J.B.S. Haldane and Julian Huxley*

By

Krishna R. Dronamraju
Genetics Center
P.O. Box 772481
Houston, Texas 77215

* Presented at the Symposium: "Julian Huxley 1887-1975; Biologist and Statesman of Science", Rice University, Houston, Texas, U.S.A., September 25-27, 1987.

Krishna R. Dronamraju

Nine pages

J.B.S. Haldane and Julian Huxley

The lifespans of J.B.S. Haldane (1892-1964) and Julian Huxley (1887-1975) overlapped for much of their lives. Both attended Eton and Oxford. Huxley was the senior by five years. Both came from distinguished scientific families. Julian was deeply influenced by his grandfather Thomas Henry Huxley, the great 19th century zoologist and evolutionist ("Darwin's bulldog"). Haldane's early research interests were guided and fostered by his father John Scott Haldane, the eminent Oxford physiologist. The two families were closely entwined in friendship. Growing up in Oxford, the Huxley brothers - Julian and Aldous - enjoyed the close friendship of Jack (JBS) Haldane and his sister Naomi (now Lady Mitchison). When Julian's first child, Anthony, was born in 1920, J.S. Haldane and his wife Kathleen provided much parental guidance and advice, which was of great comfort to Juliette (now Lady Huxley).

In the years following world war I, Julian Huxley and J.B.S. Haldane were Fellows of New College, Oxford - Huxley in Zoology, and Haldane in Physiology. Haldane was a frequent visitor to the then newly married Huxleys. In his Memories, Huxley wrote: "One of our most frequent visitors was Jack Haldane, he too a Fellow of New College, teaching physiology, though he had taken a First in Greats. He was another odd character. He dropped in whenever he liked - which was usually at tea-time - and devoured plates of biscuits, protesting that he couldn't eat a crumb, while reciting Shelley and Milton and any other poet you chose, by the yard. He had a fantastic memory and knowledge of the classics, and enjoyed displaying them." (page 137).

It was in 1920 that Huxley conducted his famous experiments on the metamorphosis of the axolotl, which is seldom seen in its adult stage. His discovery (inducing the transformation of the larva by feeding it on thyroid gland) received much attention in the popular press, and caused Haldane to warn Huxley that he would lose all credibility in the scientific community. A few years later, it was Haldane's turn, when his biological predictions in Daedalus (1924) made him an equally famous figure. It was also during those Oxford years that Haldane's sister Naomi dragged them all into acting; see her contribution "Beginnings" in Dronamraju/ (1968)

After the Oxford years, the lives of Haldane and Huxley diverged. In 1923, Haldane left for Cambridge to become the Dunn reader in Biochemistry under F.G. Hopkins. In 1925, Huxley resigned from his position as Demonstrator in Zoology at Oxford and accepted the Chair of Zoology at King's College, University of London. However, he resigned from that post as well shortly afterwards when invited by H.G. Wells to collaborate with himself and his son G.P. Wells in writing The Science of Life (1929-30). Haldane, in the meantime, began his series of papers on the mathematical theory of natural selection (1924), which formed the foundation (along with the works of R.A. Fisher and Sewall wright) for theoretical population genetics.

Popular writing

Both Huxley and Haldane first came to the public attention in the 1920s. Huxley's initial fame due to his axolotl work was soon followed by his Essays in Popular Science (1926) and The Stream of Life (1928), and above all, The Science of Life (1929-30) with H.G. and G.P. Wells. Huxley and Haldane collaborated in writing a successful text Animal Biology (1927). Haldane's first book Daedalus (1924) was soon followed by Callinicus (1925) and the collected essays entitled

Possible Worlds and other essays (1927), establishing once and for all Haldane's brilliance as a first rate scientist as well as a superb popularizer.

Haldane's popularization covered a far greater range of subjects than Huxley's, encompassing geology, astronomy, statistics, as well as a number of biological sciences. Collections of essays by Haldane appeared as books with such titles as The Inequality of Man and other Essays (1932), Heredity and Politics (1938), Keeping Cool and other Essays (1940), A Banned Broadcast and other Essays (1946), Science Advances (1947), and Everything has a History (1951). From the late 1930s onwards, Haldane's writings had a decidedly Marxist flavor. Huxley's writings included biological topics, colonial education in Africa, social planning, Soviet genetics, wild life, humanism, and travel notes. His books include A Scientist among the Soviets (1932), Africa View (1931), The Uniqueness of Man (1941), New Bottles for New Wine (1957), The Humanist Frame (1961), Essays of a Humanist (1964), Memories (1970), and Memories II (1973). One of Huxley's most influential books was Religion without Revelation (1927). In arriving at his religious philosophy, Huxley was influenced by the essays of Lord Morley, which he came across while browsing in a public library at Colorado Springs. This book and his aunt Mary Ward's book, Robert Elsmere, together made a deep impression on Huxley's mind, converting him to religious humanism. In Religion without Revelation, Huxley stated his belief that "any religion which stresses the need for propiating an external Power will be diverted away from the more essential task of using and organizing the spiritual forces that lie within each individual..... I believe in the religion of life."

Biological interests

Biological interests

Huxley's biological interests included animal behavior, amphibian metamorphosis, allometry, and embryogenesis. His twin interests in taxonomy and Darwinian evolution were skillfully interwoven in his Evolution: The Modern Synthesis (1942). Huxley's observations on the courtship behavior of the great crested grebe opened up an entirely new aspect of vertebrate ethology. He introduced the term 'ritualization' to describe the evolutionary process by which such behavior-patterns as feeding or feather-preening might become dissociated from their original functions and used in self-exhausting ceremonies. His work provided important evidence that Darwinian sexual selection did not account for some of the ceremonies of sexual behavior by birds, because these were not performed until long after their mates were chosen (Huxley, 1914). Huxley's most important contribution was in the measurement of relative growth. Inspired by the early work of his Oxford tutor,Geoffrey Smith, (1905) on differential growth-rates, Huxley compared the growth in width of the abdomen of female fiddler-crabs (Uca pugnax), with the growth in width of the carapace. The abdomenal width is expressed as a percentage of carapace-width. In very young specimens, the width of the abdomen was found to be similar in both sexes, but it became broader in adult females by allometric growth. In 1924, Huxley published a brief but important paper on the heterogonic growth of the larger 'chela', in the male crab. He derived an expression to measure heterogonic growth; $y = bx^k$, where k is a measure of the differential growth of the chela in relation to the rest of the body, y is the weight of the chela in relation to that of the rest of the body, x, and b is a constant representing y expressed as a fraction of x, the latter being considered to be

unity for the purpose. Huxley emphasized the relevance of this work to the taxonomist, because animals with heterogonic growth cannot be described meaningfully (with respect to their heterogonic organs), except in terms of k. He continued his studies of relative growth in a number of species (e.g. the size of the forceps of the earwig, Forficula auricularia), and summed up his work in Problems of Relative Growth (1932). He emphasized the mistake made by systematists when defining species and other groups in terms of percentage relationships of parts of the body.

It is of interest to note that Huxley's interests in relative growth may be traced back to his first researches in dedifferentiation and morphogenesis. For instance, he studied the varying rates at which the organs underwent dedifferentiation in the ascidian Clavellina lepadiformis (1926). With G.R. de Beer, he showed that when exposed to poisons, the hydroids of Obelia geniculata and Campanularia sp. tended to dedifferentiate and to be resorbed into the stolon, or, if detached, became ovoid,undifferentiated bodies. Various parts of the body dedifferentiated at markedly different speeds (1923).

These few examples can only give very brief glimpses of Huxley's diverse biological interests, which include bird watching as well as experimental embryology. Extensive summaries can be found in the biographical memoir, written by his pupil J.R. Baker (1978), and in Huxley's Memories (1970) and Memories II (1973).

In contrast to Huxley's formal scientific training (in Zoology), Haldane never took a degree in science. His formal academic qualification was a B.A. degree in classics and humanities from Oxford. His first experiments and first publication (in 1912) were the result of his father J.S. Haldane's influence, and were

concerned with the physiological aspects of CO poisoning. Other studies dealt with the effects of ingesting various chemicals and of breathing various gaseous mixtures on the blood pH and components of blood and urine. However, Haldane was also involved simultaneously in genetic research from 1912 onwards, and spent much of his life in this field. From 1923 to 1933, he was formally identified as a 'biochemist' and occupied the Sir William Dunn Readership in Biochemistry at Cambridge in the Department headed by F. Gowland Hopkins. From the 1930s until his death in 1964, he made significant contributions to a number of other fields as well; especially statistics, biometry, and animal behavior. During the years 1937-1957, he was Weldon Professor of Biometry at University College, London. (This was in contrast to Huxley, who resigned from the Chair of Zoology at King's College, London, in 1927, and was a free-lance biologist and intellectual-at-large, with the exception of his appointments at the London Zoo, and later at Unesco.)

Haldane's early contributions to genetics were in the measurement of linkage. He suggested the unit of map distance (and the first mapping function) in 1919, measuring it in terms of centi-Morgans (cM), a term that is still in vogue today. After the pioneering work of Garrod (1909) on the biochemical basis of gene action, Haldane (1920) was one of the few geneticists, who emphasized this point of view. However, it was in the mathematical or theoretical basis of evolution that Haldane made important contributions. It was this work, along with those of Wright and Fisher, that became the foundation for population genetics. Haldane's early papers emphasized the measurement of selection in large populations. His contributions

to human genetics were equally impressive and include the first estimation of a human mutation rate (for hemophilia). Among other works, Haldane's papers laid the basis for estimating genetic damage resulting from ionizing radiation, and for the study of infectious disease as a selective agent in relation to the maintenance of certain balanced polymorphisms in human populations.

Haldane was especially noted for conducting painful experiments in diving physiology, with himself as the chief guineapig, during world war II. He firmly believed that medical personnel and physiologists should pioneer in taking physiological risks. He emphasized the application of diving physiology to space medicine as it would involve working under no gravitation. Much of this pioneering work of Haldane (conducted in the 1930s and 1940s) has since become incorporated into space research. Haldane's interest in space research and Soviet science was noted by Lederberg (1987).

Common interests

Huxley and Haldane shared the view that the Darwinian theory of evolution, especially by natural selection, was the most significant aspect of scientific research of their time. Both devoted considerable attention to this problem during their lives. Haldane's approach was mathematical, putting it firmly on a quantitative footing. Huxley was interested in a number of aspects - among them, the species concept in taxonomy, and sexual selection - and played the role of a grand synthesiser. Both believed in the education of the public, using mass media. Haldane and Huxley were the intellectual products of a most exciting time, and represented the best of English liberal education, which enabled them to indulge in a great diversity of intellectual endeavors. They have done their utmost to pass on this knowledge and tradition to the succeeding generations.

From about 1935 onwards, Haldane embraced marxism and wrote very

passionate essays on its application to science. However, he became disillusioned when the science of genetics was suppressed in the Soviet Union under the influence of T.D. Lysenko, especially after 1949, and slowly dissociated himself from marxist philosophy and its applications. Soon after, in the 1950s, he took up another (equally passionate) interest in India and Hindu philosophies, and migrated to India in 1957, where he died in 1964.

Huxley, in contrast, continued to advocate 'Evolutionary Humanism' in its widest sense, applying it to include both the sciences and the arts. He wrote C.P. Snow that his concept of 'Evolutionary Humanism' could bridge the 'culture gap' discussed by Snow: "I would have thought that you should extend this idea of the third culture, and make it everything based on the ideas of evolution and its course, both biological and psychosocial. If so, this would be more than a bridge - it would be a new pattern of thinking about nature and human nature, which would not merely reconcile the existing conflict but transcend it in a new pattern." (letter from Huxley to Snow, October 29, 1963, Rice University Archives).

Both Huxley and Haldane were major figures in twentieth century science. Their contribution to our science and culture has been quite profound, in extending the boundaries of our knowledge, in public education, and in the application of science to human affairs. Huxley's influence on world affairs included his work for Unesco, and Haldane's,through such works as Daedalus (1924),which profoundly influenced Aldous Huxley's Brave New World (1932).

Bibliography

Extensive references to the works of Huxley and Haldane can be found in the following books.

Baker, J.R. (1978) Julian Huxley. Scientist and World Citizen,

1887-1975. Paris: UNESCO.

Dronamraju, K.R. (1985) Haldane: The Life and Work of J.B.S. Haldane with special reference to India. Aberdeen: Aberdeen University Press. (Haldane's interest in Soviet science, especially their space research program, was expressed on several occasions. It is of interest to note his comments on the occasion of the launching of the Sputnik in 1957; see "Sputnik + 30" by Dr. Joshua Lederberg, in The Scientist, October 5, 1987.)