THE LONGEST SPAN OF LIFE BASED ON THE RECORDS OF CENTENARIANS IN ENGLAND AND WALES

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In stating their aims and planning schemes of research contemporary gerontologists stress the primary importance of making old age stronger, "to add life to years, not just years to life." At present old age is considered to be a pathological condition because senile decay appears prematurely and is aggravated by disorders that are not necessarily associated with normal old age, such as arteriosclerosis, hypertension, "senile" heart, some degenerative changes of liver and kidneys, mental deterioration, certain metabolic disturbances and auto-intoxication, gastrointestinal auto-intoxication, hypertrophy of prostate, etc.

This problem of gerontology, however, cannot, for two reasons, be dissociated from the other gerontological problem—that of how to increase the span of human life. (1) Most old people cling very strongly to life. Old men have the same right to a normal and healthy existence as children or adults, even though their most useful period of life has ended. (2) Besides this factor there is a scientific reason. The development of science and medicine must proceed in spite of and with complete disregard to all possible complications of a social and political kind. For many scientists and medical research workers the problem of ageing is fascinating not only because it affects the well-being of every man and woman, but also, and often chiefly, because it is one of the greatest and most fundamental mysteries and riddles in biology and medicine, because present old age is considered abnormal, and because if this is so this abnormal process of life has to be made normal. Science and medicine will not rest until they solve the riddle of what is normal ageing and normal old age and what is the normal span of life.

From the point of view of longevity, the centenarians of the past and the present are of especial interest because the length of their life indicates the limit which is theoretically and potentially possible for every human being. With reservations, investigation into their ancestry and progeny might be useful in solving the genetical causes of longevity, while an examination of their mode of living, and of the functioning of their organism, with a post-mortem investigation, might contribute to some other problems of gerontology and geriatrics.

Difficulties of Investigation

There are several difficulties in the scientific investigation of centenarians, particularly as to their exact age. The basic information should be obtained from certificates of birth and death, of which the former presents the greatest difficulty, since it is often absent or doubtful. Young (1899) has fully discussed this and some other difficulties.

In the present paper data on centenarians are given only from 1930 to 1945, it being presumed that in this period the information and documents were more accurate than in the previous years, since the people of this country have gradually been trained in this respect. These data have been obtained from the most reliable sources available—for

the years 1930 to 1937 from the Registrar-General's *Statistical Reviews* for England and Wales, and for the years 1938 to 1945, as a personal communication, from the Registrar-General's Office at Somerset House, London. The dates of birth, however, were not verified by birth certificates, but were obtained from the persons who registered the deaths, which fact decreases the value of the data. These data have been divided into two periods, each of 8 years—namely, 1930–37 and 1938–45—and are summarized in Tables I and II. Examination of the figures in these tables reveals at once a constant and obvious fact—that the number of women centenarians is considerably larger than that of men, being about 4.4 times greater in the first period and about 4.9 times greater in the second period (Table I). Further, in the second period the actual

TABLE I.—*Number of Centenarians for Each Year in Period I (1930–7) and Period II (1938–45)*

Period I	No. of Centenarians		Period II	No. of Centenarians	
	Men	Women		Men	Women
1930	18	43	1938	16	93
1931	15	76	1939	22	90
1932	15	94	1940	20	102
1933	19	91	1941	18	91
1934	6	70	1942	12	79
1935	29	65	1943	21	92
1936	14	82	1944	21	85
1937	21	79	1945	18	93
Total	137	601	Total	148	725
Average per year	17.1	75.1	Average per year	18.5	90.6
Average per year per 20 millions of population	17.7	71.4	Average per year per 20 millions of population	18.3	83.4

TABLE II.—*Total Number of Centenarians of Each Age in Periods I and II*

Sex	Period	Age (years)													
		100	101	102	103	104	105	106	107	108	109	110	111	112	
Men	I	59	31	21	14	9	2	1	—	—	—	—	—	—	
	II	63	36	25	16	3	5	3	3	2	1	—	—	1	
Women	I	264	155	81	46	22	20	5	3	1	—	—	—	—	
	II	320	191	100	53	34	14	7	1	4	1	—	—	—	

number of women centenarians is significantly greater ($P < 0.02$, Fisher's test for small samples) than that in the first period. The increase of male centenarians in the second period was only slight, and was statistically not significant.

Limits of Longevity

From Table II it is clear that longevity of human beings might extend up to 109 and even 112 years. The age of 106–112 years has been reached by 11 (3.9%) out of 285 male centenarians and by 26 (about 2%) out of 1,326 female centenarians—that is, from both sexes a slightly larger relative proportion of men reached the oldest age. In favour of these data being of considerable value and comparative reliability is the fact that in each period investigated the annual figures of centenarians (Table I) are more or less constant, both for men and for women.

When calculated per year and per unit of the population (Table I), for 20 millions of men or women there were 17.7 male centenarians and 71.4 female centenarians in period I, and 18.3 and 83.4 respectively in period II. This fact indicates that the increase in the number of centenarians in period II cannot be explained by an increased population only, but appears also to be connected with increased longevity.

Ernest (1938), reviewing all the cases of centenarians which have been critically investigated by different authors and by himself, concludes that the longest reported span of human life was trustworthy in four cases only. "Two

I should like to express my gratitude to Lord Nuffield for the grant which has made possible the establishment and work of the Gerontological Research Unit, and to Oxford University, Prof. A. C. Hardy, and Prof. E. G. T. Liddell for the kind hospitality extended to the Unit in the Departments of Zoology and Physiology.

of these four people lived over 110, one was nearly 112, and one over 113 years at death" (p. 55), residing in the U.S.A., Guernsey, Ireland, and Canada respectively. All the other cases of greater longevity reported in the literature, scientific and non-scientific, cannot be accepted as trustworthy. The distinguished Swedish gerontologist G. Backman (1945) also concludes that 113 years could be taken as the accurate age of the longest span of human life recorded, but that 125 years might perhaps be expected. Prof. I. Fisher (1923, p. 112), of Yale University, reports a comparatively recent case of life up to 120 years in Oregon, U.S.A., the case having been investigated by the Oregon Historical Society.

Prolongation of Life in the Future

As to the possible prolongation of human life in future beyond the extreme age already reached by some centenarians (113 years), the scientists who studied this problem give different prophecies. Prof. Warthin (1929), of Michigan University, emphasizes that, according to the data of the U.S.A. Census Reports, "the increase in the average longevity is due to the saving of life through the prevention of extrinsic pathological death in the earlier decades of life, but that there has been no extension of the normal or biologic life limit" (pp. 166-7) . . . "It is therefore neither possible nor probable that the average longevity can be raised to the heights prophesied by the over-zealous and very inaccurate advocates of life extension" (p. 170). Warthin in this case refers to an extension of life up to 125-140 years.

Metchnikoff (1907), on the contrary, says that "we may predict that when science occupies the preponderating place in human society that it ought to have, and when knowledge of hygiene is more advanced, human life will become much longer" (pp. 226-7).

Prof. Fisher (1923) concludes that "it would be surprising if the future should not witness a further lengthening of human life, and at an increasing rate. Of course, there is a limit to the further increase of human life, but there is good reason to believe that the limit is still far off" (p. 103). . . . "If . . . notwithstanding all existing chances of death, it is possible for some persons to live beyond 120, the chances in the future for a larger proportion of such persons will be materially improved" (p. 112).

Prof. Simms (1946), of Columbia University, states that "there is at the time no proof for or against the possibility that we can some day extend our active life an extra one hundred or two hundred years with retention of youthful health, intelligence, and appearance" (p. 24).

A scientific and medical investigation of the span of centenarian life might, as already mentioned, be of great importance from several points of view. For example, histories of two long-lived families described by Weber

(1919) indicate heredity as one of the causative factors of longevity. His tables on pages 21 and 23 give the respective data of the span of life of the brothers and sisters in these two families. These tables are abbreviated and pooled in Table III of the present paper.

A Social Problem

The question of centenarians is closely connected with one of the gravest social problems of our days—namely, the growing proportion of old people in the population. In the excellent report of the Nuffield Foundation (Rowntree, 1947) this is illustrated by a table (p. 3) prepared by W. A. B. Hopkin, a member of the staff of the Royal Commission on Population. The abbreviated data from this table are given in Table IV of the present paper. From

TABLE IV.—Population of England and Wales by Three Main Groups (thousands). (Abbreviated from Rowntree's Report, 1947, p. 3)

Year	Age			Total Population
	Under 15	Men, 15-64; Women, 15-59	Men 65, Women 60, and over	
1944	8,671	28,382	5,396	42,449
1954	9,086	28,080	6,143	43,309
1964	8,440	27,894	6,811	43,145
1974	8,081	26,692	7,804	42,577
1984	8,043	25,547	7,944	41,534
1989	7,886	25,071	7,848	40,805
1994	7,679	24,872	7,504	40,055

this table it is estimated that by 1989 the number of old people of pensionable age will equal the number of children, while by the same year the number of persons of working age will be approximately three millions less than in 1946. The report adds (p. 2): "The trend revealed in Mr. Hopkin's figures may, however, be even more pronounced than the table suggests; for other authorities, among them the Registrar-General, have forecast that as early as 1971 the number of persons of pensionable age may equal, or even exceed, the number of children."

This position is considered to be very serious because at present helpless old people become a great burden on the younger working population. Such a position, however, will not necessarily be the same in future, as Metchnikoff and Fisher emphasize. It is probable that medicine and science will not only add years to the life of an old man but simultaneously will conserve his physical and mental vigour for a longer period. "One result of lengthening life will be a greater utilization of accumulated experience. We shall have less immaturity in judgment. . . . It will give to society a body of old yet hale men of experience, whose influence and worth cannot be measured" (Fisher, 1923, p. 111).

Conclusions

In the data recorded in the Registrar-General's Office the certificates of birth of centenarians have not been checked, and therefore their age can be accepted only with some reservation. Since, however, these data were investigated during the latest period of 16 years, and as the figures investigated were constant in character, their value and reliability are probably still considerable.

According to these data, in England and Wales per 20 millions of male or female population there were each year on the average 17.7 male and 71.4 female centenarians in the period 1930-7, and 18.3 and 83.4 respectively in the period of 1938-45. Thus, unexpectedly, their incidence was regular and not very exceptional, and more women had a long span of life than men.

There was a statistically significant increase of female centenarians during the last eight years as compared with

TABLE III.—Two Long-lived English Families, Alexander and Kempe (Weber, 1919, pp. 21, 23)

Alexander (Quakers)			Kempe		
Name	Age at Death		Name	Age at Death	
	Yrs.	Mths.		Yrs.	Days
Ann Barber (mother) ..	86		Rev. J. E. Kempe ..	97	1
George William ..	88	7	Miss M. Kempe ..	87	326
Mary Barber ..	103	5	Rev. A. A. Kempe ..	96	246
William Dollin ..	81	11	Mrs. E. Mozley ..	103	*
Henry ..	91	3	Mrs. J. F. Martin ..	94	131
Samuel ..	74	9	Mrs. C. W. Davies ..	83	121
Frederick ..	82	3	Mrs. A. D. Benson ..	94	358
Elizabeth ..	93	10	Mr. C. N. Kempe ..	77	108
Sarah Ann ..	100	*	Mrs. E. B. Parish ..	86	104
			Mr. R. C. Kempe ..	85	9

* Those marked by an asterisk were still alive at the time of publication of Weber's book.

a previous period of eight years, while a small increase in male centenarians in the last period was not significant.

During these periods the longest human lives recorded were 109 and 112 years, and this fact is in approximate accord with the conclusions reached by previous critical investigators for periods earlier than 1930.

Thus, theoretically and potentially, a span of life of 109–112 appears to be possible for a human being. As, however, the exceptional cases of longevity of human beings have occurred during the present time, when the process of ageing is abnormal, there is some possibility that the span of human life might be further extended when the process of ageing becomes a normal one.

There are some indications that the genetic factor is one of the causal factors of longevity.

Taking into consideration the primary aim of gerontology to make old age stronger and healthier, and not only longer, the prophecy of Metchnikoff and Fisher may be right—that in this way the useful period of human life might be extended and the community benefit by a greater utilization of the accumulated experience and wisdom of older people.

It is most desirable that scientific and medical investigation of cases of centenarians should be carried out by research workers.

I wish to express my gratitude to the Registrar-General and his Office, in particular to Mr. A. A. Dodge, for supplying me with all necessary data concerning published and unpublished cases of centenarians.

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Medical Memoranda

Relief of Pain in Childbirth

While acting as house-surgeons in Maryfield Hospital, Dundee, we obtained permission to try the administration of phenobarbitone and rectal ether for the relief of pain in childbirth as outlined by C. B. Lull and R. A. Hingson (1945).

The technique adopted was to give the patient a 5% sodium bicarbonate enema on admission. When her pains began to make her uncomfortable she was given 3 gr. (0.2 g.) of phenobarbitone, which was repeated in 1½-gr. (0.1-g.) doses as required. As soon as the pains became distressing—usually towards the end of the first stage—2½ oz. (70 ml.) of ether in 1½ oz. (42 ml.) of olive oil or mineral oil was administered rectally. This enema was given slowly, with the patient on the left side, care being taken to pass the catheter above the presenting part. This makes the patient feel very drowsy within a few minutes, the effect lasting for two to four hours. The rectal ether can be repeated in two hours if the effect is wearing off. If the patient is exhausted or it is suspected that the labour will be prolonged, 2 dr. (7 ml.) of paraldehyde may be added to the rectal instillation to produce a deeper sedative action.

Results.—In our series of twenty-five cases, mostly of primigravidae, we found that all received relief from this

treatment. All slept between their pains and also used their pains well. The multiparae admitted it was the easiest labour they had had, several of them requiring to be reassured that their baby had been born.

Actions on the Mother.—(1) Restlessness and distress were relieved so that they relaxed well between pains. They were in a state which was highly responsive to suggestion, and obeyed the instructions given by the attendant. (2) The pains continued with the strength and frequency which would have been expected if rectal ether had not been administered. (3) The pelvic floor relaxed well and the head advanced quickly. (4) The third stage was short, the average duration being 12 minutes, and after expulsion of the placenta the uterus contracted firmly and there was no case of post-partum haemorrhage. (5) The patients co-operated so well during the birth of the head that only three out of twenty-five required a perineal stitch. (6) There was no increase in the forceps rate.

Effect on the Foetus.—Every child cried immediately at birth, and was in no way affected by the sedation.

In conclusion, we found this method very satisfactory; it is safe for both mother and child, it is easy to administer, and it does not prolong labour.

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Safety-pin in Larynx for Five Weeks

The presence of an open safety-pin in the larynx of a 2-year-old child for over five weeks seems unusual enough to warrant record.

CASE REPORT

On April 13, 1946, a practitioner was called to see a small boy aged 2 who was reported to have had some dyspnoea during the night. He was over-quiet and pointed to his throat. He cried when the throat was examined. The practitioner described the cry as "croupous and husky." Nothing abnormal was found in the throat or chest. The temperature, pulse, and respirations were normal. The next day there was some dyspnoea and a croupous distressing cough. Laryngeal diphtheria was suspected; 800 units of antitoxin were given and the child was sent to a fever hospital. He had been immunized previously.

On admission he was given 40,000 units of antidiphtheritic serum, but the medical superintendent did not consider it was a case of diphtheria; he suspected an early pneumonia, though signs in the chest were absent. The respiration was increased and there was difficulty in getting him to take food. Negative swabs were obtained from the nose and throat on April 14, 15, and 16. The patient was fairly comfortable till April 24, when symptoms of obstruction arose. He was put in a steam tent, but did not improve, and in view of the increasing dyspnoea tracheotomy was performed the next day. During the following two weeks various attempts to remove the tube were made, but without success.

I first saw him on May 10. He was quite unable to breathe through the larynx. There was no cry. An attempt at laryngoscopy with inadequate instruments showed a mass in the larynx. The child was transferred to a nursing home and a direct laryngoscopy was performed on May 21. The larynx was filled with a mass of granulation tissue. When this was probed a foreign body was seen. It looked like a coin, but gentle traction showed that it was fixed, especially at the posterior end. The anterior end was gently pulled on and the body removed. It proved to be an open brass safety-pin 7/8 in. (2.2 cm.) long. During the next fortnight the tube was changed daily, but there was still no airway through the larynx. Direct laryngoscopy showed the swelling to be much smaller, and the left vocal cord was visible. A few days later he cried for the first time, and in a day or two began to say a few words, and was soon talking freely, with the tube corked. The tube was finally removed on June 20, a month after the operation. A week later he went home looking fit and well and talking freely and, for his age, clearly. I saw him again in October and found him quite well, and breathing and talking normally.

I am indebted to the doctors in charge of the case for details of the early history.

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