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THE LONGEVITY OF OARSMEN

A STUDY OF THOSE WHO ROWED IN THE OXFORD AND CAMBRIDGE BOAT RACE FROM 1829 TO 1928

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The question whether strenuous exercise may lead to strain of the heart and permanent damage to that or other organs, and thus to early death, is one which has excited attention even from the earliest times. Scattered throughout the Hippocratic writings will be found several references to the athlete (of the professional or semi-professional type) and to the athletic state, and in each case we detect an attitude of doubt and suspicion as to the desirability of such pursuits when persisted in to the full. Thus in the treatise on *Nutriments*,* for example, we read: "The condition of the athlete is not natural. A healthy state is superior to all."† Galen of Pergamos, whose authority was destined to dominate medicine for centuries to come, took a stronger line. Writing in the second century A.D., in his *Paraphrase of Menodotus*,‡ better known as "The exhortation" to young men "to study the Arts," rather than to follow the profession of an athlete, he gave it as his opinion that "while athletes are exercising their profession, their body remains in a dangerous condition, but when they give up their profession they fall into a condition more parlous still; as a fact, some die shortly afterwards; others live for some little time, but do not arrive at old age. . . ." Again, he says in another place: "Athletes live a life quite contrary to the precepts of hygiene, and I regard their mode of living as a regime far more favourable to illness than to health." These pronouncements carried great weight, and were, like other Galenic sayings, no doubt accepted as correct throughout the Middle Ages, and, indeed, until much more recent times.

As a sport rowing may be said to have come into vogue in the early years of the nineteenth century, on the termination of the Napoleonic Wars (Lehmann, 1931); and the first Boat Race between Oxford and Cambridge, from Hambledon Lock to Henley Bridge, was rowed on June 10, 1829. Prophecies of evil were freely indulged in, and the

Rev. Charles Wordsworth (Morgan, 1873a), afterwards Bishop of St. Andrewes, who originated the Boat Race, and who rowed four in the first race, has left it on record that "in those days we used to be told that no man in a racing-boat could expect to live to the age of 30."

Nor was this view, long held, without medical support; and in 1869 Mr. Frederick C. Skey (Morgan, 1873b), consulting surgeon to St. Bartholomew's Hospital and a Past-President of the Royal College of Surgeons, started on October 10 of that year a lively correspondence in the *Times*, dealing with the dangers to the constitution supposed to be associated with rowing, and asserting that "the University Boat Race as at present established was a national folly." A sensible leading article in the *Times* pointed out, however, that no statistical inquiry into the subject had ever been made by the medical profession, and that until this was done no firm conclusions could be arrived at. This no doubt led the late Dr. J. E. Morgan to investigate the matter, and his report we shall consider later. Since 1869, however, medical opinion has gradually changed, and physiologists and physicians now mostly hold that the danger has been greatly exaggerated, and many, perhaps most, would take the view that no young man will injure himself by rowing, provided that his organs are sound, and that he has previously undergone a proper course of training (Lewis, 1937).

But whatever individual opinion may be, the question is one which can be decided only by careful investigation along actuarial lines into the after-histories of oarsmen, so that their longevity can be determined, and be compared with that of a body of men as similar as possible in other respects but whose members have not been subjected to the strain of such violent exercise. A sidelight on the matter may perhaps be thrown by individual life histories, as, for example, those of the two well-known oarsmen who have recently passed from us, and who in their time performed wonderful feats on the river. The two referred to are Mr. Arthur Middleton Hutchinson and Mr. Stephen Fairbairn. The former, *inter alia*, rowed for Cambridge in 1881 and 1882; won the University Fours in 1880 and 1881; rowed "Head of the River" in 1880, 1881, 1882, 1883, 1884, and 1885; won the "Grand" in 1885, 1888, and 1889; and the "Stewards" in 1886 and

* On *Nutriments*, Section XXXIV, Loeb Class. Lib., 1, 355, translated by W. H. S. Jones, Litt. D.

† See also Hippocrates: (a) *Aphorisms*, Sect. II, Aphr. LI; (b) *Epidemics*, Book VI, Sect. 6, par. 2—*œuvres complètes d'Hippocrate*, E. Littré, Paris, 1846, 5, 324; (c) *ibid.*, Book VI, Sect. 4, par. 18, Littré, 5, 312.

‡ *Œuvres de Galien*, translated by Dr. Ch. Daremberg, 1, 38, Paris, 1854.

1889; and died in his seventy-eighth year, on December 10, 1937. The latter, Mr. Stephen Fairbairn, rowed for Cambridge in 1882, 1883, 1886, and 1887; rowed "Head of the River" in 1882, 1883, 1884, and 1885; won the "Grand" in 1885 and the "Stewards" in 1886; and in 1889 (rowing in the Victorian crew) won the Australian Interstate Race. He died on May 16, 1938, in his seventy-sixth year. Both these great oarsmen were at Jesus College, Cambridge, and apart from the numerous races referred to above it is recorded (Fairbairn, 1931) that they rowed together more than 100 times in eights and fours, and were beaten on five occasions only. In view of their dying as they did between the ages of 75 and 80, it cannot be said that their strenuous rowing had in any way affected their longevity. Suggestive, however, as such experiences may be, they must not be allowed to carry undue weight, it being arguable that athletes of this type are supermen and altogether exceptional. Nor must we forget that a reverse side of the picture exists, and that we might instance examples among famous oarsmen of early death from heart trouble; indeed, two such have recently occurred at the early ages of 50 and 62 respectively. As we have said, the matter is one which can be decided only by researches carried out on actuarial lines.

Previous Investigations

The first attempt to treat the question actuarially was made, as we have indicated, by Dr. John Edward Morgan (1873c), a physician of distinction on the staff of the Manchester Royal Infirmary, and also an oarsman of some experience, who in 1873 published his "Critical Enquiry into the After-health of the Men who rowed in the Oxford and Cambridge Boat Race from the Year 1829 to 1859." His method consisted in taking each crew separately, working out the number of years of life actually enjoyed by each member from the date of the race up to the year 1869, when the experience terminated, and then adding the years which those surviving in 1869 might expect to live, as calculated from "Dr. Farr's English Life Tables." The total number of years thus obtained for each crew was then compared with the expectation of life (according to Dr. Farr) of a man aged 20—that being the assumed age of each oarsman at the time of the race. Working on these lines Dr. Morgan concluded that, taking all the oarsmen together, each individual was "likely to survive the race on an average some forty-two instead of forty years" (the average prospect of longevity as indicated by Dr. Farr's table).

This first attempt to arrive at the truth deserves great credit; but the method, while conscientiously carried out, is open to serious criticism. In the first place, the data are inadequate, the number of lives investigated being some 200 only in all. This inadequate number was then subdivided into groups of eight, on the assumption that the conception of "expectation of life" can be applied to each minute group. But that places upon this "conception" a burden which it is not fitted to bear, since the "expectation of life," derived from the average of a large body of lives, equally demands a large group for its reasonable application. Then again, Dr. Farr's life table, which was used as a comparison, is a table based on the mortality of the general population (Censuses of 1841 and 1851), containing both healthy and unhealthy lives, and therefore not comparable to a body of select lives such as university oarsmen. The conclusion arrived at by Dr. Morgan is robbed, therefore, of much of its value.

Another research dealing with the subject is recorded in a paper by Mr. George L. Meylan (1903-4), who

published the results of his investigation into the after-histories of the 152 men who rowed in the Harvard University crews from 1852 to 1892, the observations being extended up to June 25, 1903. From his research he deduced that the excess of expectation of life for each oarsman over that shown by the mortality table used for comparison was 2.88 years; and 5.09 years if allowance was made for those killed in the American Civil War. The research, however, is based on methods similar to those employed by Dr. Morgan, and is therefore open to a like criticism.

In 1937 Drs. Cooper and O'Sullivan and Mr. E. Hughes reported that of 100 men rowing for Ormond College (Melbourne) between 1885 and 1905, twenty-four were dead when the investigation ceased (in what year is not stated), as compared with an expected mortality of 31.8 of the general population, as shown by the figures of the Australian Mutual Provident Society. The number of oarsmen concerned—only 100—is, however, very small and the table of comparison not strictly comparable—a criticism which applies also to certain other communications on this subject.

A more important piece of work is that carried out by Dr. Louis I. Dublin, statistician to the Metropolitan Life Insurance Company, who in 1928 reported on the after-histories of 4,976 college athletes—from ten universities in the United States—who had engaged in the following sports: baseball (1,111), rowing (576), track-running (1,076), football (1,233), two or more sports (822), and minor sports (158). The athletes concerned had graduated for the most part between 1880 and 1905 (but a few prior to 1880), and were observed up to 1925. The after-histories of these men were then compared with the standard of mortality as revealed by the "Medico-Actuarial Table," which represents the experience of all the large life insurance companies in the United States during the years 1885 to 1909; and by the "American-Men Table of Mortality," a table which embodies a similar experience during the years 1900 to 1915. Dr. Dublin is careful, however, to point out that these tables were only employed because none more suitable for comparison was available, the insured population compared being not altogether of the same grade, physically or socially, as the college athletes. The comparison used is therefore in favour of the latter.

Briefly it may be said that, taking all athletes together, Dr. Dublin found that the actual deaths represented 93.2 per cent. of those which would have been expected on the basis of the medico-actuarial table; or 91.5 per cent. if comparison were made with the more recent American-men table. In either case the comparative results were considerably in favour of the athletes. Compared with the American-men table the various sports came out in the following order:

Sport	Number Engaged	Actual Deaths per cent. of Expected
Football	1,233	88.3
Track-running	1,076	91.8
Rowing	576	94.1
Baseball	1,111	98.0
All sports combined		91.5

Considering the rowing men in greater detail, Dr. Dublin had a group of 576 oarsmen with which to deal. Among these 576 individuals 215 deaths occurred, as compared with 228 to be expected under the American-men table of

mortality, giving the whole body a mortality of 94.1 per cent. of that expected. It is satisfactory to add that while the mortality of the oarsmen under the age of 45 was above the average, that of members of the group over 45 was distinctly lower than that expected by the American-men table, thus pointing to no excessive prevalence of degenerative diseases, cardiac or other, among oarsmen.

Taking the results as a whole, and bearing in mind the somewhat favourable basis of comparison used, it would appear that the oarsmen show a rather better expectation of life than the insured lives, the mortality being somewhat above the average for ages under 45, but below for those over that age. Dr. Dublin noted a high percentage of deaths from accidental causes among the younger men, and it may be that the excess mortality at the earlier age is in part to be explained by the more adventurous lives lived, after graduation, by the athletic type of men, and by their possession of that spirit which prompts them to take risks which others would avoid, and to seek fame and fortune in distant lands, sometimes never to return. We shall refer later to another aspect of Dr. Dublin's investigation.

It is evident from what has been said that the subject is one of some complexity and that further investigation is desirable. An opportunity for effecting this is offered by the publication of the Official Centenary History of the University Boat Race, compiled by Mr. G. C. Drinkwater, M.C. (O.U.B.C.), and Mr. T. R. B. Sanders (C.U.B.C.). This work deals with all the races rowed between Oxford and Cambridge during the years 1829 to 1929, numbering eighty-one* in all. It contains also, in an appendix, a complete "Register of Blues," in which are given details of the life of each individual oarsman, including the date of birth and, where necessary, the date of death.

Material Available for the Present Research

We have thus for investigation a group of oarsmen who, as we shall see, number 767, and whose life history is known, either completely in the case of the 394 who have died, or up to December 31, 1928 (the end of the period of observation), in the case of those then still living. Although from an actuarial point of view the data are still meagre, it was felt that some valid general deductions might be made if the period of observation covered by Dr. J. E. Morgan was thus extended to a recent date and the problem approached along somewhat different lines. The following additional details relating to the oarsmen concerned will be of interest.

In regard first to the number of individual oarsmen engaged, the figure 767 given above has been arrived at in the following manner. Eighty races between the Universities were rowed between 1829 and 1928 inclusive. From this it follows that 640 oarsmen from Oxford and a similar number from Cambridge actually rowed in the races, but in arriving at the total number of individual oarsmen allowance has to be made for those who rowed more than once.

Among the Oxford crews:

101 rowed twice during the period investigated	101
48 " three times " " "	96
18 " four " " " "	54
3 " five " " " "	12
In one instance the date of death is not known; the case has therefore been excluded	1
	<hr/> 264

Hence at Oxford the number of oarsmen available for investigation out of the possible 640 was 376.

At Cambridge we have similarly to deduct:

98 who rowed twice during the period	98
46 " " three times " " "	92
17 " " four " " "	51
1 " " five " " "	4
In 4 cases the date of death is unknown and the cases are therefore excluded	4
Making a total of	<hr/> 249

Leaving 391 lives to investigate.

We have thus 376 Oxford and 391 Cambridge Blues, making a total of 767 oarsmen to consider. Of these, 431 had died before December 31, 1928, and 336 were still living. Each oarsman was included only once, and was observed from the occasion of his first race until the end of 1928, or his earlier death should that have occurred.

In the centenary history, in about eighty cases the year of birth was alone given (but not the month and the exact day). In half of these the birthdays were assumed to fall in the period January to June and the remainder in the latter half of the year, July to December. In seven further cases the date of birth was unobtainable. In these instances the oarsmen were assumed to have raced for the first time at the age of 21, except that where the date of taking the B.A. degree is given this was assumed to have occurred at the age of 21. Any errors of a year or so introduced in these few cases would have no appreciable effect on the results. It would have been interesting could we have made a comparison between those who rowed once only and those who rowed more often, but the numbers available were too few to provide actuarial results of any value. For similar reasons no useful deduction could be made by comparing the life expectancy of the ninety coxswains who steered the rival crews with that of the oarsmen concerned.

Methods of Investigation Pursued

Where a large body of lives is under observation it is possible to derive "rates of mortality" (the probability, that is to say, that a person aged precisely x years will die before reaching age $x + 1$) which show a reasonable progression from age to age, and may be compared directly with the results obtained from other similar investigations. If the number of lives observed is small, however, rates of mortality at individual ages are likely to be irregular, and a better line of approach is to compare the actual number of deaths, in groups of ages, with the number "expected" by some standard table. To do this it is necessary to construct a table of "exposed to risk"—that is, to find for each age x the number of those who during the period covered by the investigation passed through the year of age x to $x + 1$, or died during that year. (The process may be modified to apply to groups of ages.) This number, multiplied by the rate of mortality for age x derived from the standard table, will give the "expected deaths." It is this method which we have followed in the present investigation. We may add that the table of "exposed to risk" was constructed upon a "calendar-year" basis, the nearest age on December 31 in any year being taken as the exact age at that date. The lives were observed as from the date of the oarsmen's first race until December 31, 1928, due allowance being made for the fact that the lives were exposed for a part only of the calendar year of entry.

It is well known that the rates of mortality experienced by the general population of this country have improved

* As the period of observation terminated on December 31, 1928, we have in our investigation excluded the race rowed in 1929 and limited ourselves to the 80 races rowed between 1829 and 1928.

materially during the last century. The effect of this improvement upon *assured lives*, which probably represent the closest obtainable approximation in type to those of university graduates, has been shown by the tables published by the Institute of Actuaries. A period ending in 1863 was covered by the H^M table. The O^M table dealt with the experience of 1863-93, and there is now available the "A 1924-9" table, covering the years indicated by its title.

After consideration it was decided to investigate the experience of the university oarsmen in four periods:

- (1) From January 1, 1829, to December 31, 1862
- (2) " " " 1863, " " " 1893
- (3) " " " 1894, " " " 1923
- (4) " " " 1924, " " " 1928

As regards the first two periods, the most appropriate of the standard tables mentioned above to use for comparison were the H^M and the O^M respectively. Similarly, the A 1924-9 table is suitable for the last period. Period 3, including as it does the years of the Great War, presented difficulties, since, apart from the risk of death from causes immediately traceable to the war, it is known that the mortality even of the non-combatant population was considerably influenced by war conditions. In this period, although all cases were included as being exposed to "normal" risks, deaths directly due to the war (thirty-seven in number) were excluded from the "actual" deaths, which were compared with the number "expected." These "war-death" cases simply passed out of the experience at the date of death. In default of a better standard table for the investigation of the "normal" deaths of the period we employed rates of mortality midway between those shown respectively by the O^M and the A 1924-9 tables. It will be realized that an individual oarsman may appear in two or more of the periods, but not at the same ages. A man whose nearest age was 21 on December 31, 1829, for instance, might be traced up to age 54 in the first period, and from age 54 to his death in the second period, or, if he survived age 85, would appear also in period 3.

The actual numbers of lives involved in the four periods are as follows:

Period 1.—1829-62 :

First raced during period 1	231
Died	23
Surviving at end of period 1	208

Period 2.—1863-93 :

Survivors from period 1	208
First raced during period 2	262
	470
Died during period 2	110
Surviving at end of period 2	360

Period 3.—1894-1923 :

Survivors from period 2	360
First raced during period 3	227
	587
Died during period 3 :	
War causes	37
"Normal" causes	225
	262
Surviving at end of period 3	325

Period 4.—1924-8 :

Survivors from period 3	325
First raced during period 4	47
	372
Died during period 4	36
Surviving at close of investigations	336

The total number of men entering into the investigation at any time is the sum of the items "first raced during period," and amounts, as we have said, to 767.

Results of Investigation

In the following table the actual deaths during the several periods are compared with those expected according to the appropriate standard tables, as explained above. The final column shows the actual number of deaths expressed as a percentage of the number "expected"—that is, the number which would have occurred if the oarsmen had experienced rates of mortality similar to those shown by the standard table of the same period.

TABLE I

Age Group	Actual Deaths	Expected Deaths by Standard Table	Actual as Percentage of Expected
<i>Period 1.—1829-62. Standard Mortality Table H^M</i>			
Up to 50	22	25.2	87.3
51 to 70	1	1.0	100.0
Over 70	—	—	—
All ages	23	26.2	87.8
<i>Period 2.—1863-93. Standard Mortality Table O^M</i>			
Up to 50	53	62.1	85.3
51 to 70	39	59.8	65.2
Over 70	18	21.6	83.3
All ages	110	143.5	76.7
<i>Period 3.—1894-1923. Standard Mortality Table: Mean of O^M and A 1924-9</i>			
Up to 50	32*	40.7	78.6
51 to 70	85	98.0	86.7
Over 70	108	125.8	85.9
All ages	225	264.5	85.1
<i>Period 4.—1924-8. Standard Mortality Table A 1924-9</i>			
Up to 50	3	3.4	88.2
51 to 70	13	13.2	98.5
Over 70	20	21.9	91.3
All ages	36	38.5	93.5

* Excluding 37 Great War deaths.

An inspection of the figures shows that in each of the periods and age groups the comparison favours the oarsmen. (The age group 51-70 in period 1 has no significance in view of the paucity of numbers.) Thus, taking the lives as a whole, the actual numbers of deaths in the four periods were only 87.8 per cent., 76.7 per cent., 85.1 per cent., and 93.5 per cent. of those that would have been produced by the mortality which we have adopted as standard for the respective periods.

It must be emphasized again that these results are based upon what is, for a mortality investigation, a very small body of lives. The subdivision into age groups has been made as a matter of interest, but divergencies in the results as between one age group and another, when the figures are small, are as likely to be accidental as to be significant. Similarly, the results shown in the first period, where the "expected deaths" amount to only twenty-six, are not entitled to as much weight as those of the other periods. Subject to these reservations we may conclude that *over the whole period of the investigation the mortality experience of university oarsmen was appreciably*

superior to that of assured lives of their own generation, but that of late years this relative superiority has shown a tendency to diminish. Certainly our research gives no support to the idea that strenuous rowing in healthy subjects, when combined with adequate training, places any undue strain upon the cardiovascular or other organs and leads to any diminution of longevity.

It is not impossible, also, looking at the figures from another angle, that the mortality of oarsmen has maintained a uniform level of excellence, and that the general body of assured lives has only recently approximated to this level. This aspect of the matter is investigated in the following table, in which the actual deaths are compared with those expected, not by the standard tables applicable to the respective periods but, in all cases, by the up-to-date A 1924-9 table.

TABLE II

Period	Age Group	Actual Deaths	Expected Deaths by the A 1924-9 Table	Actual as Percentage of Expected
1	Up to 50	22	8.7	252.9
	51 to 70	1	0.5	200.0
	Over 70	—	—	—
	All ages	23	9.2	250.0
2	Up to 50	53	24.7	214.6
	51 to 70	39	40.8	95.6
	Over 70	18	19.9	90.5
	All ages	110	85.4	128.8
3	Up to 50	32*	23.3	137.3
	51 to 70	85	81.1	104.8
	Over 70	108	120.2	89.9
	All ages	225	224.6	100.2
4	Up to 50	3	3.4	88.2
	51 to 70	13	13.2	98.5
	Over 70	20	21.9	91.3
	All ages	36	38.5	93.5

* Excluding 37 Great War deaths.

From these figures it appears that at ages up to 50 the mortality standard experienced in periods 1 to 3, while superior (as shown by Table I) to that of assured lives of the same periods, was less favourable than that of to-day. At ages above 50, however, the figures do tend to bear out the suggestion made above, that university oarsmen, at any rate since the eighteen-sixties, may have enjoyed the low rates of mortality which only of late years have become applicable to assured lives generally.

Addendum

We have pointed out that in our investigation we have been obliged to compare the oarsmen with a body of men living at the same time, insured and accepted, indeed, for life insurance at ordinary rates and free from any serious blemish, but probably not possessing those advantages of physical fitness and social and economic standing enjoyed by the athletes concerned. The ideal would be to compare the life-expectancy of the oarsmen with that of their fellow graduates, living at the same period and under similar conditions except that they did not participate in such strenuous exercise. This has not been possible in our case, the necessary data not being available, since we must set aside the ninety coxswains concerned in the races as a body of lives too small to form the basis of any useful investigation.

Dr. Louis I. Dublin (1930, 1932), to whose work we have already referred, has, however, succeeded in making a comparison in the United States between athletes as a whole and their fellow graduates, and with very interesting results. He studied the life histories of 38,269 graduates from ten of the Eastern colleges in the United States (including Harvard, Yale, and Cornell) who had attended the classes from 1870 to 1905, the experience being extended to 1925. Of these 38,269 graduates 6,500 were honours men and 5,000 athletes (baseball, crews, track-running, football, etc., of whom 576 were oarsmen—see above). Taking the group as a whole (38,269) and comparing them with the American-men table of insured lives (see above), the mortality of the college graduates was 91 per cent. of that experienced by the insured group, thus showing an outlook 9 per cent. in favour of the graduates. Dr. Dublin then compared the mortality of the college graduates with that of the athletes alone and of the honours men alone, when the interesting result emerged that the honours men showed distinctly the lowest mortality. The mortality of the graduates as a whole and that of the athletes was much the same up to age 50, but above that the mortality of the athletes proved appreciably higher.

With regard to the expectation of life the investigation gave at age 22 the following result:

		Expectation
Insured men (American-Men Ultimate Table)	44.29 years
Athletes	45.56 ..
Graduates	45.71 ..
Honours men	47.73 ..

These results, based as they are on considerable numbers, give, as Dr. Dublin says, food for thought, and the more so since they are not without support from the results obtained at Yale by Professors Greenway and Hiscock (1926). They would seem to indicate that although the American athlete, if healthy and properly trained, will suffer no harm from his strenuous exertion and will have an expectation of life greater than that of the ordinary healthy insured person, yet his outlook is not so favourable as regards longevity and expectation of life as that of his companions the ordinary graduates, and distinctly less so than that of the honours men. Whether this is true also for the English athlete, with his somewhat different outlook in regard to sport and games generally, and especially for the oarsmen, who form, it may be noted, only one-ninth of Dr. Dublin's group of athletes, is a question which we must leave to future research.

Dr. Dublin suggests that the athletic build and great longevity do not go hand in hand. Certainly those engaged in insurance work will agree that not infrequently it is the small and undersized individuals who live the longest. On the other hand, we must not forget the difference in temperament between the athlete and the scholar—the former leading an active life and possessing an ardent spirit, which, as we have already hinted, may drive him into enterprises and risks, not free from danger to life, which the scholar is more likely to escape. This more sheltered life led by the scholar may go far to explain the interesting observations to which we have drawn attention, and to which further research will no doubt be directed.

It is our pleasing duty to express our thanks to Mr. T. R. B. Sanders, joint editor of the *Centenary History*; to Mr. R. W. A. Fowler, A.I.A., of the Clerical, Medical and General Life Assurance Society; to Sir Adolphe Abrahams; and to Mr. H. R. Aldridge for kindly help during the progress of the work. To Dr. Louis I. Dublin of New York we are also indebted for photostat copies of original articles not

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CHRONIC URTICARIA *

BY

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The subject of chronic urticaria is one of great interest, first because its complex nature, and frequently its long duration, set a difficult problem, and, secondly, because perhaps more than any other skin condition, it brings us in close touch with general medicine. I have purposely avoided the acute cases, whether of external or internal origin, as these rarely cause any difficulty, and I am restricting this discussion to those cases of urticaria of internal origin which are already of long standing when we first see them. With regard to the final mechanism responsible for wheal formation, it is now generally believed to be due to the release of relatively large amounts of H-substance as a result of cell damage; this may be caused in several ways, of which antigen-antibody reaction is one. So far as possible I propose to consider the subject from the clinical point of view, and to base my remarks on cases which have been under my care, but it would perhaps be wise, before proceeding to this clinical study, to discuss some of the theories that have been put forward to account for the production of chronic urticaria.

Theories of Causation

It is thought that the toxin responsible for the condition may be absorbed from foci of infection in the teeth, nose, throat, lungs, gall-bladder, or urinary tract. In other cases the patient suffers from urticaria when exposed to cold, and this has been shown to be due to the presence of a dermolysin in the blood which unites with the cells at a low temperature and lyses them on rewarming, setting free H-substance. Another cause of urticaria, probably more common than one might imagine, is emotional upset. In this connexion an interesting theory has been put forward by Stokes and Pillsbury (1930), who believe that as a result of nervous strain there is a diminished secretion of hydrochloric acid in the stomach, leading to an increase in the Welch bacilli in the intestine and so to the production of a histamine-like substance, the absorption of which can give rise to the

triple response. As a further result of hypochlorhydria there is diminished absorption of calcium from the food; again, diminished pancreatic and intestinal secretion leads to imperfect digestion of proteins with absorption of abnormal cleavage-products of protein from the alimentary tract, and because of this the patient may become sensitized to food and bacterial proteins. Another view is that the release of histamine as a result of antigen-antibody reaction is accompanied by emotional upset, the frequent repetition of this leading to a conditioned reflex. Thus the emotion can then itself release histamine even in the absence of the allergen.

It is also believed that the urticarial mechanism can be set in action by the products of damaged epidermal cells, and Lewis showed that a needle-prick in the epidermis can give rise to a vascular response. It is probable, however, that in perhaps the majority of cases the toxin is absorbed from the alimentary tract. In the first place the condition may be caused by allergy due to specific food sensitiveness. It has been shown by A. and M. Walzer (1927, 1928) that the protein may be absorbed unchanged into the blood stream and, reaching sensitized tissue, produce an antigen-antibody reaction. This is especially likely to occur if there is hypochlorhydria, or if the proteopexic power of the liver fails. Secondly, abnormal split-products of protein derived from food, due to deficient digestion, or products of bacterial action on proteins, may be absorbed and, escaping destruction in the liver, produce the symptoms. This will take place if the detoxicating power of the liver is at fault.

Barber and Oriel (1928), as a result of extensive biochemical investigations of the blood and urine during and after allergic attacks, came to the conclusion that there is evidence of hepatic disturbance in these cases, and that a failure of the proteopexic and antitoxic power of the liver is to some extent responsible for the condition. Oriel (1931) also found that it was possible to precipitate a proteose-like substance by adding excess of alcohol to an ether extract of the urine. He found that the amount of this proteose was greatly increased during an attack of urticaria or angioneurotic oedema. He claimed that in certain allergic diseases, including urticaria, the proteose contains the specific hapten responsible for the condition, and that when it is injected intradermally it causes a reaction similar to that produced by the allergen to which the patient is sensitized. He also showed that urinary proteose can act as an antigen, and that sensitivity can be transferred by the injection of the serum of a sensitized patient. This was carried out by the Prausnitz-Kustner technique. He believes that proteose is sometimes the primary allergen, but that in many cases it acts as a secondary allergen in patients sensitized to an exogenous substance.

Another factor which is of importance in chronic urticaria is heredity, for it is well known that in certain families there is a predisposition to urticaria, asthma, hay-fever, eczema, Besnier's prurigo, and migraine. This inherited state has been described by Coca (1926) as "atopy." I do not think that it would be profitable, in the present state of our knowledge, to discuss the views advanced by Coca to explain this hereditary tendency. An interesting theory to account for familial predisposition to allergic conditions is that put forward by Langdon-Brown (1932), who suggests that this tendency is due to absence of the ferment histaminase, which destroys histamine as soon as it is released. This view is supported by the work of Barber and Oriel, who found an increase in the amino-acids in the blood and urine in

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