Total immediate ancestral longevity (TIAL) score as a longevity indicator: an analysis on Einstein and three of his scientist peers

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Summary   The total immediate ancestral longevity (TIAL) score was first introduced by Raymond Pearl as a convenient parameter for quantitating human longevity. TIAL is the summed ages at death of the six immediate ancestors (namely parents and four grandparents) of a propositus. In this communication, I present the calculations of TIAL score for Einstein (1879–1955) and three of his scientist peers, namely Charles Darwin (1809–1882), Irene Joliot Curie (1897–1956) and Aage Bohr (1922–). The TIAL scores for Einstein, Darwin, Irene Curie and Aage Bohr were 390, 378, 372 and 436 respectively. These are markedly lower than 477 reported for Jeanne Calment, the French woman who died in 1997 at the oldest authenticated age of 122 years and 164 days. I conclude that the TIAL score is a convenient and easily quantifiable longevity parameter which anyone interested in determining his or her longevity can use to estimate a tentative number. More light could be shed on the worth of the TIAL score as a longevity indicator, if additional data on the TIAL scores of royalty and celebrities (for whom verified genealogical data are available) are reported. © 2001 Harcourt Publishers Ltd

INTRODUCTION

In a 1998 brief communication in *Science*, entitled, 'The Oldest Human', Robine and Allard (1) reported that Jeanne Calment of Arles, France, who died at the oldest authenticated age of 122 years and 164 days in 1997, had a total immediate ancestral longevity (TIAL) score of 477. The concept of TIAL as a convenient longevity marker was first introduced by American polymath, Raymond Pearl (1879–1940) in late 1920s. Pearl, who founded the journals *Quarterly Review of Biology* in 1926 and *Human Biology* in 1929, formulated TIAL as the summed ages at death of the parents and grandparents of each propositus (2,3).

Though over six decades have passed since its introduction by Pearl, TIAL as an acronym remains obscure in biomedical literature, and not a single publication exists on TIAL in the NLM Medline database covering the research papers which have appeared in the post-1965 period. Robine and Allard's (1) communication stimulated me to calculate the TIAL scores of a few eminent scientists whose ancestral birth and death records are available to the public. Thus, in an extension of my studies (4–7) on the biomedical aspects of Albert Einstein's life reported previously in this journal, I present my calculations on the TIAL scores of Einstein and three of his peers in science, namely Charles Darwin, Irene Joliot Curie and Aage Bohr. The relevance of TIAL (an easily calculable number) for longevity assessment is also discussed briefly.

SUBJECTS AND METHODS

Study Subjects

I chose Darwin, Irene Joliot Curie (daughter of Pierre and Marie Curie) and Aage Bohr (son of Niels Bohr) as scientist peers of Einstein. While Darwin's pre-eminent standing

as the foremost evolutionary theorist in the 19th century makes him as an equal to Einstein in the science arena, the peer status of Irene Joliot Curie and Aage Bohr to Einstein was validated by the Nobel Prizes awarded to them in 1935 and 1975 respectively. The choice of Irene Joliot Curie and Aage Bohr was based on the fact that it was easier to track (because of their illustrious parents), the ancestral record of their paternal and maternal grandparents.

Methods

Genealogical data of the six immediate ancestors for Charles Darwin (8–10), Albert Einstein (11), Irene Joliot Curie (12–15) and Aage Bohr (16) were collected from published sources. For Aage Bohr, who is still living, ancestral dates of birth and death were cross-checked for accuracy by contacting him directly. In the absence of complete dates of birth and death (year–month–day) for an ancestor who was born in the first half of the 19th century and before, his or her age at death was calculated by assuming that the death had occurred on a date, which enables rounding inclusive. For example, Robert W. Darwin's (father of Charles Darwin) age at death, based on his reported life span (1766–1848) was calculated as 82 years, though it could have been 81 years. This was just a convenient measure adopted for calculable purposes. The TIAL score for each of the four scientists were calculated based on Pearl's formulation, i.e. TIAL is the summed ages at death of the parents and four

grandparents of a propositus (2). Then, adjusted TIAL score was calculated from the TIAL score (adjusted TIAL score = TIAL score/6).

RESULTS AND DISCUSSION

Table 1 shows the TIAL score of three scientists born in the 19th century, namely Charles Darwin, Albert Einstein and Irene Joliot Curie. These scores were calculated from the age at death of their respective six immediate ancestors. The TIAL scores for Darwin, Einstein and Irene Curie were 378, 390 and 372 respectively. The TIAL score for Aage Bohr, born in the 20th century, was 436 (Table 2). The TIAL scores of these four scientists are markedly below that of 477 reported for Jeanne Calment.

In Table 3, adjusted TIAL score for each of the four scientists studied is provided and compared with the age at death for Darwin, Einstein and Irene Curie. While Darwin and Einstein exceeded their adjusted TIAL score by 10 and 12 years at the time of their death, Irene Curie was 4 years short of her adjusted TIAL score at the time of her death. Aage Bohr, still living (as of July 2000), has already exceeded his adjusted TIAL score by over 5 years. Even though Irene Curie's father Pierre Curie died at a relatively younger age of 46 in a fatal accident, her adjusted TIAL score of 62 doesn't vary markedly to that of Darwin and Einstein.

There is consensus among scientists that both genetic and environmental components contribute to human longevity. Individual lifestyle (smoking, drug intake and

Table 1 TIAL score of three scientists born in the 19th century

Scientist	Immediate ancestors					TIAL[1] score for the scientist
	Relationship[1]	Names	DOB[1] (yr/mo/d)	DOD[1] (yr/mo/d)	Age at death (Yrs)	
Charles Darwin (1809–1882)	F	Robert W. Darwin	1766	1848.11.13	82	378
	M	Susannah Wedgwood	1765	1817.07.15	52	
	PGF	Erasmus Darwin	1731.12.12	1802.04.18	70	
	PGM	Mary Howard	1740	1770	30	
	MGF	Josiah Wedgwood	1730.07.12	1795.01.03	64	
	MGM	Sarah Wedgwood	1734.08.18	1815.01.15	80	
Albert Einstein (1879–1955)	F	Hermann Einstein	1847	1902	55	390
	M	Pauline Koch	1858	1920	62	
	PGF	Abraham Einstein	1808	1868	60	
	PGM	Helene Moos	1814	1887	73	
	MGF	Julius Koch	1816	1895	79	
	MGM	Jette Bernheimer	1825	1886	61	
Irene Joliot Curie (1897–1956)	F	Pierre Curie	1859.05.15	1906.04.19	46 (accidental)	372
	M	Marie Sklowdowska	1867.11.07	1934.07.04	66	
	PGF	Eugene Curie	1827	1910.02.25	83	
	PGM	Sophie Clair Depoully	1832	1897.09.27	65	
	MGF	Wladyslaw Sklodowski	1832	1902.05.08	70	
	MGM	Bronislawa Boguska	1836	1878.05.09	42	

[1]Abbreviations: F, father; M, mother; PGF, paternal grandfather; PGM, paternal grandmother; MGF, maternal grandfather; MGM, maternal

Table 2 TIAL score of a scientist born in the 20th century

Scientist	Immediate ancestors					TIAL[1] score for the scientist
	Relationship[1]	Names	DOB[1] (yr/mo/d)	DOD[1] (yr/mo/d)	Age at death (Yrs)	
Aage Bohr (1922–)	F	Niels Bohr	1885.10.07	1962.11.18	77	436
	M	Margrethe Norlund	1890.03.07	1984.12.21	94	
	PGF	Christian Bohr	1855.02.14	1911.02.03	56	
	PGM	Ellen Adler	1860.10.07	1930.11.30	70	
	MGF	Alfred Norlund	1850.01.31	1925.09.01	75	
	MGM	Emma Holm	1862.11.19	1926.04.19	64	

[1]Abbreviations: F, father; M, mother; PGF, paternal grandfather; PGM, paternal grandmother; MGF, maternal grandfather; MGM, maternal grandmother; DOB, date of birth; DOD, date of death; TIAL, total immediate ancestral longevity.

Table 3 Comparison of adjusted TIAL score and age at death of four scientists

Scientists	DOB[1] (yr/mo/d)	DOD[1] (yr/mo/d)	TIAL[1] score (yr)	Adjusted TIAL[1] score (yr)	Age at death (yrs)
Charles Darwin	1809.02.12	1882.04.19	378	63.0	73
Albert Einstein	1879.03.14	1955.04.18	390	65.0	76
Irene Joliot Curie	1897.03.17	1956.03.17	372	62.0	58
Aage Bohr	1922.06.19	n.a.	436	72.7	n.a.

[1]Abbreviations: DOB, date of birth; DOD, date of death; TIAL, total immediate ancestral longevity; Adjusted TIAL Score = TIAL Score/6; n.a., not applicable, since the propositus is still alive.

other health-challenging behavioral patterns), nutritional status and exposure to environmental stress (such as harassment, war anxiety, radiation and pollution) are some of the environmental components which can contribute positively or negatively to an individual's longevity. But, there is lack of agreement on how much percent is contributed by the genetic component to human longevity. The adjusted TIAL score seems to be a convenient, reliable and quantifiable parameter which can indicate the genetic component of one's longevity. However, siblings share the same adjusted TIAL score, since they share the same parents and grandparents. But, generally siblings do not die at the same age. Thus, the difference in the ages at death of siblings may indicate the contribution of the environmental component to human longevity. If this conjecture holds, is it acceptable to infer that since Darwin and Einstein exceeded their adjusted TIAL score by over 10 years at the time of their death shows, nearly 14% of their lifespan was contributed by the environmental component? Einstein's younger sister Maja Einstein (1881–1951), though sharing with her brother the adjusted TIAL score of 65 years, died at 69 years and 6 months. Thus, in her case, the environmental component could have contributed only around 6% to her lifespan.

The ages at death of Darwin's five siblings are also of interest in this context. According to the data provided by Hubble (8), among the five siblings Darwin had, his third elder sister Susan (1803–1866) died close to the adjusted TIAL score of 63 of this cluster. Two other siblings, namely eldest sister Marianne (1798–1858) and youngest sister Catherine (1810–1866) missed reaching the adjusted TIAL score at the time of their deaths by 3–7 years. The remaining two siblings, the second elder sister Caroline (1800–1888) and elder brother Erasmus (1804–1881), lived 25 and 14 years beyond the adjusted TIAL score respectively.

The case of Irene-Joliot Curie is also worthy of analysis. Though her father, Pierre Curie, died in an accident at the age of 46, and her mother Marie Curie also had a premature death due to excessive radioactive exposure during work at the age of 66, Irene Curie's TIAL score is 62 years. But she died four years short, at the age of 58 years, again primarily due to excessive radioactive exposure during her professional career (17,18). Irene Curie's younger sister, Eve Curie Labouisse (b. 6 December, 1904), who shares the same adjusted TIAL score of 62 years, and who did not choose science for her profession, is still living (as of July 2000) at the age of 95 years. Eve Curie Labouisse has thus exceeded her adjusted TIAL score by nearly 33 years.

I conclude that TIAL score is a convenient and easily quantifiable longevity parameter which anyone interested in determining his or her longevity can use to estimate a tentative number. In this study, I have presented data only on four eminent scientists. More light could be shed on the worth of TIAL score as a longevity indicator, if additional studies along these lines (such as the TIAL scores of royalty and celebrities, for whom verified genealogical data are available in public record) are reported in the near future.

ACKNOWLEDGEMENTS

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