Haldane's Contributions to Biological Research in India

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After a few brief visits to India in quick succession, J B S Haldane accepted P C Mahalanobis's invitation and moved to India to join the Indian Statistical Institute, Calcutta, as a Research Professor in 1957. He left the Institute in 1962 and after a brief period of employment with the Council of Scientific and Industrial Research, New Delhi, he moved to Bhubaneswar to start his own Genetics and Biometry Laboratory. Haldane died in Bhubaneswar in 1964.

What were Haldane's contributions during his period of stay in India? In his own words (written in a letter to Mr Harrison Brown, Foreign Secretary, US National Academy of Sciences, in 1964, upon being elected to the Fellowship of the Academy): "*Since I have done little independent work in the last seven years, I venture to hope that my election is in part a recognition of the research done by my colleagues in India*". In 1961, Haldane stated "*I owe a great deal to this (Indian Statistical) Institute, but what I undoubtedly owe most is the opportunity it has given me of making some very important discoveries, namely, the discoveries of a number of younger men than myself, who, I think, are in the great tradition of scientific research*".

Indeed, the most notable contribution of Haldane during his period of stay in India was to start several young men in their scientific careers, many of whom later gained international renown for their own scientific work. Haldane advised that "*if you want to excel in science, try to develop the habit of quantitative thinking*" and that "*... it is your duty to begin thinking statistically about anything that can help your country and the world*". Quantitative biological research in India gained a major impetus with Haldane's move to India. Haldane encouraged his team of young students to carry out research in various areas of biology,

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with emphasis on quantification and statistical design and analysis. Estimation of the amount of earth moved by earthworms in the agricultural fields in India, study of variation in the number of petals on flowers within a single species, impact on total grain yield of planting different varieties of rice in the same plot compared with planting a single variety, were some of the projects his students completed under his guidance.

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The study of the genetic impact of marriages between biological relatives occupies a central place in human genetics. Children of biologically related parents are said to be inbred. Because biological relatives are likely to share genes derived from their common ancestor(s), children of biologically related parents have an increased probability of being homozygous for such ancestrally derived genes. This, in theory, is expected to increase the prevalence of rare recessive disorders in populations where marriages between biological relatives are common. Haldane was aware that in many communities in India, especially in southern India, uncle-niece and cousin marriages are preferred. However, estimates of frequencies of such marriages and their adverse genetic impacts on children were unavailable. In a major project undertaken in Andhra Pradesh by two of Haldane's students, these frequencies and impacts were estimated. This study prompted Haldane to develop a new statistical test of significance of the inbreeding coefficient of a population. Later, upon the advice of Haldane, data on frequencies of various types of related marriages were collected at the all-India level during the 1961 decennial census of India, thus providing a valuable database for human genetics research in India.

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In 1949, in a landmark paper entitled 'Disease and evolution', Haldane suggested that it is an advantage for a species to be biologically diverse and even to be mutable for genes conferring disease resistance. He suggested that serological and biochemical diversity in human populations may correlate well with disease resistance. To test this hypothesis, Haldane guided and supported a student to carry out genetic studies in human populations living in malarial endemic regions of south India. This and

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subsequent studies have shown that, to a large degree, Haldane's hypothesis was correct.

Haldane also provided guidance to two students in collecting and analysing data on traits that run in families in order to determine their modes of inheritance. One of them went on to carry out an important study, under Haldane's guidance, on the rate of change in frequencies of genes in a population resulting from admixture with other populations. Haldane also guided one of his more mathematically inclined students, Suresh Jayakar, on some problems in population genetics; he obtained some elegant and important results on genetic consequences of temporal variation of natural selection.

Haldane emphasized the need to undertake palaeontological research in India. The National Institute of Sciences of India (now, the Indian National Science Academy) invited him to a symposium in 1953 to put forward his suggestions on evolutionary studies in India. Haldane pointed out that "*neither Europe nor North America possesses any satisfactory Jurassic beds (213–244 million years before present) laid down on land. That is probably why our knowledge of Jurassic mammals is so poor. There are several areas in India where Jurassic strata of continental origin are found. So I think it quite likely that an Indian palaeontologist will find the first complete skeleton of a Jurassic mammal".* Indeed, within a couple of decades, the first Jurassic mammal from India was discovered by an Indian geologist, and was fittingly named *Kototherium haldanei.*

In addition to providing research guidance to individual students, Haldane's role in improving biology teaching in India was phenomenal. In 1960, the Indian Statistical Institute started a unique degree course in statistics in which the curriculum included, in addition to statistics and mathematics, natural and social sciences. Haldane's contribution was summed up clearly by P C Mahalanobis: "*As a matter of fact, the integrated teaching programme which we have could not have been put through, I'm almost certain, without his very massive support*". In his speech delivered

on the occasion of the inauguration of this integrated teaching programme, Haldane lamented that in Indian universities "*students who choose a biological course must give up the study of mathematics, not to mention statistics, at an early stage. This means that graduates in the biological sciences are automatically debarred from most of the types of research, which would be of value in developing our agriculture and husbandry*". Haldane was in charge of teaching biological sciences in this programme. He took his teaching duties so seriously that he saw "*no prospect of doing serious research, even of a theoretical kind, in the next two years*".

Haldane delivered a very large number of popular lectures on various aspects of biology in schools, colleges, universities, conferences and even on the All India Radio. Every one of these lectures contained new ideas for biological research that could be conducted in India without the use of any sophisticated equipment. In sum, Haldane provided a major momentum to biological research in India.

Suggested Reading

[1] Ronald Clark. *The Life and Work of J B S Haldane*. Oxford University Press. Oxford and New York, 1984.

[2] John Maynard Smith. J B S Haldane. in *Oxford Surveys in Evolutionary Biology*. (eds) P H Harvey and L Partridge. Oxford University Press. Oxford. Vol.4, 1987.

[3] Dronamraju K R (ed). *Haldane's Daedalus Revisited.* Oxford University Press. Oxford, 1998.

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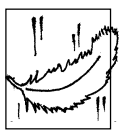

"For a biologist, the alternative to thinking in evolutionary terms is not to think at all"

— Sir Peter B Medawar
Nobel Laureate