The War on Cancer: 41 years after Nixon’s Declaration

Mark Clanton, MD, MPH,
Chief Medical Officer,
American Cancer Society, High Plains Division

American Cancer Society®

Environmental Science Institute
Fostering environmental research, education, and outreach across disciplines
Embedded YouTube Video of Nixon’s Declaration of War on Cancer:
http://www.youtube.com/watch?v=E2dzEDnGqHY
The above general timeline traversing the point from **scientific discover** to **clinical practice** is fundamentally governed by the existence and cost of technology.

If new technology must be invented for the purpose of translating a new test or treatment into a practical clinical tool then the timeline is elongated.
The above general timeline traversing the point from scientific discovery to clinical practice is fundamentally governed by the existence and cost of technology.

If new technology must be invented for the purpose of translating a new test or treatment into a practical clinical tool then the timeline is elongated.
Risk Factors/Causes of Cancer in the US

- Smoking
- Obesity/Poor Nutrition/Inactivity
- Unknown
- Occupational Exposure
- Viruses
- Family History/Genetics
- Alcohol
- UV and Ionizing Radiation
- Prescription Drugs

*Redesign of survey in 1997 may affect trends. Estimates are age adjusted to the 2000 US standard population using five age groups: 18 – 24 years; 25 – 34 years; 35 – 44 years; 45 – 64 years; and 65 years and over.
Where and How will Science Battle Cancer in the Future?
Where will the War on Cancer be Waged in the Future?

• Understanding Personal and Population Risk for Cancer
• Precision Screening and Diagnosis
• Changing Science Policy
Gene-Environment Interaction: Public Health and Personal Risk

or

Where DNA Meets the World
If smoking is the most common cause of lung cancer, why do only 10 to 20% of heavy smokers develop the disease?
Why are rates of breast cancer high in the United States compared to other parts of the world...

...though, even in the US, most women do not develop the disease?
Gene-Environment: a new area of investigation of Public Health Research

The dance between genes and environment is the focus of a burgeoning field of public health research:

Gene-environment studies describe the complex ecology of disease

Researchers in public health are expanding the definition of the environmental exposure beyond pollution and radiation to now include how genes are influenced by the body’s exposure to:

- Diet
- Exercise
- Infections (Hepatitis B, HPV)
- UV light
- Workplace hazards
Comprehensive answers will be found when we understand what happens when DNA meets the world.
The historical view of science viewed DNA as a structural and static element of biology and reproduction whose influence flowed from the cell to the individual and whose effects on health were then expressed in populations. We now understand that the environment interact DNA in a dynamic way to affect the health of individuals and the populations that they constitute.
DNA
- Single gene mutations
- Nucleotide polymorphisms
- Gene-gene interactions
- Gene-environment interactions

Environment
- Environmental Exposures
- Diet
- Exercise
Is Obesity a Genetic or Environmental Cause of Cancer?

This unusual question is complex and will only be answered when we consider the effects of personal genetics and environmental interactions such as exercise, diet and exposures.
The Impact of Gene-environment Interactions

Assuring Conditions for Population Health

Community
Government and Public Health Infrastructure
Academia
The Media
Health Care Delivery System
Employers and Business
RECENTLY ENROLLING: CPS-3

- UT Medical School could play a role here
- Need more than 300,000 enrollees
- Enrollments occurring in Missouri, Oklahoma, and Texas
- Long term commitment
- Diverse population
Can we find Cancer Cells before they become a Cancer Diagnosis?

- Circulating Tumor Cells
Circulating Tumor Cells: Shed from tumors, and in the bloodstream

- Progress in Prostate Cancer?
- What is Our Detection Limit Capability?
• Draw blood (10ml)
• Cells are processed and isolated using either a biological or physical process
• RNA is amplified 8,000 times
PROSTATE CANCER:

- Researchers from Mount Sinai School of Medicine have identified a six-gene signature that can be used in a test to predict survival in men with aggressive prostate cancer.
- Men with the six-gene signature were high-risk, with a survival time of 7.8 months, and men without it were low-risk, with a survival time of approximately 34.9 months.
- "The genes noted in the model suggest possible changes in the immune system related to late-stage disease that warrant further study as a target for immune-based therapies," said Dr. Oh.

Journal Reference:

In studies done on prostate, breast and colon cancer patients, median survival of metastatic patients with positive samples is about half the median survival of metastatic patients with negative samples.

Precision Screening Cancer: Colorectal Screening

The Present as an Example
Colon Cancer Screening Today

- Card based test such as Hemoccult and SDNA
- Sigmoidoscopy
- Virtual Colonoscopy
- Double Contrast Barium Enema
- Colonoscopy
Colon Cancer Screening Tomorrow

Colonoscopy and Gold Nanoparticles
Nanoscale devices are one hundred to then thousand times smaller than human cell
Can nanostructures help us see cancer?

Quantum dots:

• Tiny quantum dots are made from semiconductor crystals as small as one nanometer (one-billionth of a meter).

• They can zero in with pinpoint accuracy on human prostate cancer.

In ultraviolet light, each dot radiates a brilliant color.
Advances in Colorectal Screening and Diagnosis:
Gold Nanoparticles

- Identification and removal of non-invasive high grade neoplasia
- Flat/ulcerative colorectal neoplasms more dangerous
- Flat lesion more difficult to find
- Gold nanoparticles may offer more precise diagnosis of GI cancers.

Scanning electronmicrograph of gold nanoparticles created by the National Cancer Institute and the National Institute of Standards and Technology, Credit: NIST (2008)
Can Research be changed to speed its impact on Humans?
The above general timeline traversing the point from **scientific discover** to **clinical practice** is fundamentally governed by the existence and cost of technology.

If new technology must be invented for the purpose of translating a new test or treatment into a practical clinical tool then the timeline is elongated.
Compressing the time to translation is possible when either the technology necessary to translate basic scientific knowledge to test and therapy exist or when existing technology which is being used for another purpose can be adapted for a new purpose (another form of translation).
“The highest and best purpose of biomedical science is realized when the knowledge derived from research is used to improve the human condition.”

Mark Clanton, MD, MPH - NIH
QUESTIONS?
Health Policy and Medical Practice Issues

- Understanding more about them mechanisms of disease will undoubtedly lead to new treatments.
- The more scientists identify and fine-tune the genetic factors behind disease or drug response, the more doctors will want to screen individuals for gene variants in order to tailor medical care.
- Such personalized medicine may well lead to higher health care costs and thus may create a policy quandary.
Policy Quandaries

- If not communicated well, the findings from gene environment research could even backfire.

If you found a set of genes that made people highly resistant to the effect of smoking on lung cancer - and again, that’s a hypothetical - it’s unlikely that those same genes would make people resistant to the other bad effects of smoking like heart disease.