyometric Training: In Perspective Part 1," *Sport Coaching Association of Canada* 3, no. 5 (1993): 1-8.

advanced or "shock" end of the plyometric continuum.[131] Heights intended for advanced athletes were mistakenly applied to athletes of all types and sizes and stages of development. For example, in 1967 Yuri Verkhoshansky, former researcher and professor of sport science at the State Central Institute of Physical Culture in Moscow, published "Are Depth Jumps Useful?" The author recommended a height of between 0.75 meters for maximum speed development and 1.10 meters for maximal dynamic strength, but failed to modify the exercise or adequately distinguish between what he termed as "more prepared" and "less prepared" athletes.[132]

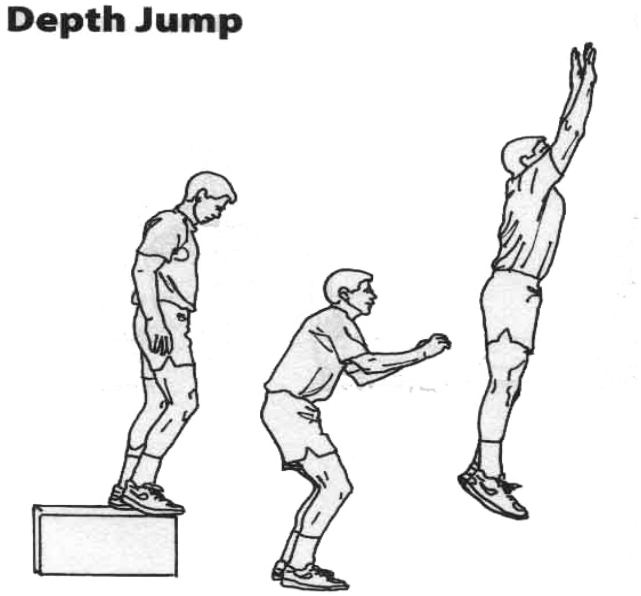

Figure 56. Diagram of a Depth Jump.[133]

[131] Ibid.
[132] Yuri Verkhoshansky, "Are Depth Jumps Useful?," *Yessis Soviet Sports Review* 3, no. 3 (September 1968): 75-78.
[133] Image located at: www.jumpusa.com (accessed April 17, 2008).

CHILDREN AND YOUTH

One area afforded extensive research was the physical and mental development of children. The maturation process of children was directly linked to the efficiency of the workforce and the defense of the country. This is clearly illustrated by the title of the 1970 article, "Requirements and Norms for the All-Union Battery of Physical Perfection- Prepared for Work and Defense of the Country," which detailed the physical requirements of children between ten and eighteen years of age.[134] It contained numerous norms and requirements for various categories, including ski races, jumping ability, swimming, throwing ability, and necessary strength criteria (pull-ups, push-ups, etc.) for different age groups. Other examples of children-related research included the analysis of physical culture programs in secondary schools and the mastery of movement in children that would help ensure a steady stream of sports stars in years to come.[135]

GENDER

Gender research featured highly on the Soviet list of priorities. V. L. Fedorov and I. M. Yankauskas highlighted how Soviet women had achieved international dominance and world records at the European, World, and Olympic Games.[136] The authors proceeded to comprehensively update Soviet researchers, teachers, and trainers in the

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[134] "Requirements and Norms for the All-Union Battery of Physical Perfection- Prepared for Work and Defense of the Country," *Yessis Soviet Sports Review* 5, no. 2 (June 1970): 50-55.
[135] "The Physical Culture Program in Secondary Schools," *Yessis Soviet Sports Review* 2, no. 4 (December 1967): 84-112; G. Leskov, "Mastery of Children Realized," *Yessis Soviet Sports Review* 2, no. 4 (December 1967): 113-115.
[136] V.L. Fedorov and I.M. Yankauskas, "Urgent Matters Concerning the Theory and Methods of Women's Sports," *Yessis Soviet Sports Review* 5, no. 3 (September 1970): 56-64.

morphological, anatomical, and physiological findings related to the training of sportswomen. They concluded that despite improvements in the training and performances of sportswomen, the precise details of how to optimally train females had not been fully realized. However, the authors were confident that "the trust in trainers, scientists and doctors will soon remove the existing gaps in our methods." Elsewhere, other gender research demonstrated the detail to which Soviet researchers focused including the pulse, arterial blood pressure, and breathing patterns of sportswomen in various phases of the menstrual cycle.[137]

The *Yessis Soviet Sports Review* is littered with numerous other examples of the application of "cutting edge" sport science to the sports training and competitive processes. Further research included the use of mathematical factor analysis of training factors associated with decathlon performance, the use of electronic vectorgraphic systems to analyze efficiency of motion such as starting out of the blocks in the short sprints, and the use of cybernetics—the science of communication and control processes in sport.[138]

At this juncture of the chapter it would appear that Soviet Union researchers had created a training utopia where cutting edge technology could automatically be applied by coaches and their athletes to garner vast quantities of Olympic medals. However,

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[137] O.D. Dzhovataya, "Pulse, Arterial Blood Pressure and Breathing in the Woman-Sportsman in Various Phases of the Ovarian-Menstrual Cycle," *Yessis Soviet Sports Review* 1, no. 4 (March 1966): 18.
[138] V.M. Zacheorski, "The Use of Mathematical Factor Analysis of Training Factors Associated with Decathlon Performance," *Yessis Soviet Sports Review* 1, no. 4 (March 1966): 12-13; I.P. Ratov, "Electronic Vectorgraphic Systems of Express-Analysis of Movement and Their Possibilities in Sport," *Yessis Soviet Sports Review* 3, no. 4 (December 1968): 84-91; A. Kulakov, "Cybernetics in Sport," *Yessis Soviet Sports Review* 4, no. 3 (1969): 60-63.

much like the inefficiencies that were pervasive throughout the Soviet political system, the application of science to sport was also far from ideal. Ben Tabachnik notes that despite the Soviet Union conducting more sport research than all other countries combined, only a small percent of the research was used by Soviet coaches.[139] While research institutes may have had upward of five hundred researchers, they lacked middlemen to disseminate the knowledge to ensure it ended up in the coaches' hands. Furthermore, poor researcher and coaches' salaries resulted in a lack of incentive to work harder and develop ideas.[140]

The preceding examples of Soviet sport science serve to illustrate the difference between a Soviet and an American or Western (featured in Chapter Six) approach to enhance sporting performance. As Matveyev insightfully noted earlier, while American researchers focused on individual problems such as individual styles of high jump or how to measure the anaerobic threshold, Soviet sport scientists explored every branch of sport science in a concerted effort to apply their findings directly to the sporting arena. Unfortunately, not all Soviet methods were ethical and some did not have the best interests of their athletes at heart.

[139] Tabachnik and Bruner, *Soviet Training and Recovery Methods*, 20.
[140] Ibid., 21.

PERIODIZATION AND THE ANABOLIC AGE

Figure 57. Photo Illustration by Francisco Kjolseth

One problem in trying to discuss the efficacy of periodization and to truly assess its impact is that it arrived on the sporting scene at almost exactly the same time as anabolic steroids. The first anabolic steroid, Dianabol, was invented in 1958 and as Terry Todd documents in "A History of the Use of Anabolic Steroids in Sport," they were being widely used in track and field by 1970.[141] Todd argues that the Soviets began to experiment with drugs such as testosterone in the early 1950s, and like American athletes

[141] Terry Todd, "A History of the Use of Anabolic Steroids in Sport," in *Sport and Exercise Science: Essays in the History of Sports Medicine*, ed. Jack W. Berryman and Roberta J. Park (Urbana, Ill.: University of Illinois Press, 1992).

they moved on to the anabolic drugs such as Dianabol as soon as they were available.[142] As anabolic drugs became more widely used on both sides of the Atlantic, it became common during the 1960s and 1970s to attribute a person's or a nation's athletic success to their drug use, rather than improved training techniques. During the Cold War years, in particular, many Americans made statements about the unfair advantage that Eastern Bloc athletes had because of what was perceived to be their state-supported doping programs.[143]

The further problem, however, is that we now understand that using such agents as testosterone, anabolic steroids, human growth hormone, creatine, and the host of food supplements and other nutritional aids employed by modern athletes does actually affect human performance. Despite early proclamations by the medical profession that steroids had little or no performance enhancing effect, steroids have now been shown to significantly increase strength, muscle mass, athletic performance, and the ability to recover from vigorous training.[144]

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[142] Ibid., 325-326.

[143] Sports and iron game historian Terry Todd notes that most athletes in the Sixties and early Seventies were secretive about their use of anabolic steroids. But, in 1971, American superheavyweight weightlifting champion Ken Patera shattered the code of silence when he told reporters that he was anxious to meet the famous Russian super-heavy, Vasily Alexeev, in the 1972 Olympic Games. The previous year, at the World Championships, Alexeev had barely beaten Patera, but Patera now felt they were on a more equal footing: "Last year, the only difference between me and him was that I couldn't afford his pharmacy bill. Now I can. When I hit Munich next year, I'll weigh in about 340, maybe 350. Then we'll see which are better-his steroids or mine." For further information see: Terry Todd, "Anabolic Steroids: The Gremlins of Sport," *Journal of Sport History* 14, no. 1 (Spring 1987): 87-107.

[144] John M. Tokish, Mininder S. Koches, and Richard J. Hawkins, "Ergogenic Aids: A Review of Basic Science, Performance Side Effects and Status in Sports," *American Journal of Sports Medicine* 32, no. 6 (2004): 1543-1553; Anthony Giorgi, Robert P. Weatherby, and P.W. Murphy, "Muscular Strength, Body Composition and Health Responses to the Use of Testosterone Enanthate: A Double Blind Study," *Journal of Science and Medicine in Sport* 2 (1999): 341-355; K.E. Friedl, "Effect of Anabolic Steroids on Physical Health," in *Anabolic Steroids in Sport and Exercise*, ed. C.E. Yesalis (Champaign, Ill: Human Kinetics, 2000), 175-225; H. Haupt and G. Rovere, "Anabolic Steroids: A Review of the Literature," *American*

Although there has not been an all-revealing exposé of the systematic doping of athletes as occurred in the former East Germany, over time it has emerged that doping played a significant role in Soviet high-performance sport.[145] Dr. Sergei Portugalov, who was responsible for the pharmacological administration to several Soviet national teams over a fifteen-year period, explained in a leading Russian sport journal, "I am categorically against the use of stimulants in youth sport, but high performance sport is a very special case…The question of how an athlete can lift three hundred kilos or set a record in the one hundred meters interests everyone—scholars, equipment makers, television and of course, pharmacology."[146] Portugalov proceeded to explain the accuracy to which Soviet drug testing was manipulated to avoid detection, **"**Basically, the question of a drug test's result has no meaning whatsoever…if a test is negative it only means the pharmacological preparation was done correctly. If it is positive, then the coach is an idiot.**"**[147] The ability to consistently and confidently pass drug tests was supported by a March 1989 article in the Soviet magazine, *Smena*, which reported during the 1988 Olympic Games in South Korea that the Soviet team were pre-tested aboard the ship, *Mikhail Sholokhov,* sixty miles off the Korean coast to ensure nobody tested positive.[148]

Journal of Sports Medicine 12, no. 1 (1984): 34-38. Note: Steroids have also been shown to cause numerous negative side effects including liver damage, testicular atrophy, cardiovascular disease, and psychological disturbances.

[145] Robert Edelman, "Comparative Analysis of Doping Scandals: Canada, Russia and China," in *Doping in Elite Sport: The Politics of Drugs in the Olympic Movement*, ed. Wayne Wilson and Edward Derse (Champaign, Ill.: Human Kinetics, 2001), 163. For full coverage of the systematic doping of East German athletes see: Steven Ungerleider, *Faust's Gold: Inside the East German Doping Machine* (New York: St Martins Press, 2001).

[146] Yelena Vaitsekovskaia, "Doping," *Sportekspress Zhurnal* 1, no. 1 (December 1996): 52-59. In Edelman, "Comparative Analysis of Doping Scandals: Canada, Russia and China," 162-163.

[147] Ibid.

[148] "Steroid Use Rampant in U.S.S.R. Soviet Magazine Says," *Globe and Mail* (25 March 1989).

Further disclosures of Soviet doping practices were revealed by Michael Kalinski, former Chairman of the Department of Sport Biochemistry at the Kiev Institute of Physical Culture, who described how in 1972, he received a classified thirty-nine page paper entitled "Anabolic Steroids and Sport Capacity." The document promoted the positive effects (increased strength and performance) of steroids, while ignoring acknowledged side effects such as decreased sperm production, impotence, premature puberty, liver problems and skeletal muscle injuries. Fortunately, Kalinski's conscience prevented him from distributing the document and the secret was only revealed in 2000 once he gained refuge and US citizenship, ten years after leaving the Soviet Union at the end of 1990.[149]

The acknowledged benefits of steroids, raises the question of whether it is possible to distinguish between improvements in performance attributable to periodization and those due to drugs. How can we say it is periodization that has brought the time in the 100 meters to under ten seconds, for example, when the runner may well be filled with anabolic agents?[150] Unfortunately, because of the multifaceted nature of training for sport it is difficult to categorically answer this question. In the 2001 interview conducted for this dissertation, Matveyev was specifically asked to discuss the

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[149] Janet Rae Brooks, "Former Sport Scientist Reveals Soviet Steroid Program for Athletes," Salt Lake Tribune, www.sltrib/soviet/steroid/10235 (accessed June 30, 2003).

[150] At the 1988 Seoul Olympics in the 100-meter final, Ben Johnson of Canada finished first in a new world record time of 9.79 seconds. However, three days later Johnson was disqualified and stripped of his gold medal for taking anabolic steroids. Following this historic event the International Olympic Committee issued the following statement: "The urine sample of Ben Johnson collected on Saturday 24th September 1988 was found to contain the metabolites of a banned substance namely stanozolol (anabolic steroid)…The I.O.C. Medical Commission recommends the following sanction: disqualification of this competitor from the Games of the XXIV Olympiad in Seoul. Of course, the gold medal has been withdrawn by the I.O.C." For further information on Ben Johnson and his classic rivalry with Carl Lewis of the United States see: Wallechinsky, *The Complete Book of the Olympics*, 13-15.

drug/periodization issue. He unequivocally answered that regardless of whether an athlete was taking drugs, the athlete who was able to guide results using the laws of periodization would always be at an advantage and would always perform better than the athlete who did not know how to "guide."[151] In 2002, Tudor Bompa, arguably the West's foremost authority on training theory and periodization was asked the same question. He felt that unless somebody did very vigorous studies that it would be difficult to prove one was of more importance than the other. For Bompa the key benefit of taking drugs was to enhance recovery.[152]

[151] Lev Pavlovich Matveyev interview.

[152] Tudor Bompa interview by author conducted on 11 January 2002 at the National Strength and Conditioning Association Sport Specific Conference held in San Antonio, Texas.

VALERI BORZOV: THE UKRAINE EXPRESS

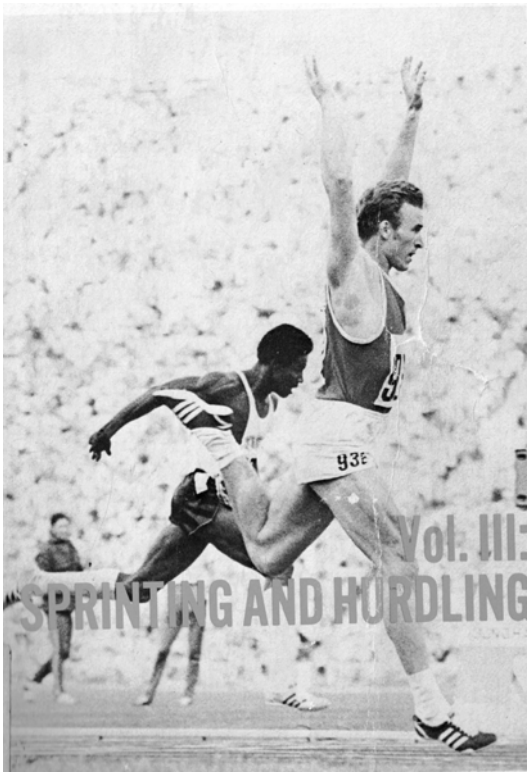

Figure 58. Valeri Borzov of the Soviet Union wins the 200-meters final from Larry Black of the USA at the 1972 Olympic Games in the Olympic Stadium in Munich, Germany.[153]

While it is virtually impossible to separate the intertwined history of periodization and drug use, it is not impossible to see how the application of such methods in the Soviet Union could create truly superior athletes. Valeri Borzov, otherwise known as the "Ukraine Express," provides a good example of the application of theory to practice.[154]

[153] Wilt, ed., *How They Train: Sprinting and Hurdling*. This image was taken from the front cover of the aforementioned book.
[154] Duncanson, *The Fastest Men on Earth*, 146-155.

Valeri Borzov was born on 20 October 1949 in the town of Sambor, located in the Lvov region of the Ukraine.[155] At the age of twelve he came under the tutelage of coach Boris Voitas, who put him through a vigorous training program, emphasizing enjoyment and long term athletic development. For technical preparation he taught him the value of relaxation by sprinting with paper tubes held between his teeth, "The one who did not bite or squeeze the tube was considered a sprinter, while the rest were considered simply runners."[156]

After Voitas laid the physical foundation for sprinting, Borzov enrolled at the Kiev Institute of Physical Culture where he studied biomechanics. While there he came under the applied scientific coaching approach of Valentin Petrovsky, a senior lecturer with a doctoral degree (Ph.D.) in biology.[157] Petrovsky's method of training entailed breaking the 100 meters into component parts—each with their own performance indicators based on the success of Soviet and foreign sprinters. The indicators included the: 1) time for thirty meters from a flying start to evaluate maximum speed; 2) time from a crouching start to thirty and sixty meters for evaluation of the efficiency of the start and rate of acceleration and 3) times for the 100 and 200 meters for evaluation of speed endurance.[158]

In 1968, with a season's best time of 10.2 seconds in the 100 meters, Petrovsky determined that Borzov, in comparison to the world's best sprinters, lacked maximum speed and acceleration. To remedy the situation and to allow Borzov to reach the goal of

[155] Wilt, ed., *How They Train: Sprinting and Hurdling*, 10-11.
[156] Ibid., 148.
[157] Brokhin, *The Big Red Machine*, 119-122.
[158] Duncanson, *The Fastest Men on Earth*, 53.

running 10.0 seconds at the European championships the following year, Petrovsky designed a plan that called for improvements of 0.1 seconds in the thirty meters from a flying start, and at both thirty and sixty meters from a crouch start. Neil Duncanson, author of *The Fastest Men on Earth*, which chronicled the lives of all the Olympic 100 meter champions from the inauguration of the modern Olympic Games until 1988, noted how Borzov's calculations were made with slide-rule accuracy, resembling the design of an aircraft rather than the training of a sprinter.[159] In his quest for improvement, Petrovsky analyzed slow-motion film of previous champions to determine the optimal sprint model for emulation on the track.[160] A specific example of detailed biomechanical analysis of Borzov's technique was provided by L. Oyfebakh in the *Yessis Soviet Sports Review*. After studying film of Borzov competing at the 200 meters at the Znamenski Memorial Games in Kiev, Oyfebakh concluded that Borzov executed all the basic elements of the race correctly and as a result his technique could be used as an example to others.[161]

Petrovsky's detail-orientated approach paid dividends as he planned achievable progressive goals based on Borzov's level of preparation. Borzov described the progression as follows. It began with the first stage which was "to win the Soviet Championships and then trying to 'look good' as Petrovsky would say, in the European

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[159] Ibid., 148.

[160] The importance of analyzing film and formulating ideal models was endorsed in an interview conducted by the author with Coach Tom Tellez on 24 August 2006 at the University of Houston, Texas. Coach Tellez was the coach of Carl Lewis, winner of nine Olympic gold medals. Coach Tellez much like Petrovsky, described how by reading track and field research and by analyzing film he was able to formulate athletic models of what he wanted to coach and how he wanted his athletes to look when they executed their events.

[161] L.Oyfebakh, "On the Track with Valery Borzov," *Yessis Soviet Sports Review* 5, no. 4 (December 1970): 94-97.

Championships, then trying to compete with the Americans and only when I had beaten the Americans several times, to try to get through to the final of the Olympic Games."[162] Petrovsky's philosophy was to focus on a small number of competitions. Borzov would therefore train through meets of lesser importance in order to peak at key races such as the European Championships and the Olympics.[163]

Petrovsky's plan came to fruition as Borzov claimed both the one hundred and two hundred meter titles at the 1972 Olympic Games in Munich. He won the one hundred meters in 10.14 seconds, a full tenth of a second faster than his nearest competitor, Robert Taylor of the United States. After the race he commented, "I can't believe the Olympic gold medal could be won so easily," while claiming, "I gave about ninety percent of what I have to give."[164] The two hundred meters was won with similar aplomb, with Borzov recording 20.0 seconds—a new European record that tied fourth on the all-time list of 200 meter performances.[165]

Over the years, Borzov has often been described as an automaton, a man-made product of a high-tech sprint factory.[166] However, the reality is quite different. Borzov is the only world-class, male sprinter to emerge from the Soviet Union or Eastern Bloc. Indeed, no Caucasian (or Asian) sprinter has ever run the 100 meters legally (not wind

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[162] Duncanson, *The Fastest Men on Earth*, 149.
[163] Wilt, ed., *How They Train: Sprinting and Hurdling*, 10-11.
[164] Duncanson, *The Fastest Men on Earth*, 152; "100 Meters," *Track and Field News* 25, no. 4 (September 1972): 14.
[165] "200 Meters," *Track and Field News* 25, no. 4 (16 September 1972): 16.
[166] Duncanson, *The Fastest Men on Earth*, 147.

aided) under ten seconds.[167] Even the most advanced training methods cannot create the innate ability to sprint necessary to win an Olympic gold medal. Petrovsky was able to achieve success because he: 1) applied a scientific approach to training by isolating specific weaknesses in Borzov's race; 2) created an ideal model to work towards; 3) progressed according to a set plan of achievable goals, and 4) peaked at the right time. This may sound logical but as Matveyev argued in his work, the ability to plan and peak at the right time is critical and can often mean the difference between winning and losing regardless of individual talent levels.

CONCLUSION

This chapter has demonstrated that the combination of applied Soviet sports science and periodization had a marked effect on the training of Soviet athletes as they proceeded to dominate in large part the Summer and Winter Olympic Games from 1956 until 1990. More importantly the ideas created by the Soviet's approach to training and sport science influenced sport worldwide. Matveyev introduced a new paradigm for the preparation of athletes. Because of his work coaches finally understood that training needed to be carefully planned, needed variety, and needed to be carefully coordinated or "guided" in order to create optimal performance. When interviewed, Matveyev, the "Father" of periodization, acknowledged that it was never his intention to popularize his

[167] John Hoberman, "Race and Athletics in the 21st Century," Play The Game, http://www.playthegame.org/Knowledge%20Bank/Articles/Race_and_Athletics.aspx (accessed July 14, 2006).

methods—however, his research on periodization ensured that the world of training for athletics would never be the same again.

CONCLUSION

> The evolution of running occurs not through the efforts of one man, but through the history of what has gone before and what is [will be] happening in the future.[1]

This dissertation has taken me (and you the reader) on a two thousand year journey. At the start of this expedition my goal was to explore and understand how training and the application of science had impacted the performance of elite runners in the twentieth century. This was a largely unexplored research area, and I was particularly fascinated by the changes that occurred in the late twentieth century when periodization theory, a Soviet import, suddenly revolutionized track and field training. Why was it, I wondered, that things changed so rapidly? Why were the Americans so far behind the Soviets and Eastern Europeans in their methods? To understand the impact of periodization on American track and field, I decided that I needed to understand what preceded it, and so I began by gathering all the materials I could find that talked about training theory in English. I examined the main books written by track and field's great coaches, researched the biographies of the prominent runners of the twentieth century, and made a systematic examination of the magazines and journals that conveyed training information to runners and coaches. As I traveled further along this research path I decided that I couldn't understand the twentieth century until I'd understood what had happened before it, and so I went back even further in time and then worked forward,

[1] Walsh, *The Bowerman System*, 8.

trying to think analytically about what I was discovering about training in the pre-modern era.

The decision to go back to the ancients proved valuable as I discovered among many other fascinating facts that a rudimentary version of periodization existed in that early era. Periodization can be defined as a logical, phasic method of manipulating training variables in order to increase the potential for achieving specific performance goals, such as peaking at the right time.[2] I also discovered that it was in ancient Greece that an early connection between medicine and science was forged, helping to give rise to a "Science of Gymnastics."[3] Donald Kyle and Norman Gardiner propose that from the time of the fifth century B.C. onwards, athletes devoted sufficient time to specialized training to be regarded as professional. Unfortunately, due to the paucity of sources in ancient Greece (and Rome) a fractured insight into the training of ancient athletes is inevitable. However, if we are to take the sources at face value (and there is no reason to believe that a sophist such as Philostratus would have gained much political leverage by falsely describing training practices), then Philostratus's account—published around A.D. 220—provides compelling evidence of the birth of a rudimentary form of periodization. The tetrad system, described by Philostratus, contained the basic cycling of training intensity necessary to be considered periodized.[4]

In Chapter Two, I examined athletic training from the Dark Ages until World War I. During the eighteenth and nineteenth centuries, the ideas of the Greeks continued to

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[2] Stone, "The Concept of Periodization."
[3] Gardiner, *Athletics of the Ancient World*, 89; Robinson, *Sources for the History of Greek Athletics*, 212.
[4] Philostratus, *Philostratus: Concerning Gymnastics by Thomas Woody*.

resonate. However, a fascinating array of other archaic training methods also came into common use. Roberta Park, sport historian and professor emeritus at The University of California at Berkeley, notes how training practices during this period were based on theories derived from observation, experience, and word-of-mouth using the "distillations of practices used in training racehorses and gamecocks."[5] Purging, vomiting, forced "sweatings," restricted fluid intake, and the eating of semi-raw flesh featured prominently throughout the eighteenth and nineteenth century, practices that James Irvine Lupton and James Money Kyrle Lupton, authors of *The Pedestrian's Record* (1890) felt if "carried into effect are calculated to send a man to the grave rather than the cinder-path."[6] However, the human body (even when deprived of basic elements such as water) still exhibited tremendous resilience as professional pedestrians such as Captain Barclay performed amazing feats of human endurance by walking 1,000 miles in 1,000 hours for a prize of 1,000 guineas.[7] This era also witnessed the early stages of the application of science to athletic training. However, doctors and coaches still advised caution when prescribing training for fear of overexertion connected with a condition dubbed the "athlete's heart." At the end of this distinctly amateur era, the level of athletic training when compared to modern standards could be classified as "light," in which athletes could stay competitive with very little training.

I next looked at training between the World Wars (1917-1945). In this era, training methods for track were characterized by the advent of "moderate" training loads

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[5] Park, "Athletes and Their Training in Britain and America, 1800-1914," 61.
[6] Lupton and Lupton, *The Pedestrian's Record*.
[7] Peter Radford, *The Celebrated Captain Barclay: Sport, Gambling and Adventure in Regency Times* (London: Headline Book Publishing, 2001).

and the introduction of several innovative new methods. The eight-to-ten week preparatory period characteristic of training prior to 1917 was replaced by fall and spring training culminating in the competitive season. Glenn Cunningham, world record holder in the mile (1934-1937) typified the moderate level of training performed by middle distance runners performed during this era by running in the region of fifteen miles per week. The inter-war years also gave birth to some of the most important innovations in the history of track and field training. The introduction of *fartlek* and interval training by coaches Gosta Holmer and Woldemar Gerschler in the training of their respective athletes—Gunder Hagg and Rudolph Harbig—involves methods that continue to form the cornerstone of competitive track training programs today. This era also gave the first real glimpse of the potential advantage that applied sport science could play in elevating performance. While American sport scientists worked in isolation examining the basic tenets of physiology such as the mechanisms of muscular contraction and the effects of exercise on the heart, the applied German team approach of Rudolph Harbig (athlete and former world record holder in the 400 and 800 meters), Woldemar Gerschler (coach and professor of Physical Education), and Dr. Herbert Reindell (cardiologist) demonstrated that applied sport science could have revolutionary consequences in elevating performance levels and breaking world records.

In Chapter Four I used the quest to become the first man to break the four minute mile barrier as an organizing principle for the changes in track training that occurred after World War II. The ultimate conqueror, Sir Roger Bannister, who broke the record on 6 May 1954, benefited from the innovative use of interval training developed by Woldemar

Gerschler and Herbert Reindell in the mid 1930s. While there was a general trend towards an increased volume of training during this period, Bannister demonstrated that the quality of training (performed in as little as half an hour a day) could be equally if not more important than the volume (number of miles run) of training. Bannister was successful, as historian Arnd Krüger has suggested, because he adopted a distinctly scientific approach to training and peaking for his world record attempt.[8]

Chapter Five chronicled the training theories and methods of some of the most successful track coaches and athletes between 1945 and 1975. Following the arduous "Stotan" training methods of Percy Cerutty (featured in Chapter Four), Arthur Lydiard in the late 1950s and 1960s introduced the concept of preliminary marathon training—100 miles per week for all distance runners from 800 to 10,000 meters.[9] Lydiard's recommendations along with the training of Emil Zátopek (winner of the 5,000 and 10,000 meters and the marathon at the 1952 Olympic Games), Peter Snell (winner of the 800 and 1,500 meters at the 1964 Tokyo Olympics) and Jim Ryun (former world record holder in the mile) epitomized a transition from moderate to "heavy" training loads that occurred during this era. Other eminent coaches such as Payton Jordan of Stanford University and William Bowerman of the University of Oregon offered balance to the heavy volume training approach by emphasizing quality over quantity.[10] Finally, University of Indiana swim coach James "Doc" Counsilman provided a key link to the Soviet Union's detailed scientific approach by demonstrating the application of science to

[8] Krüger, "Training Theory and Why Roger Bannister Was the First Four-Minute Miler," 305-324.
[9] Cerutty, *Athletics: How to Become a Champion*; Lydiard and Gilmour, *Run to the Top*.
[10] Jordan and Spencer, *Champions in the Making: Quality Training for Track and Field*; Bowerman, *Coaching Track and Field*.

sport. For Counsilman, swimming was an arena in which science and performance merged and where "each practice session can be a course of scientific discovery."[11]

Following the end of WWII, interest in the scientific aspects of training increased exponentially among coaches, athletes, and researchers. Hans Selye's seminal *The Stress of Life* (1956) examined the very foundation upon which training was based—the nature and magnitude of the adaptive response. Coaches such as Fred Wilt (inaugural editor of *Track Technique*), Forbes Carlile (Australian Olympic swim coach) and DeLoss Dodds (head track and field coach at Kansas State University 1963-1977) recognized the importance of Selye's contribution and sought to directly apply his work to the track or swimming pool. The late 1950s witnessed an explosion in the application of weight training to sport. The effective use of weight training to increase speed and power, reduce injury, and improve flexibility finally "put to bed" the long-held belief that weightlifting would make someone "musclebound."[12] By the 1970s weight training was deemed an integral component of an athlete's training program and had completely revolutionized track and field training methods.[13] Exercise physiology in the "formative years" (1963-1976) and biomechanics (post-1960) established themselves as separate academic disciplines, becoming part of the "academy" of sport sciences in nearly all Physical Education Departments and American universities. However, while research scientists in America and the West focused on solving many of the basic questions connected with physiology and biomechanics such as how to measure the "lactate threshold" or what was

[11] Counsilman, "Coaches Can Be Their Own Scientists," 4.
[12] Todd and Todd, "Peter V. Karpovich," 213-220; Todd, "The Myth of the Muscle-Bound Lifter," 37-41.
[13] Hooks, *Weight Training in Athletics and Physical Education*.

the best high jump technique, it became apparent in the mid-to-late 1960s that a new science of training organization was emerging in the former Soviet Union and other allied communist states. In the language of Thomas Kuhn, author of the *The Structure of Scientific Revolutions,* a paradigm shift in the ruling theories of training was taking place.[14]

In my final chapter, I examined the rise of Soviet sport science and the advent of periodization. Following WWII the Soviet Union established itself as the sole military and political force capable of matching the United States. In the battle for world ideological supremacy the Soviet Union utilized sport as a political tool to demonstrate the superiority of its communist system. To achieve world sporting domination the Soviet Union mobilized vast sums and an array of resources which quickly produced the desired result. From 1956, Soviet athletes, by and large, proceeded to dominate the winter and summer Olympic Games up until the dissolution of the USSR in 1991. Integral to achieving the best sporting results was the application of "cutting edge" sport science and the advent of periodization. In the late 1950s and early 1960s Professor Lev Pavlovich Matveyev of the Central State Institute of Physical Culture in Moscow, in his groundbreaking research, analyzed thousands of athletes to develop the "Fundamentals of Sports Training" and the all-important theory of periodization. From his research Matveyev derived a general theory of sport based on scientific principles that guided (or steered) the training process to facilitate ongoing progress and peaking at the right time.[15]

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[14] Kuhn, *The Structure of Scientific Revolutions*.
[15] Matveyev, *Periodization of Sports Training*.

However, the exact details of this comprehensive method of planning an athlete's training remained primarily in Eastern Europe and it was not until 1975, in *Track Technique,* that Frank Dick of Great Britain introduced the first detailed English-language overview of Matveyev's theory of periodization. Dick was able to convey in relatively simple language the theory of periodization and begin the all-important process of helping Western coaches incorporate this revolutionary new method of planning into the training of their athletes.

Over the course of this dissertation it became apparent that to understand how to optimally enhance an athlete's performance it was vital to place training within the wider context of sport culture. Although conceptually it is easier to break sport into its constituent parts, sport and the training for track should not be viewed through the isolated lens of one particular discipline or individual coaching philosophy but rather through a holistic understanding of all the different factors (and branches of sport science) that affect performance. It is perhaps here that Lev Pavlovich Matveyev's groundbreaking concept of periodization had its greatest appeal (and impact) as he introduced a general theory of training that could be applied to all sports. The introduction of periodization had major reverberations for the training of athletes throughout the world and over the course of the last thirty years periodization replaced most of the early training systems discussed in this dissertation.

Ultimately, what made periodization find such quick acceptance in the United States was the fact that American coaches had already embraced science. Nearly all coaches and athletes understood by 1975 that high performance sport was no longer

possible without scientific support and they further knew that they were at a disadvantage when competing against Soviet-bloc athletes whose government was providing them with extraordinary levels of training expertise. How periodization ultimately spread throughout the world of American track and field and then into other modern sports remains a subject for future researchers, however. The question of how periodization spread leads us in turn to other research areas, associated with this dissertation, worthy of future study. Examination of the training theory and methods of elite runners from antiquity through 1975 proved a sizeable task but inevitably left a twenty-five year plus gap in training knowledge that may prove be my next topic of investigation.

The traditional model of periodization when applied to resistance training may be defined as linear due to the progressive increases in intensity over time. However, since the introduction of Matveyev's original work, different periodization schemes designed for specific applications have evolved which are worthy of further study and comparison. The undulating or non-linear form of periodization involves large daily fluctuations in the load and volume of training while other periodization models include abrupt step-like alterations in workload; the balanced distribution of technical skill and strength work during preparation and competition phases and the "conjugate" sequence system where concentrated workloads with one primary emphasis are arranged in a series of blocks.[16]

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[16] D. Baker, G. Wilson, and R. Carlyon, "Periodization: The Effect on Strength of Manipulating Volume and Intensity," *Journal of Strength and Conditioning Research* 8 (1994): 235-242; Steven J. Fleck and William J. Kraemer, *Designing Resistance Training Programs*, 2nd ed. (Champaign, Ill.: Human Kinetics, 1997); A.D. Ermakov and N.S. Atanasov, "The Amount of Resistance Used in the Training of High Level Weightlifters," *Soviet Sports Review* 18, no. 3 (1983): 115-117; A. Bondarchuk, "Long Term Training for Throwers" (paper presented at the Australian Track and Field Coaches Association/Rothmans Foundation, 1994), 12-20; Mel Siff, *Supertraining* (Denver, CO: Supertraining Institute, 2000).

Over the years Matveyev's theory of periodization has often been criticized for its lack of application to modern professional team sports where (unlike Olympic events) planning measured progress and peaking is difficult due to heavy competitive schedules. Furthermore, the application of a periodized model in the United States has resulted in its own unique challenges as most athletes (as we discovered in Chapter Seven) have to peak two to three times per year, making it difficult to achieve one genuine peak.[17] The questions of how periodization applies or has been modified to fit professional team sports and the American system are topics worthy of future investigation.

Finally, due to this dissertation's timeline, analysis of the application of science to sport finished in 1975. This leaves another three decades of advances in science and medicine that warrant further investigation. The march of scientific progress in the twenty-first century continues unabated as witnessed by recent advancements in genetic engineering. This powerful example of modern technology has tremendous potential in treating multiple disease processes associated with conditions such as cystic fibrosis and hemophilia but it could also be used by athletes to "cheat" their way to the top of the medal podium.[18] For this reason, the World Anti-Doping Agency (WADA) in 2002 recognized "gene doping" as a new threat by including it in the list of prohibited practices, defined as "the non-therapeutic use of cells, genes, genetic elements, or of the

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[17] Freeman, *Peak When It Counts: Periodization for American Track and Field*, 64-68. Freeman devotes a specific chapter to "Challenges for the American Coach," where he outlines several of the challenges and the possible solutions.

[18] Fabian Filipp, "Is Science Killing Sport? Gene Therapy and Its Possible Abuse in Doping," *European Molecular Biology Organization Reports* 8, no. 5 (2007): 433-435; "G.M. 'Marathon' Mice Break Distance Records," New Scientist, http://www.newscientist.com/article.ns?id=dn6310 (accessed February 10, 2008).

modulation of gene expression, having the capacity to enhance athletic performance.[19] Gene doping and the use of designer steroids (and other performance enhancing substances) as epitomized by the recent Bay Area Laboratory Co-Operative (BALCO) scandal provide examples of ever increasing technology aimed at enhancing performance (albeit illegally) worthy of future study and research.[20]

While researching this topic it has been a privilege to learn and gain insight into the training philosophies and practices of some of the greatest coaches and athletes who have ever lived—coaches such as Brutus Hamilton, Dean Cromwell, Franz Stampfl, Percy Cerutty, Arthur Lydiard, Payton Jordan, Bill Bowerman, James "Doc" Counsilman, and Tom Tellez and athletes such as Paavo Nurmi, Jesse Owens, Emil Zátopek, Roger Bannister, Peter Snell, Jim Ryun, and Valeri Borzov. These men, both through their training methods and personal stories continue to impact modern running. Ryan Hall, the fastest American-born marathoner in history, and one of the USA's best prospects for the 2008 Beijing Olympic Games, for example, recently paid tribute to Jim Ryun and his annual running camp by stating, "The Jim Ryun running camp was one of the greatest running experiences of my life. Who I am as a runner and [as] an individual, directly stem from my time at the camp."[21] Ryan Hall's homage to Ryun reminds us of Oregon coach Bill Bowerman's remark that, "The evolution of running occurs not

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[19] "The World Anti-Doping Code: The 2008 Prohibited List, International Standard.," World Anti-Doping Agency, http://www.wada-ama.org/rtecontent/document/2008_List_En.pdf (accessed April 10, 2008).
[20] Mark Fainaru-Wada, *Game of Shadows: Barry Bonds, Balco, and the Steroids Scandal That Rocked Professional Sports* (New York: Gotham Books, 2006).
[21] "Jim Ryun Running Camp," Ryunrunning.com, http://www.ryunrunning.com/ryun/ (accessed April 10, 2008).

through the efforts of one man, but through the history of what has gone before and what is [will be] happening in the future."[22]

Frank Dick's 1975 overview of Professor Matveyev's theory of periodization further reinforces Bowerman's comments above and created the endpoint for this dissertation's two thousand year journey. The introduction of periodization caused a major shift in the paradigm of planning an athlete's training, so much so that by the turn of the twenty-first century periodization formed the foundation "of most modern coaching theory and practice."[23] So complete has the paradigm shift been that as Tudor Bompa—the foremost Western authority on periodization asserts, periodization is now "the basis of every serious athlete's training."[24] While the applied use of periodization and science does not guarantee coaches and athletes will achieve success, it certainly improves their chances of attaining it.

[22] Walsh, *The Bowerman System*, 8.
[23] Rowbottom, "Periodization of Training."
[24] Bompa, *Periodization: Theory and Methodology of Training*, 499-512.

GLOSSARY

Active Rest—The time off from regular training. The active refers to activities such as hobbies or sports that involve some degree of physical activity.

(ATP) Adenosine Triphosphate—Primary short-term source of energy to fuel muscular contractions.

Anaerobic Glycolysis—The non-oxidative breakdown of glycogen to restore levels of ATP.

Anaerobic Threshold— The intensity of exercise at which there is a disproportionate increase in anaerobic metabolism from aerobic metabolism.

Biomechanics— The application of mechanical laws to living structures.

Biomotor Abilities—Include strength, speed, endurance and coordination.

Cardiac Hypertrophy—Enlargement of the heart.

Circuit Training— Selected exercises or activities performed in sequence.

Clean and Jerk—Olympic weightlifting movement where the barbell moves explosively from the ground to the shoulders (Clean) and then is raised above the head (Jerk).

Concentric—A type of muscular contraction where the muscle shortens as it exerts force.

Density—Refers to the number of training sessions.

Eccentric—A type of muscular contraction where the muscle lengthens as it exerts force

Electrocardiogram— A test that records the electrical activity of the heart.

Endocrine—Refers to glands that secrete hormones circulated in the bloodstream.

Fartlek— Periods of more intense running are alternated with periods of less strenuous effort in a continuous workout.

Glycogen—Storage form of glucose, found in liver and muscles.

Intensity— A measure of how difficult training is. In weight training it is defined as a percent of the maximal weight that can be lifted for a specific number of repetitions.

Interval Training—Training program that alternates bouts of heavy or very heavy work with periods of rest or light work.

Lactic Acid (Lactate)—by-product of anaerobic glycolysis.

Macrocyle—One entire training year, normally thought of as starting with the last competition of one year and ending with the last competition of the following year.

Microcycle—One week of training.

Mesocycle—Refers to a major training phase within a year, or, a training phase four to six weeks long.

Overreaching—An accumulation of training or non-training stress resulting in a short-term decrement in performance capacity with or without related physiological or psychological signs and symptoms of overtraining in which restoration of performance capacity may take from several days to several weeks.

Overtraining—An accumulation of training or non-training stress resulting in a long-term decrement in performance capacity with or without related physiological or psychological signs and symptoms of overtraining in which restoration of performance capacity may take from several weeks or months.

Pedagogy—The art, science or profession of teaching.

Periodization—Systematic, sequential and progressive approach to the planning and organization of training of all biomotor abilities (strength, speed, suppleness, stamina and skill) into a cyclic structure in order to obtain optimal development of an athlete's or a team's performance.

Snatch—Involves rapidly lifting a barbell from its starting position on the floor, to an overhead position in one continuous motion.

Specificity—A training effect is limited to the physiological systems used and overloaded during training.

Steady State Running—A state obtained in moderate muscular exercise when the removal of lactic acid by oxidation keeps pace with its production.

Strides—Smooth running in the range between jogging and sprinting at maximum speed.

Supercompensation—The post training period when the trained function/parameter has a higher capacity than the original one.

Taper—A reduction in training volume lasting from several days to two weeks prior to important competitions to allow complete recovery and best possible performances.

Ventilatory Threshold—The point at which there is a non-linear increase in the ventilation rate in relation to oxygen consumption.

Volume—A measure of how much training is performed. In weight training it is defined as the total number of repetitions, or the total amount of weight lifted in a specific period of time (such as a week).

The following glossary was primarily taken from Brian J. Sharkey and Steven E. Gaskill, *Sport Physiology for Coaches* (Champaign, Ill.: Human Kinetics, 2006) and Steven J. Fleck and William J. Kraemer, *Periodization Breakthrough* (New York: Advanced Research Press, 1996).

RESEARCH NOTE

The quest for the origins of training began at the Todd-McLean Physical Culture Collection in the H.J. Lutcher Stark Center for Physical Culture and Sports at the University of Texas at Austin. The collection is regarded as the largest and finest compilation of archival materials related to physical culture, strength, body building, and alternative medicine in the world. Examination of its contents revealed a wealth of track and field and training information, ranging from the original works of Hieronymus Mercurialis's *De Arte Gymnastica* (1569) and John Sinclair's *The Code of Health and Longevity* (1807) to the most recent sports and physical culture journals such as the *Journal of Strength and Conditioning Research*.[1] Training information was supplemented by the use of the Perry-Casteneda Library at the University of Texas at Austin and extensive use of its inter-library loan service that afforded access to rare training materials including original Soviet and German articles and a copy of Lev Pavlovich Matveyev's pioneering text *The Fundamentals of Training*.[2]

In the increasingly electronic age, the author found himself ever more reliant upon electronic sources and emails that provided key information and personal reflections from track and field coaches and related personnel. The author was in regular contact with Vern Gambetta (former editor of *Track Technique*); James Dunaway, track and field authority and frequent contributor to *Track and Field News*, and internationally

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[1] Sinclair, *The Code of Health and Longevity: Or a Concise View of the Principles Calculated for the Preservation of Health and the Attainment of Long Life*; Mercurialis, *De Arte Gymnastica Aput Ancientes*.
[2] Lev Pavlovich Matveyev, *Fundamentals of Sports Training*, trans. Albert P. Zdornykh (Moscow: Progress Publishers, 1981).

acclaimed track and field coach, Dan Pfaff.[3] Finally, this dissertation was supplemented by crucial oral history interviews. The author was fortunate to meet a fellow student, Shanna Dorian at the University of Texas at Austin prior to her trip to Moscow in the fall of 2001 as part of her Eastern European studies degree. There she interviewed Lev Pavlovich Matveyev—the "Father" of periodization at the Russian State Academy of Physical Culture in Moscow. Other key coaches and former athletes that I personally interviewed included: Tudor Bompa, the foremost Western authority on periodization; Michael Stone, head of sports physiology for the United States Olympic Committee; Tom Tellez, coach to Carl Lewis—who with nine Olympic gold medals in his career was voted "Sportsman of the Twentieth Century" by the International Olympic Committee, Leroy Burrell, Head Track and Field Coach at the University of Houston and former world record holder in the 100 meters and Boyd Epley, former Head Strength and Conditioning Coach at the University of Nebraska and founder of the National Strength and Conditioning Association.

Finally, I also relied heavily on my own extensive personal library and material accumulated while employed as a volunteer and professional track and field coach under the mentorship of Coach Dan Pfaff including detailed workout and training plans.[4]

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[3] James Dunaway was once called "The Track Nut of the World," by *Sports Illustrated* and has covered every Olympics since Melbourne (1956). He is also the author of James O. Dunaway, *Sports Illustrated Track and Field: Running Events* (Philadelphia: Lippincott, 1972).

[4] Dan Pfaff was the Assistant Track and Field Coach at the University of Texas from 1995 to 2003. As of 2008 he is the current head coach and COO of Tiger Bar Sports. Coach Pfaff continues to inspire and help athletes fulfill their potential as witnessed by nine athletes of his athlete who have qualified for the 2008 Beijing Olympic Games**.**

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INTERVIEWS

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Leroy Burrell, interview conducted on 24 August 2006 by the author at the University of Houston, Texas.

Lev Pavlovich Matveyev interview conducted on November 16 2001 by Shanna Dorian of the University of Texas conducted at the Russian State Academy of Physical Culture, Moscow

Michael Stone interview conducted on 11 January 2002 by the author at the National Strength and Conditioning Association Sport-Specific Conference in San Antonio, Texas.

Tom Tellez interview conducted on 24 August 2006 by the author at the University of Houston, Texas.

Tudor Bompa interview conducted on 11 January 2002 by the author at the National Strength and Conditioning Association Sport Specific Conference held in San Antonio, Texas.

VITA

Nicholas David Bourne was born, in Stratford, East London on 28 June 1965, the son of Edna Kathleen Rogers and Henry James Bourne. From 1979 until 1983 he attended Sir George Monoux High School in Walthamstow, East London. In the fall of 1983 until the summer of 1986 he attended the Royal Liverpool Hospital College, School of Physiotherapy (affiliated to Liverpool University) where he graduated as a Chartered Physiotherapist (physical therapist). In 1988 he began the first of two Master's degrees at Loughborough University of Technology where he graduated with a degree in Physical Education and Sport Science. In 1998 he graduated from the University of Texas at Austin with his second Master's Degree in Kinesiology with a Specialization in Exercise Science. There he volunteered in the varsity weight room with women's athletics and the Longhorn football team and was also employed as a teaching assistant in the Department of Kinesiology and Health Education. In 1999 he returned to the University of Texas at Austin to pursue an interdisciplinary doctoral degree combining the disciplines of sport history and exercise science. While at the University of Texas he was employed (2000-2002) as a graduate assistant in the University of Texas weight room assisting with men's football, swimming, baseball and track and field teams. Later he was employed (2002-2004) as a volunteer assistant track and field coach. In addition, while at the University of Texas he was employed as a Graduate Teaching Assistant where he taught a number of classes including weight training and conditioning, applied human anatomy laboratory,

physiological basis of conditioning, core conditioning and was a regular guest lecturer on the athletic training degree program.

In 2003 he began Curricular Practical Training (CPT) as an assistant track and field coach and physical therapist to a number of elite track and field athletes in Cary, North Carolina. As part of the role, the author accompanied athletes to the US Championships, the European circuit and the 2003 World Track and Field Championships. This enabled him to gain a unique insight into the professional world of track and field and gain valuable knowledge and experience for this dissertation. Later in 2007, after focusing attention to his doctoral dissertation, Bourne was employed as an performance specialist intern and later as a full-time employee for the world renowned Athletes' Performance in Tempe, Arizona and Los Angeles, California—responsible for training some of the leading athletes in sport.

His professional qualifications include being a licensed physical therapist in the United States, a chartered physiotherapist in the United Kingdom, a USA Level I and II (sprints and hurdles) Track and Field coach, a Certified Strength and Conditioning Specialist (CSCS), and a USA Weightlifting (Club Coach). Bourne has presented his research at the North American Society for Sport History annual meeting, and published articles in the *British Journal of Sports Medicine* and *Iron Game History*. He is also the founder of www.martialartsforfootball.com.

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This dissertation was typed by the author