

THE HEIGHT OF COLLEGE WOMEN

(Second Note)

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[The following figures and data collected by Dr. Mosher in connection with her work at Leland Stanford University are of much interest to those who are watching the mental and physical development of the race.]

THE popular belief that women are increasing in size has, apparently, received some confirmation from the study of 4,023 women who entered Stanford University during the past thirty years.* This study has been limited to the entrance physical examinations, a limitation which minimizes the influence of the college work; the number of graduate students included in these cases is probably too small to have had any great amount of influence. Every available record has been used which gave age, weight, and height of the women at their entrance physical examinations.

The romantic story of the founding of Stanford University gave its opening in 1891 a very wide publicity and attracted students, not only from California and the neighboring States, but also from the Middle West and from the far East, both North and South. Every State in the Union, with the exception of Delaware and North Carolina, has sent its daughters to Stanford University. The distribution of the birthplaces in the thirty years considered

*Mosher, Clelia Duel, "Concerning the Size of Women," Preliminary Note in California State Journal of Medicine, Feb. 1921. The main part of this preliminary note is presented here together with certain revisions and additions.

is surprisingly uniform. California, with 1,502 native-born students, contributes only about 35 percent of the total number considered in this study. If we omit the Californians and consider only the number from the other Pacific States, we find 131, while 132 were born in the New England States; the Middle Atlantic group provided 242 and the Mountain States 292; the East North Central States are represented by 672 and the West by 682. The South shows a smaller number, 42 from the East and 68 from the West-South Central States.

The foreign born number 132. They are rather evenly distributed through the three decades, and show no marked deviation from the average height of their respective years. Many of the foreign-born students are Canadians who have lived a good part of their lives in the United States; others are foreign-born daughters of American missionaries and engineers, who were by chance living in foreign lands; or in some cases there are American college men's children born abroad while their fathers and mothers were in residence in foreign universities. In any case, the numbers are too small to influence materially the average height for any given year. Thus it would seem that these Stanford women are a fair sample of American college women rather than a localized group.

Table I shows by States* the distribution of the birthplaces of 4,023 Stanford women, and also shows the number in each group of States.

The curves for the Californians and non-Californians both show the upward trend of weight and height and the downward trend of the age curves.

*It is unfortunate that the records made it impossible to separate the numbers of women coming from North and South Dakota; these were therefore considered together.

**TABLE I. PLACE OF BIRTH BY STATES OF
4023 STANFORD WOMEN**

New England States—132

Connecticut	26	New Hampshire	8
Maine	32	Rhode Island	5
Massachusetts	52	Vermont	9

Middle Atlantic States—242

New Jersey	25	Pennsylvania	80
New York	137		

South Atlantic States—42

District of Columbia	13	South Carolina.....	3
Florida	3	Virginia	6
Georgia	5	West Virginia.....	5
Maryland	7		

East North Central States—672

Illinois	256	Ohio	123
Indiana	120	Wisconsin	96
Michigan	77		

West North Central States—682

Iowa	242	Missouri	100
Kansas	111	Nebraska	87
Minnesota	92	N. and So. Dakota.	50

East South Central States—43

Alabama	5	Mississippi	6
Kentucky	21	Tennessee	11

West South Central States—68

Arkansas	14	Oklahoma	6
Louisiana	7	Texas	41

Mountain States—292

Arizona	21	Nevada	38
Colorado	97	New Mexico.....	11
Idaho	24	Utah	40
Montana	47	Wyoming	14

Pacific States—1633

California	1502	Washington	53
Oregon	78		

Alaska—2

Hawaii—10

Foreign Born—132

Birthplace Unknown—73

The grouping of these cases in four age periods does not obliterate these curves, but shows the same general directions.

The accuracy of these results is still further augmented by the fact that the investigator made the physical examinations in 1893-4-5; from 1911 to 1918; and part of the examinations in 1910, 1919 and 1920-21. These years contain 1945 of the total 4,023 cases included in this study, and are distributed in the first and second decades as well as in the third. Certain of the remaining records were made by examiners trained by the investigator, thus minimizing the element of error introduced by the personal equation in measuring. The curve constructed from the writer's own measurements shows the same upward trend for height as in the curve based on all of the cases for the thirty years.

The stadiometer found in all gymnasium examining rooms has been used for all of the measurements. The method of determining the height has been as follows: The woman stands with heels touching the rod, and with the chin kept level; she is then asked to make herself as tall as possible, being sure that the feet are kept on the ground. Two or three or even more readings are usually made, and the highest of these is recorded. The danger of error is found to be greatest in the tall girls, who so often carry their heads forward in their effort to minimize their height. Since the number of tall women is apparently increasing, the probability of minimizing the average height of the modern woman is thereby increased, unless special attention is given to securing the maximum measurement in these cases.

The examinations are usually concentrated in the first days of the semester or quarter, but are always made during all hours of the working day. Thus it would seem fair to disregard the diurnal changes as having any very material influence on the results.

A statistical study has been made of the probable errors of the average heights for the years 1891-2, 1893-4, 1916-17, 1917-18, and for 1893-4 compared with 1916-17. All of the measurements of this last pair were made by the writer. This study shows that the average heights are based upon series which more than satisfy statistical requirements, and that the difference in heights in the contrasted pairs is so many times greater than the probable error of the difference as to afford statistical assurance of validity.

Thus far the cause of the obvious error in the average height for the year 1903-4 has not been found. It has, however, been ascertained that all of the measurements for that year were made by the same person. Re-examinations by the examiner who had made most of the examinations for a period of years both before and after 1903-4 were found in two cases. Both of these re-measurements were much smaller—2.6 cm. in one case and 0.6 cm. in the other.

The variation in numbers of records in the different years has been influenced by several factors. In the early years physical examination was required only of women who elected work in physical training. The inference that these women were exceptionally vigorous suggests an added value for the conclusions in that the first measurements are probably of the best developed and most physically active women of that period.

In 1917-18 compulsory physical training for two years was required of all undergraduate women before being granted their degrees. This requirement brought a somewhat increased number of women to the gymnasium for physical examination, an increase which is reflected in the

number of cases recorded in Table II for 1917-18 and also in 1918-19.

With the growth in the work of the University Public Health Committee, beginning in 1902-3, the anthropometric emphasis in the examining room was rather rapidly replaced by an increased attention to the individual hygiene of the entering women. This materially influenced the completeness of the measurement records in certain years, and is reflected more or less in the number of cases complete enough for this study. In 1912-13 only 91 records of height were made. This was due to the fact that the director was, like the physical examiners in other colleges, overbusy, and so cut out every possible measurement in order to secure extra time with these entering women for the seemingly more vital problems in their hygiene. Although the number of cases in the year 1912-13 is therefore smaller, the average for the year would seem to be based on a fairly representative series of cases, since it proves to be exactly the same as that of the year before and that of the year following.

A general survey of all available data suggests that two great factors are concerned in these results: (a) the change in fashion, making possible the wearing of clothing which interferes less with the hygiene of the woman; (b) the increased physical activity which has been brought about (1) by the change in dress, (2) by the development of physical training and sports in the secondary schools as well as in our colleges, (3) by the change in the conventional attitude toward these activities for women. The close relation between the physical changes in women and these causes will be discussed in a later paper.

**TABLE II.† AVERAGE HEIGHT OF 4,023
STANFORD UNIVERSITY WOMEN IN
YEAR GROUPS**

1891-92 to 1920-21, Inclusive

University Year	No. of Cases	Average Height in Inches
1891-2	94	62.4
1892-3	91	63.2
1893-4	89	63.0
1894-5	124	63.3
1895-6	108	63.0
1896-7	127	63.4
1897-8	124	63.2
1898-9	124	63.2
1899-1900	117	63.5
1900-1	118	63.4
1901-2	104	63.8
1902-3	150	63.8
1903-4	102	64.9
1904-5	39	62.9
1905-6	78	63.5
1906-7	158	63.8
1907-8	180	63.6
1908-9	63	63.5
1909-10	133	63.9
1910-11	193	63.6
1911-12	131	63.8
1912-13	91	63.7
1913-14	146	63.7
1914-15	168	63.9
1915-16	178	63.7
1916-17	170	64.0
1917-18	238	64.2
1918-19	276	63.8
1919-20	157	63.6
1920-21	152	63.9*

†Some of the averages in this table differ slightly from those published in the original preliminary note, owing to certain clerical errors which unfortunately escaped correction before publication.

*Examinations of women entering during the first and second quarters only.

To be well within the limits of safety we may disregard the average height for the first recorded year, since the abrupt change (62.4) for 1891-2 to the average for the succeeding years is so great as to

excite some suspicion of its accuracy, especially as we have no data showing the relation of this low average to the averages of the years preceding.

We may therefore conclude, pending further investigation, that, as illustrated by the changes recorded in 4,023 women entering Stanford University during the

TABLE III. AVERAGE HEIGHT OF 4,023 UNIVERSITY WOMEN BY TEN-YEAR PERIODS. (From Table II.)

Years in 10-Year Periods	No. of Cases	Average Height in Inches
1891-2 to 1900-1 (inclusive)	1116	63.2
1901-2 to 1910-11 (inclusive)	1200	63.6
1911-12 to 1920-21 (inclusive)	1707	63.8

past thirty years, the average height of the college women of today has increased from one to one and two-tenth inches.

There is also a definite increase in the average weight. The detailed data of this part of the investigation will be presented in a later paper, together with the evidence which shows that this increase in weight and height has occurred in spite of the fact that the average age of the women entering Stanford University has grown less. The racial as well as economic importance of these changes, which point to a more fully developed and more perfectly functioning type of woman, can hardly be overestimated.