THE DECLINE IN THE AVERAGE LENGTH OF LIFE

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IT is the purpose of this article to take issue with those who are so elated with results obtained in their own immediate fields leading to significant reductions not only in certain death-rates but also in the prevalences of certain diseases that they feel justified in predicting marvelous increases in the average length of the whole of life in the no great future. Most of these optimistic authorities have failed to appreciate that practically all these results have been attained in children's diseases and that little or no attention has been given to the situation at ages beyond the prime of life. The writer claims that conditions in this country at advanced ages have been on the down grade ever since the first mortality records were established at Washington and that they have now reached such a pass that all the great gains at the early ages are already more than offset by the losses at advanced ages. In brief, evidence will be offered in this article to show that the average length of life in this country is now actually decreasing.

It is out of the question to try to present, in this short article, all the statistical evidence to support the writer's present contention, but it is planned to offer most of the evidence later in a much longer article. Over forty mortality tables were constructed to yield not only the results portrayed in this article but also all possible results which would have a bearing upon the results presented here. A thorough search was made for any result which would seem to throw any doubt upon the conclusion drawn here—that the average length of life in this country is decreasing—and the search was in vain.

It is most momentous and almost inconceivable that a civilized and even highly prosperous nation should have a decreasing average length of life. The decrease proved to be very pronounced in the state of New York, and at one time the writer was afraid that the large population of that state was weighting his general results too much and that, possibly, the results obtained for the states investigated were due wholly to New York. However, an investigation omitting the state of New York led undeniably to the same conclusion. An investigation of the whites of native parentage pointed to the best probable results but could not be completed satisfactorily because of a recent change in classification in the federal records.

The main results, shown here, were obtained from abridged mortality tables constructed from the population and mortality statistics of the males of what are now known as the original registration states —the New England states and Indiana, New Jersey and New York—or the only states which have supplied satisfactory records of deaths ever since 1900—and even 1890. The results are given only in graphical form—not only to save space but also to emphasize *trends* rather than absolute results. The graphs for 1890, 1900, 1910 and 1920 represent the results of previous articles in SCIENCE[1] in which attention was called, for the first time, to the fact that the average length of life was increasing in this country—and this is the important point—in spite of *increasing* losses at advanced ages.

As the census is taken only once in ten years, the populations for the individual years since 1920 were interpolated by fitting the well-known Pearl-Reed formula to the total populations of the males and females—separately—of the ten original registration states for 1890, 1900, 1910 and 1920. These interpolated populations were then distributed—for each sex—into ten-year age groups in the proportions existing in 1920. The mortality statistics, of course, are collected each year, but the data for 1926 and 1927 had to be obtained from Washington in manuscript form.

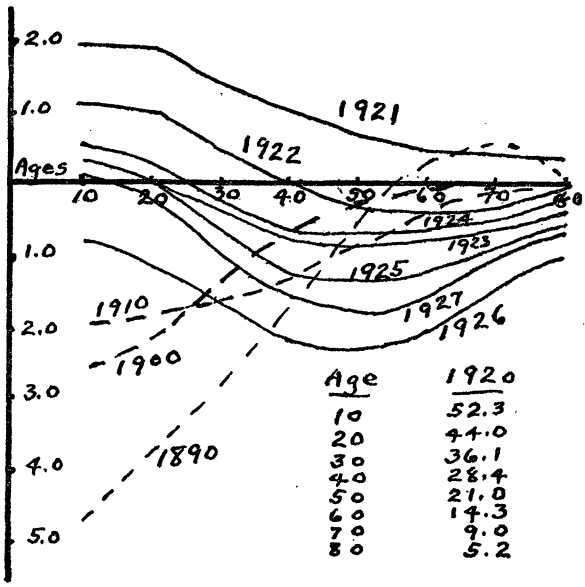
The results for the females are not given here but present the same picture—in somewhat less smooth form.

It will be understood, of course, that there is an average length of life corresponding to each age—the average length from that age on—although it is usually called the expectation of life in that case. In working with abridged mortality tables it is necessary to omit the first few ages—say, before age ten—for well-known reasons, but the expectation at age ten is usually a rough approximation of the average length of the whole of life.

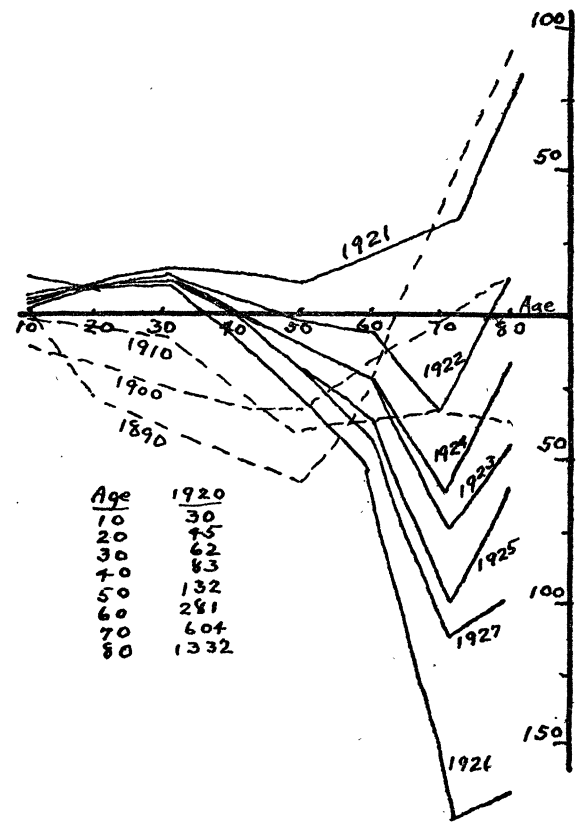
Let us examine the graphs of the (male) expectations of life. After considerable experiment it was found more illuminating to portray not the expectations but rather deviations of the expectations, say from those of 1920, by ages. This holds also and especially for the portrayal of the death-rates. It will be seen that during the thirty years from 1890 to 1920 the expectation of life at age ten—and therefore approximately the average length of life—increased markedly. Compared with the great increases at age ten, the later intersections of the curves and their fairly complete reversal in order at the higher ages, taken for this period alone, do not stand out very

[1] July 7, 1916; March 23, 1923.

EXPECTATION OF LIFE—MALES
(DEVIATIONS FROM "1920")



DEATH RATES PER 10,000—MALES
(DEVIATIONS FROM "1920"—PLOTTED UPSIDE DOWN)



strongly, although the writer believed them to be significant from the start and so expressed himself in the article of 1916 cited above.

The results for 1920—the horizontal base line—proved a little disconcerting to the writer for a time, for that year showed not only unexpected improvement at the early ages but also fairly satisfactory conditions at advanced ages. The abnormality of year 1920 should have been appreciated at that time, however, because we were just recovering from the pandemic of "flu" of 1918 when the general death-rate jumped back up temporarily to where it had been about twenty years before, and the improvement of 1920 (and 1919 and 1921 as well) could have been easily explained as a natural reaction to conditions in 1918.

Every one has been familiar with the consistent improvement of conditions at earlier ages and some have been more or less aware of the situation at advanced ages, but there is no printed evidence that any one was sufficiently aware of the seriousness of the latter situation to propose the pertinent question of whether the latter situation would ever develop to the point where it would dominate. In any case, the question is no longer pertinent—the decline at advanced ages already dominates and the average length of life—or at least the expectation from age ten—is already going down. The curves for the individual years 1921 to 1927 inclusive tell their own story. The order of the curves is not exactly regular, but who can doubt the significance of the general trend? It will be noted that the expectation from age forty-five or fifty on is the lowest of which we have any record—far lower than it was even forty years ago—and it is still going down, not up.

Values of the expectation of life are very valuable in measuring the true relative effects of the various gains and losses at different ages, but the basic death-rates are the data which enable us to *locate*—with respect to age—any serious trouble. If we refer to the graphs of the death-rates—or rather, the corresponding deviations from "1920"—it will be seen that the changes in death-rates previous to age thirty are not significant and although it might well be argued that little significant change could be expected in a short period of only seven years, by the same logic the changes in the neighborhood of age seventy are tremendous. It is well to recognize that improvement at the early ages has a rather definite limit and that the decline at advanced ages has no appreciable limit. It follows naturally that with all the improvement in the world at the early ages the present downward trend at the advanced ages, if unchecked, will continue to dominate and produce a greater and greater net decline in the average length of life.

The great decline at advanced ages is remarkably concentrated about age seventy although it extends as

far back as age forty. In fact, the definiteness and consistency of all the writer's results were truly remarkable when it is recalled that each result—even in the same group—was obtained independently of every other; no smoothing process was used anywhere in the whole investigation—except what was naturally involved in interpolation.

To paraphrase the words of a contemporary humorist, all that I know is what the various statistical data tell me, but, to me, the whole picture, from our earliest records in 1890 to the present time, points consistently and inevitably to a future of a declining average length of life until the American adult wakes up to the fact that the odds are at present heavily against his living as long as his father or grandfather. Some will say—and no doubt truly—that it is all a natural consequence of the great drift to the cities. Others will go farther and say life has become too fast and strenuous and that we do not know as yet how to adjust ourselves to such a life. To the medical authorities the whole problem will loom as one of relieving the strain upon the heart. But little will be accomplished until the American adult himself is duly informed and made to realize that he is in the midst of a decidedly losing fight and that the situation will continue until he applies himself energetically to be superior to his environment. Moreover, each adult must fight his own individual battle, since he usually brooks no interference with his own individual mode of living. Medical authorities and scientists can be depended upon to care for the children and their diseases, but they have little or no chance to interfere with the lives of adults.

It truly looks as if it is going to be a losing fight for some time to come, for although some adults are making a commendable effort to live sane lives the vast majority seem very indifferent and many give apparently no thought whatever to habits which they clearly know are bad and which they know they could easily discard. There is surely no worse influence than that wielded by well-meaning authorities who go around airing their ill-founded beliefs that all is going well and that before long everybody is going to be living seventy-five to a hundred years!

The present recurrence of the "flu" promises to obscure the issue, not only by a further abnormal decline but even by the later reaction or recovery which is pretty sure to occur and which is very apt to produce a false impression of security and health improvement.

OBITUARY

SIDNEY SAVORY BUCKMAN, 1860–1929

SIDNEY SAVORY BUCKMAN, British paleontologist, passed away at his home at Thame in Oxfordshire, England, on the 26th of February, 1929. He was born in 1860, the son of a naturalist and geologist, James Buckman, who will be remembered as the venerable professor at the Royal Agricultural College at Cirencester. Sidney Buckman was early led to take a strong interest in the paleontology and stratigraphy of the British Jurassic. In these fields he was one of the most active and brilliant of investigators throughout his life. His passing is the fall of a leader.

Buckman's first scientific paper appeared in 1878, his nineteenth year. From then on his work, carried on in spite of the cares of business, was prodigious. Possessed of boundless mental energy, the keenest of keen intellects and a philosophical mind of the first order, he soon uncovered weaknesses in existing systems of interpretation. This brought him into controversial contact with the Geological Survey, a contact which produced active research on both sides, and finally a justification of Buckman. This work produced a notable result in the "Monograph of the Inferior Oolite Ammonites," 1887–1907; and it culminated in "Type Ammonites," 1909–1928, his great masterpiece.

In these memoirs, as well as in certain of his shorter contributions, Buckman's improved methods of study and his broader results were worked out. The outstanding principle in his method is his insistence on fine subdivision in both paleontological and stratigraphical analysis as the only means of bringing ultimate, significant details into relief, and of producing thereby a basis for discerning real relationships. This method resulted in a multiplication of genera and species of ammonites, for which Buckman has been adversely criticized. But at least Buckman's names stand for real groups, even though future work may modify their rank. A feature of his work is his development of the principle of classification by descent. This is the keynote of his later work, to be seen especially in "Type Ammonites" and "The Brachiopoda of the Namyau Beds" (1917–1919).

His paleontological studies soon convinced him that the simple stratigraphical principles of William Smith could be applied with much greater precision than had hitherto been attempted. This led to a great deal of stratigraphic subdivision, so that the thirty-three Jurassic zones of Oppel became elaborated into a system of about four hundred zones. Strange as it may seem, criticism of this part of the work has been much less severe. But this, as Buckman points out, is