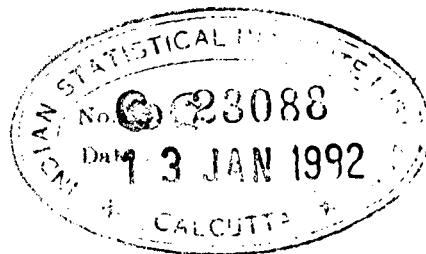


# J.B.S. HALDANE : A TRIBUTE



Indian Statistical Institute  
203 Barrackpore Trunk Road  
Calcutta 700 035, India  
1992

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## FOREWORD

*J.B.S. Haldane was one of the foremost biologists of this century. His contributions to science have been extensive especially in the areas of physiology, biochemistry and genetics. He is well known for his work on mathematical basis of evolutionary theory. Although he primarily worked at University College London, towards the later part of his life, he left England and joined the Indian Statistical Institute. During the period he was with the Institute, he initiated several research projects on quantitative biology and was instrumental in formulating (along with P.C. Mahalanobis) the academic program for B.Stat (Honours) course of the Institute.*

*Indian Statistical Institute was fortunate to have had the advice and guidance of such an eminent scientist. J.B.S. Haldane was also a renowned social thinker. He wrote extensively on matters of social concern and the role a scientist should play in contemporary society. He was also a great popularizer of science. After his move to India from England, he emphasized non-violent study of biology and the practice of low-cost science which has relevance even now.*

*On the occasion of his birth centenary, the Indian Statistical Institute is bringing out this centenary album to emphasize Haldane's philosophy of life and his views on science and society. The album contains some of Haldane's own writings and speeches besides invited articles from some of Haldane's contemporaries and students. Some photographs of Haldane during his stay in India are also included. It is a pleasure for me to thank all the contributors to this album and to Dr. Partha P. Majumder, Organizing Secretary and other members of the Organizing Committee for their help in bringing out this album as a tribute to the great scientist.*

*B.L.S. Prakasa Rao*

**B.L.S. Prakasa Rao**

**Director**

**Indian Statistical Institute**



J.B.S. Haldane, F.R.S. and P. C. Mahalanobis, F.R.S. (1957)

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**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

**AN AUTOBIOGRAPHY IN BRIEF**

**J.B.S. Haldane**

A number of inaccurate statements have been published about me in the press – quite as many in articles favouring me as in hostile statements. So I propose to give a brief account of my scientific career. I was born in 1892. I owe my success very largely to my father, J.S. Haldane. He was perhaps best known as a physiologist, but he was so far from being a specialist that in later life he was elected president of the Institution of Mining Engineers and delivered the Gifford lectures on the “Existence and Attributes of God.” I suppose my scientific career began at the age of about two, when I used to play on the floor of his laboratory and watch him playing a complicated game called “experiments” – the rules I did not understand, but he clearly enjoyed it.

At the age of eight or so I was allowed to take down numbers which I called out when reading the burette of a gas-analysis apparatus and later to calculate from these numbers the amounts of various gases in a sample. After this I was promoted to making up simple mixtures for his use and, still later, to cleaning apparatus. Before I was fourteen, he had taken me down a number of mines, and I had spent some time under water both in a submarine and in a diving dress. He had also used me as the subject in many experiments. In fact I spent a good deal of my holidays from school in learning my father’s trade. Most Indian boys do this, but not the sons of scientists. After I was twelve, he discussed with me all his research before publication, and sometimes tried out a lecture course on me before delivering it to students.

At school I deserted “classics”, that is to say, the study of Latin and Greek, at the age of fourteen and studied chemistry, physics, history, and biology, with my father’s full backing but to the annoyance of the headmaster, who said I was becoming “a mere smatterer”. The teaching of chemistry was good, and by the age of sixteen I had learned some facts discovered since my father had studied that subject, so that I could help him and C.G. Douglas; and my first scientific paper was a joint one with them, read to the Physiological Society when I was seventeen.

I went to Oxford on a mathematical scholarship in 1911 and took first-class honours in mathematical moderations (roughly the Indian B.Sc. level). But as nobody can study mathematics intensively for more than about 5 hours daily and retain sanity, I also attended the final honours course in zoology in my first year. One of my fellow students was the late Professor Narayan K. Bahl, who later did so much for the teaching of zoology in India. At a

seminar for zoology students in 1911, I announced the discovery, from data published by others, of the first case of what is now called linkage between genes in vertebrates. My evidence was considered inadequate, and I began breeding mice with A.D. Sprunt, who was killed in 1915. In 1912 I switched over to *literate humaniores*, a course based on Latin and Greek classics, but including the study of a good deal of modern philosophy and ancient history. I took first-class honours in this subject in 1914 and had intended to go on to study physiology. But in 1914 I joined the British army and have, therefore, no scientific degree. In 1916 my mouse work with Sprunt and my sister, Mrs. Mitchison, was published.

During World War I, I was wounded twice, in France and in Iraq, after which I spent 16 months in India. I determined to come back as soon as I could associate with Indians on a footing of equality.

On returning to Oxford after the war, I was elected a Fellow of New College and began teaching physiology while myself attending Sherrington's advanced practical course in that science. Indian readers who find it incredible that I was appointed without a degree in physiology, or any other science, would do well to remember that Srinivasa Ramanujan, India's greatest mathematician since Aryabhata, had no degree and would thus be disqualified from teaching in an Indian University were he alive today. I may not have been a good teacher, but I was a successful one. In 1922 there were about sixty candidates for honours in physiology, three from New College. These three were one-half of the six who secured first-class honours. I had 20-30 hours a week of teaching and other university duties. However, I managed to get 10 hours of private tuition done at night after 8.00 P.M. and to concentrate 9 hours on Wednesday, so I got some time for research and reading. I worked on human chemical physiology and on genetics. Perhaps my most important discovery in physiology was that when I drank ammonium chloride solution I developed various symptoms of severe acid poisoning, including breathlessness. My main genetic discovery was the rule as to the sex of hybrid animals. In 1921 I put in a term as biochemist in the Edinburgh Royal Infirmary and learned a little medicine in the wards.

In 1922 Professor Hopkins (later president of the Royal Society, Nobel laureate, etc.) invited me to Cambridge as reader in biochemistry. I was his second-in-command for 10 years and supervised the work of about twenty graduate students - much of which was first rate. Perhaps my own most important discovery was that a substance for which carbon monoxide competes

with oxygen, now called cytochrome oxidase, was found in plant seedlings, moths and rats. The most remarkable thing about this discovery was that I was able to find out a good deal about a substance in the brains of moths without cutting them up or killing them. However, my enunciation of some of the general laws of enzyme chemistry may have been more important.

In 1924 I published what my colleagues generally think my most important paper, the first of a series on the mathematical theory of natural and artificial selection. Five of these papers have been reprinted in the United States and are available to libraries which do not possess the *Proceedings of the Cambridge Philosophical Society*. They contained calculations showing great intensity of natural selection in favour of dark colour in a British moth species. This was regarded as ridiculously high, but 30 years later Kettlewell found a slightly higher figure in field studies. In 1930, in my book *The Causes of Evolution*, I published the first estimate of a human-mutation rate. Since then, this has become a matter of international politics in connection with atom-bomb tests.

Toward the end of my period at Cambridge I spent some time at the John Innes Horticultural Institution in a London suburb, directing research on plant breeding, and continued to do so after I became part-time professor of genetics in University College London, in 1933. My most important work was with Miss de Winton on an ornamental plant, *Primula sinensis*. We were the first, for example, to study linkage in a plant with double the usual number of chromosomes. I also showed that one of the genes responsible for its colour acted by changing the acidity of the petal sap.

I have always been of some use to my colleagues because I knew what was going on in several different branches of science, and it was, I think, in the autumn of 1933 that I did what posterity may regard as the best and most important action of my life. I found posts for several Jewish refugees from Germany, and I did my best to help others. One evening Dr. Boris Chain dined in my house. We talked about the work he had done in Germany, and I said, "There is a man named Florey at Oxford who is interested in that sort of thing. I advise you to visit him." Later Florey and Chain isolated penicillin, which has saved hundreds of times more lives than atomic bombs have caused deaths, a fact often forgotten by critics of science. Florey and Chain have been rewarded for this work. They shared a Nobel prize, and Florey is now president of the Royal Society. Perhaps all my discoveries will be forgotten and I shall be remembered only in the words of the ancient

Greek poet Pindar: "He once nourished the contriver of painlessness, the gentle limb-guardian Asklepios (Dhanvantari), the heroic conqueror of manifold diseases." Bacteriologists, by the way, are heroic: bacteria are much more dangerous than tigers. For such activities I had the honour of figuring on the list of persons to be arrested if German armies conquered England in 1940.

In 1936 I became professor of biometry in London but never got a building for my own use. Some of my colleagues in this department did very fine work, and two became Fellows of the Royal Society, as I had in 1932. I participated in a little of their work and made some contributions to mathematical statistics, of which perhaps the most labour-saving is my calculation of the cumulants of the binomial distribution.

In 1939 the British submarine "Thetis" sank on her trials with the loss of over one hundred lives. About one-half the dead were civilians; two unions asked me to investigate the disaster. I did some experiments on myself and friends, no more drastic than I had done at Cambridge, and shed enough light on what had happened to convince the British Admiralty that their "experts" knew very little. They asked me to continue the experiments, and when war broke out I was given various assignments. E.M. Case and I, for example, were the first people to pass 48 hours shut up in a miniature submarine with apparatus which we had correctly calculated would renew the air for that time. My wife and I worked out methods for the rapid ascent of divers, and so on. During this work I made a curious discovery. Oxygen, when breathed at a pressure over about 6 atm., has quite a taste. Nevertheless, since textbooks have priority over truth, students of chemistry are well advised, when examined, to state that "oxygen is a colourless, inodorous, and tasteless gas." I advise even M.Sc students against stating that Case and Haldane reported to the contrary in a letter to *Nature* in 1941. After breathing oxygen for five minutes or so at such pressures, one has violent convulsions; and my frequent demand for a soft chair or a cushion is due to the fact that I fractured my backbone in such convulsions.

Among the papers I wrote during the 12 years between the end of the war and my departure to India is one published in 1956 on a method for estimating the number of lethal mutations produced in mice by gamma rays and other agents causing mutation. A clear answer to this question would allow us to give a partial answer to the question, "How many human babies in future generations will die as the result of atomic-bomb tests?" I was not,

of course, offered facilities for such work. G.S. Carter at Harwell began to use my method. He then resigned his post, for an undisclosed reason, and took a job with a poultry-breeding firm. However, Sugahara, Okazawa, Tutikawa, and Muramatsu have used heavy doses, like those absorbed by the survivors of Hiroshima and Nagasaki. The Japanese workers have used much smaller doses, such as might be given to workers in atomic-energy establishments or to radiologists who took precautions. They naturally got rather few mutations and cannot yet estimate the rate very accurately. According to my method, about 500 rs are needed to produce a lethal mutation, while two other methods give a somewhat lower figure of about 300, which was what I guessed in 1956. If the Japanese workers are right, the damage done to future generations by the tests so far carried out is a bit less than Pauling and Russell have stated but very much more than American official spokesmen have claimed.

In 1957 I came to India to work at the Indian Statistical Institute, and I have to thank Professor P.C. Mahalanobis for making this possible. My most important work there was, beyond doubt, starting S.K. Roy, K.R. Dronamraju, T.A. Davis, and S.D. Jayakar on their scientific careers, which are likely, in my opinion, to be illustrious. At least twenty of my pupils have become Fellows of the Royal Society, so I can probably judge fairly well. At the Indian Statistical Institute I personally published two pieces of theoretical work which may be of lasting value, besides many which are unlikely to be so. Since leaving it, and while employed by the Council of Scientific and Industrial Research, I have published jointly with Jayakar one paper on human relationships. I am grateful to Mahalanobis for giving me the opportunity of working in the Indian Statistical Institute, where I learned a great deal about what can and cannot be done in India, even though it gradually became clear that I could not carry out the kind of work I had wanted to in that institute.

I have of course done a good deal more than appears in this summary. I have taken part in politics, written a book of stories for children, and put my Latin and Greek learning to some use by commenting on biological passages in ancient writings. I may have been the first to ask the cosmological question, "Is space-time simply connected?" – though only a man of the stature of Einstein is likely to answer it. And I have made several bad mistakes. But I think this article gives some notion of my contributions to scientific knowledge.

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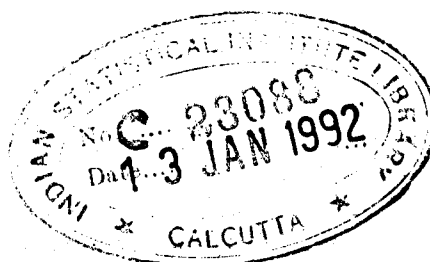
*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

MY PHILOSOPHY OF LIFE

J.B.S. Haldane



*A talk broadcast in November, 1929. The other speakers in the same series were G. Lowes Dickinson, Dean Inge, Bernard Shaw, H.G. Wells, and Sir Oliver Lodge.*

I differ in several respects from the other speakers in this discussion. To begin with, I am twenty-seven years younger than the youngest of them. So that I am the only representative of the generation whose finest members died in the Great War. And my intellectual background is very different. As a child I was not brought up in the tenets of any religion, but in a household where science and philosophy took the place of faith. As a boy I had very free access to contemporary thought, so that I do not to-day find Einstein unintelligible, or Freud shocking. As a youth I fought through the war and learned to appreciate sides of human character with which the ordinary intellectual is not brought into contact. As a man I am a biologist, and see the world from an angle which gives me an unaccustomed perspective, but not, I think, a wholly misleading one.

In describing the world as I see it in so short a time, I cannot avoid being dogmatic. I do not doubt that some of the statements which I am going to make are false. A survey of the beliefs which intelligent men in the past have held as certainties makes that sufficiently clear. One cannot order one's life without a set of beliefs of some kind. But the intellectually honest man must recognize the utterly provisional nature of his beliefs. So when I make an apparently definite statement, I must ask you to put before it some such words as 'It seems to me very probable that ...' I will now try to state my point of view.

Man lives in two worlds, the visible world which changes with time, and an invisible world whose constituents do not change. But both worlds can only be described as they appear to us, that is, from a human and imperfect standpoint. Among the components of the invisible world are the realities corresponding to mathematical statements like  $16+9 = 25$ . This is a statement of a fact as real as the Albert Memorial, which any sane person must recognise when it is pointed out to him. But unlike the Albert Memorial, it was a reality 10,000 years ago, and will be 10,000 years hence. There are also invisible realities corresponding to scientific laws, and I think also to some of our general notions of what is beautiful and good. These latter realities are harder to apprehend because we approach them through a mist of emotion. We know very little about what may be called the geography of the invisible



world. The religions, if I may continue the metaphor, have covered the vacant spaces of its map with imaginary monsters, the philosophies have ruled them with equally imaginary parallels of latitude. Both have affirmed, in opposition to the so-called practical man, that the meaning of the visible world is to be found in the invisible. That has been the secret of their success. They have failed when they tried either to describe the details of the visible world or to dictate the details of conduct in it. The churches are half empty to-day because their creeds are full of obsolete science, and their ethical codes are suited to a social organization far simpler than that of to-day. But they still command the allegiance of a number of intelligent people because, amid a world of transitory interests, they support in some measure the claims of the ideal. I am not a member of any religious body, because I find those claims upheld elsewhere. If I thought that the aims of science and art were merely material I should belong to some church. But I believe that the scientist is trying to express absolute truth and the artist absolute beauty, so that I find in science and art, and in an attempt to lead a good life, all the religion that I want.

I have not very much use for people who are not in touch with the invisible world. At best they are good animals, and too often not even that. The men and women who have done best, both for themselves and their fellows, are those who have brought these two worlds into relation. For example, you can hear me to-night because James Clerk Maxwell fifty-six years ago embodied an extremely important set of properties of electromagnetic waves in a set of equations. Those equations represent an eternal truth – something in the invisible world. Their discovery rendered wireless communication possible. If you do not make any contact with this timeless world ( in other words, have no inner life) you have at best a very precarious hold on happiness. Given that contact, you enjoy a very considerable security from the results of misfortune in the visible world, and a complete immunity from boredom. Dean Inge, H.G. Wells, and I agree to a considerable extent about the nature of this invisible world, because we are all, in some degree, disciples of Plato.

One does not come naturally to the realization of eternal truths and values. One is brought there by education in the widest sense. It is one of my principal functions to teach certain scientific truths to students at Cambridge University. Many of them are both able and eager to learn. But others are neither able nor eager. Under our present economic system they are enabled to come to Cambridge because their parents are wealthy. By so

doing they keep out others who are better qualified intellectually to learn, and more willing to do so. As a teacher I cannot support a social system which is responsible for this injustice. We have got rid of physical starvation. We still have intellectual, aesthetic, and spiritual starvation, which to my mind are greater evils than any mere economic inequality. Until our educational system is so altered as to give a fair deal to every boy and girl who desires a first-rate education and is capable of benefiting by it, my political views are likely to remain, as they are now, on the left.

There is a worse evil than intellectual starvation, and that is the deliberate suppression of free thought and free speech. I rejoice to live in a country where this evil, though it exists, is less serious than in most other countries. But I believe that even in England freedom of publication is unduly restricted in the names of decency, morality, and so on. There is much more liberty in this respect across the Channel, and no one who has worked beside the French in peace and fought beside them in war can accuse them of degeneracy. So many new ideas are at first strange and horrible though ultimately valuable that a very heavy responsibility rests upon those who would prevent their dissemination.

Moreover, the censorship to which I refer is applied in a very partial way. A book glorifying war may be quite as anti-social, and to my mind quite as obscene, as one glorifying illicit love, but it is never suppressed, and seldom publicly denounced. I now turn from the world of ideas to the visible world. I am a biologist, that is to say, I study the nature of living creatures, and I naturally look at things from a biological point of view. I feel at home in the world because I know that the other animals, and the plants too, are my blood relations. Even the inert matter has mostly been alive in the past. When I look at a limestone mountain I realize that, grim and lifeless as it appears, it was made by countless billions of my microscopic fellow-creatures. What is more surprising, I think that I can even have some very dim inkling of what it feels like to be limestone. We know material objects in general from the outside. We know our own bodies from the inside. Just as everyone knows what it feels like to be hot, so I know from my own personal experience what it feels like to consist of an abnormally large or small amount of calcium carbonate, of which the limestone mountain is built. In this concrete and detailed way I feel my relationship to the world around me.

I am a part of nature, and, like other natural objects, from a lightning flash to a mountain range, I shall last out my time and then finish. This

prospect does not worry me, because some of my work will not die when I do so.

As a biologist I am interested in my body. Most people are only interested in anything below their skins when they are ill. I like to study the performance of mine as my friends do that of their motor-cycles or receiving sets. It amuses me to know what my heart does when I run upstairs, or how quickly my finger-nails grow. To a biologist even a toothache can be interesting. Naturally I regard health as extremely important, far more so than wealth, and I shall regard my life as well spent if I can do a little, by research and education, to make my fellow-creatures healthier. There is still an immense amount to be learnt about health, but if what is at present known to a few were part of the general knowledge, the average expectation of life in this country could probably be increased by about ten years. Two difficulties lie in the way: ignorance and the dissemination of falsehood. To take a simple example of the latter. Enormous sums are spent in disseminating lies about health in order to advertise medicines and 'health foods' which are generally useless and often dangerous. A widely advertised vitamin preparation contains, besides vitamins, a substance definitely poisonous to children. Under the law of the land I might have to pay thousands of pounds in damages if I mentioned the preparation in question, even if my statement could be proved to be true. On the other hand, I am at liberty to say publicly that diphtheria antitoxin is useless, which is a plain lie.

Now for an example of the prevailing ignorance. When a father advises his son on a choice of occupation, he is generally guided mainly by economic, and partly by ethical considerations. He wants his son to avoid bad wages and bad company. He does not think about bad health, though he may be impressed by the risk of violent death. Yet the health of different occupations differs to an extraordinary extent, and the average man knows very little about the risks of even his own job, let alone his neighbour's. Otherwise no sane man would take up such an occupation as that of metal grinder or barman, with a mortality double that of the average man, when he might become a carpenter or a railwayman, and thus enjoy an expectation of life above the average. Our rulers are equally ignorant of these matters. Protective duties and subsidies are granted quite impartially to healthy occupations like agriculture, and unhealthy ones such as the cutlery trade. When this policy is opposed it is opposed on economic grounds, and never because, by encouraging an unhealthy trade, you are condemning some of your fellow-

countrymen to death. All parties agree in putting economic considerations before biological; wealth before health. I could give you plenty more examples of this ignorance if time permitted.

Even a healthy man or woman is incomplete. For a large number of men the main interest in life, the main object of their desires, the main source of their satisfaction, is Woman. For me the fascination of woman is only second to that of science. In most cases man's interest in woman culminates in marriage. Provided it does not then cease, the marriage is generally a success. Successful marriage requires a certain effort by both husband and wife. But, speaking as a happily married man, I can assure you that no other effort is so amply rewarded. Marriage has a biological basis, and would be far more often a success if its biology were generally understood and the knowledge acted on. But you can only study the physiology of marriage against a background of general human physiology. If you do so the facts fit into their proper places. If not, you get a distorted and unhealthy view of them.

The psychological, even the intellectual, benefits of marriage, seem to me to be enormous. If a man has lived for some years in the closest intimacy with a woman, he learns to look at life from her point of view as well as his own. A man who cannot do this is like a man blind in one eye. He does not appreciate the solidity and depth of the world before him. The ideas I am putting before you here are largely my wife's, or at any rate, family ideas, rather than my own private productions. The unmarried woman is perhaps even worse off than the unmarried man; and few women seem to me to be psychologically complete till they have become mothers. During the Middle Ages Europe was far too much influenced by celibate men. To-day much too big a part in public life is played by the celibate woman, and too little by mothers. I find few ideas more genuinely disgusting than that held by many education authorities that a woman ceases to be suitable as a teacher when she becomes a mother. Because I have so high an opinion of marriage at its best, I think that it should be possible to end it if it fails for any of a number of reasons, instead of, as now, for one only. This is called 'undermining the sanctity of marriage.' Marriage generally brings children. Everyone will see that it would be an evil if the birth-rate of this country were halved, in which case the population would rapidly fall; or doubled, in which case it would cease too quickly. But they will disagree whether too many or too few children are born at present. I do not know myself, though I am clear that

too many children are born in the slums, too few in the well-to-do suburbs. If we shall not arrive at a sensible solution of the population problem till we realize that it is a question of numbers, like the design of a motor-car or the framing of a budget, and cannot be settled by an appeal to abstract principles alone.

Our present educational system is unjust to children because the majority of them do not get a fair chance and practically none are taught the truths of science from a human point of view. Science teaching should begin, not with a mythical body in rest or uniform motion, but with the human body. Mine did so begin at the age of three.

Between different men and women there are immense inborn differences which no amount of education can overcome. I do not believe that any training could have made Ramsay MacDonald into Jack Hobbs, or *vice versa*. The ideal society would enable every man and woman to make the best of their inborn possibilities. Hence it must have two characteristics. First, liberty, which would allow people to develop along their individual lines, and not attempt to force all into one mould, however admirable. Second, equality of opportunity which would mean that, as far as is humanly possible, every man and woman would be able to obtain the position in society for which they were best suited by nature. The waste of human beings under our present system is a far worse evil than any merely economic waste. I believe in democracy because equality of opportunity is impossible where inherited rank or wealth is important, but for no other reason. I do not know what would be the ideal form of government of a community where that equality had been achieved. Democracy appeals to me, not as an end in itself, but as the most hopeful route, at least for England, to a classless society. In a classless society far-reaching eugenic measures could be enforced by the State with little injustice. To-day this would not be possible. We do not know, in most cases, how far social failure and success are due to heredity, and how far to environment. And environment is the easier of the two to improve. I am a citizen of the British Empire, which includes the great Dominions. My highbrow friends complain that the Dominions have produced little great art or literature. I answer that at least they have done something unique. Before the war the average expectation of life of a baby born in New Zealand was sixty years, in Australia fifty-seven years, in Denmark, the next healthiest country, fifty-six years. England also ran. Since then other countries have caught up to a large extent, but New Zealand and Australia still seem to be

COMPARATIVE MORTALITY OF SOME OCCUPATIONS  
(ENGLAND AND WALES, 1921-1923)

STANDARD MORTALITY FOR CIVILIAN MALES  
BETWEEN AGES 20 AND 65 : (AVERAGE 100)

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Anglican Clergymen	56
Insurance Officials	60
Farmers	67
Agricultural Workers	68
Civil Servants (all grades)	80
Railwaymen	83
Electrical Workers	85
Motor Vehicle Drivers	86
Carpenters and Woodworkers	88
Printers	95
Metal Workers	96
Salesmen and Shop Assistants	97
Builders	99
Clerks (not Government)	99
Coal Miners	101
Doctors	102
Textile Workers	105
Makers of Clothing (including Boots)	108
Workers in Amusement Trades	121
Brewers and other Makers of Drinks	126
Glass Workers	128
Horse Drivers	138
Potters	148
Dockers	150
Innkeepers	162
Seamen	177
Bookmakers	193
Barmen	195
Tin and Copper Miners	325
Cutlery Grinders	330

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leading. I am proud to belong to a Commonwealth which has won the first and second places in the great race against death.

I am also a European, and proud of it. Europe is sick to-day, but it is at least making some attempt to cure that sickness by a federal union of its States. And it still leads the world in science, literature, art and music. In methods of production the United States are ahead of us, and many Europeans think that we should copy them. Dean Inge believes that the working class in the United States is better off than our own. His opinion is shared in unexpected quarters. When my wife and I were in Moscow last year at a great scientific congress we only saw two propaganda films. One was against alcohol; the other showed the manufacture of Ford cars as an argument for American industrial methods. I take a different view for the following reasons. Though they are still reducing their infantile mortality, since 1921 the death-rate of Americans at every age from thirty upwards has been increasing steadily. Whether as the result of hustle, prohibition, or the spread of medical cults, such as 'Christian Science' and osteopathy, which reject the results of science, America is at present heading for death, and not life. Europe has much to learn from America, a little even from Asia, but I do not think that we should imitate either of the continents.

Some of you probably think I have laid too much emphasis on death-rates; I have talked about them for two reasons. Firstly, they are the only means we have of comparing the health of two trades or two nations and I think that there is a very close connection between health and happiness. Secondly, otherwise well informed people are ignorant of the facts concerning them.

I am an Englishman, and, what is more remarkable though of Scottish origin, I believe in England. At the present moment our country counts for less in international politics than during the last century. Nevertheless some of our ideas and practices are at present conquering the world. In Moscow, which has rejected the great British invention of Parliament, there was a word which I constantly noticed on posters. It was not 'soviet', nor 'red', nor yet 'revolution', but 'phutbol'. The same is happening all over the world. Spanish bull-fighters are becoming centre-forwards. German students are taking to football instead of slashing one another's faces. And with British sport goes the ethical code called Sportsmanship, which future historians may perhaps consider a British invention as important as Parliament and Railways. I hope to see British sport conquer most of the world. But I

am no narrow patriot, and would welcome a French invasion of the British kitchen.

England is only likely to regain her former pre-eminence if we can be ten years ahead of the rest of the world in industry, as we were a century ago. We would, of course, reorganize our industries, but other countries have already done so. We shall not regain our place by doing that. We have probably no great undeveloped mineral resources. But we have undeveloped human resources, especially among the children of the skilled artisan class. Our best hope for the future lies in giving them a chance to become Watts and Stephensons.

Finally, I am a human being, a citizen of the world which applied science is daily unifying. My own profession of scientific research knows no frontiers and no colour bars. Japanese, Indians, and Chinese, as well as Europeans and Americans, are, or have been, among my colleagues. I am naturally in favour of any measures tending to unify humanity and prevent war. But my views as to the best methods of achieving these aims are not informed by sufficient knowledge to be worth stating. For the same reason I am saying nothing about economics.

I am glad that I live to-day and not at any time in the past. In the 4000 years before about A.D. 1800 civilization had spread over a gradually widening area, but its quality had not greatly improved. A century ago in England children were hanged for theft, and a married woman could own no property. Neither of these evils existed in Ur of the Chaldees 4200 years earlier. In the nineteenth century we doubled our average expectation of life, quadrupled our average real wage, and vastly improved our education and morals. This was made possible, in the main, by the application of science. To-day the whole form of civilization is changing. We are trying unheard-of experiments. The great experiment of Socialism is being tried in Russia and will doubtless be tried elsewhere. We meet with huge and unexpected accidents like the Great War. We shall go on having such accidents so long as our rulers are not merely ignorant of science, but think on pre-scientific lines. (You will remember how the Kaiser talked of the war in terms of 'shining armour', and Mr. Asquith of 'unsheathed swords.') We have got to learn to think scientifically, not only about inanimate things but about ourselves and one another. It is possible to do this. A single mind can acquire a fair knowledge of the whole field of science, and find plenty of time to spare for ordinary human affairs. Not many people take the trouble to do so. But



without a knowledge of science one cannot understand current events. That is why modern literature and art are mostly so unreal.

We live in a dangerous age, but an extraordinarily interesting one. History is being made on a vaster and quicker scale than ever before. For humanity as a whole, I am hopeful. For England I am only moderately hopeful, though I believe that if we are willing to adapt ourselves to the new conditions of life, we may yet be as great a nation as ever. But even if I am blown to pieces in the destruction of London during the next war, or starved to death during the next British revolution, I hope that I shall find time to think as I die, 'I am glad that I lived when and where I did. It was a good show.'



J.B.S. Haldane delivering a lecture at the Indian Statistical Institute  
(September 1954)

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

**1992**

**“LET US DEVELOP A  
STATISTICAL CONSCIENCE”**

**J.B.S. Haldane**

*Speech delivered on the 26th Anniversary Day of the Indian Statistical Institute, 19 December 1957*

Professor J.B.S. Haldane, who spoke after the presentation of the foreign guests, said :

I hate to strike a discordant note but I think it should be pointed out that properly speaking the history of this Institute goes back not only to 1931 but for more than 2,000 years. Asoka appointed an official called the *Dharmamahamatra* (excuse my Sanskrit). This, as I understand it, means the great measurer of duty or performance, who had to report to him every five years, and on whose reports the policy of the Government was to some extent based. Now I have not yet read the original documents but I hope to do so when I know a little Sanskrit, so I cannot say more. But I hope that if there is any opposition to the Bill which Professor Mahalanobis mentioned from traditionalist elements, in the Lok Sabha or the Rajya Sabha, they will realise that the idea of using accurate counting and measuring to frame State policy is not a new-fangled Western importation into India. It is much more probable, so far as I can judge that it originated in India, and it certainly goes back for a long way in India's past.

### Statistics and "Dharma"

The Second point is perhaps more important. We do not always realise that measurement and counting, which are the essentials, in my opinion, of statistics have a bearing on our duty, or whatever word you may choose to translate the very wide word *Dharma*. This a harder idea to grasp, but I believe that it is so important that some statistics should be a part of even the most elementary education. Why is it important? Let me take an example which is unfortunately topical. As you know, this year the rice crop has been a complete or partial failure in several areas of this country including some parts of West Bengal. Now, if official statistics are sufficiently badly wrong in one direction, some people may die of hunger next year. If they are too far wrong in the other direction, money will be spent on importing food which might have been spent on buying from abroad machinery, books, drugs, and other essentials. So far no doubt the responsibility rests on the Government and its advisers. But not all the responsibility rests with the Government.

We can all cut down the food which we eat a little, and particularly

perhaps, as the Government has suggested, our consumption of rice. Perhaps even more important, we can stop wasting food. Every scrap of food left on a plate or thrown away because more food was cooked than is needed, may help to kill a man, woman, or child in the course of next year. We in England learned this during the last war. There was very heavy propaganda against wasting food and the vast majority of us took it seriously. We thought it wrong to serve more food than was needed. I know that in India a host or hostess is ashamed if they do not serve on the table enough food to satisfy their guests. They like to leave some over. I should like to see them twice as ashamed if some food is left over at the end in such a way that it is going to be wasted. At the present time, I would go farther and say that the man or woman who wastes food is doing more harm to the country than the man or woman who steals it. But stealing is punished, and waste is not.

### Difficulties in saving food

I think that three difficulties stand in the way of a national movement to save food. One is a historical factor. Suppose that fifty years ago everyone in Bengal had been as economical as possible with food, the Government might have concluded that it was safe to turn over even more land from growing paddy to growing jute, thus increasing the export of jute to British factories. Similarly in England if we save food or grow more food today, some of us fear that the Government may conclude that the country can spare more land for American aerodromes or rocket-launching sites. But such an objection can certainly not be made in India today. We must admit that there is some corruption in Indian public life. But a good deal of it springs from the same source. It was naturally thought a patriotic duty to swindle Governments representing foreign conquerors, whether they were Turkish or British. And it is not quite so easy to break such habits. But I am quite sure that they must be broken. And I venture the hope that this Institute might be perhaps able to form some estimate of the national loss from small amounts of money and commodities sticking to the hands of officials.

The second difficulty is conservatism as regards food habits. But it is mainly the third difficulty which concerns us here. If I drive too quick along the Barrackpore road, I may kill a child. Even if I am not sent to jail for doing so, I know that the memory of that dead child will haunt me all my life. For that reason I hope I will not be as dangerous a driver as I might otherwise

have been. But if I waste food I may also kill a child or play some part in killing one. But I cannot say just where or when I may have a hundredth or a tenth of share in the death of a child. I shan't see this child die and I shan't feel the responsibility. Now if we could get this statistical conscience, if I may coin a phrase, into the hearts of even a few thousands of the people of India we could avoid a lot of the evil which we do. I believe that it will be an important task of the Indian Statistical Institute to encourage the growth of statistical conscience among the people of India. And that task will be more easily carried out perhaps, now that it is recognised that the tasks of the Institute are considerably wider than the mere collection and tabulation of statistical data.

Such an appeal, such a development of statistical conscience, can, I suggest, be done in two ways. One would be an appeal to the conscience of all who can afford to waste food. I would like to suggest, for example, a poster showing on one side a woman throwing away uneaten rice and on the other hand a child dying of hunger. Of course, it is not the job of this Institute to design such posters. But I may be able to do something to make a few people, I will not say more conscientious, but more statistically minded, more prepared to think statistically about a large number of problems. And if I can do that, then my time here will not be wasted.

### **Importance of counting and measuring**

I do not know quite why Professor Mahalanobis gave me and my wife jobs here. But perhaps it was because we had counted and measured, generally in a rather crude manner, certain things which had not been counted or measured before, always in connection with living beings. It will be our job to try to spread this habit of counting and measuring living beings. Unfortunately, I am desperately ignorant of what has been done in India. Here is a question which I would like to ask you. I don't say, shout out the answer but let me know the answer if any of you know it. Do any of you know of any good figures on the yield of coconuts in different years from a number of individual coconut trees growing in the same area? Can one, that is to say, predict the yield of a tree next year from its yield this year? And how big are the differences, or if you like what is the variance in the yield of coconut palms? Now that is a very important question for States like West Bengal where the coconut is an important crop. And I am ashamed to say I

don't know if the figures exist. Before any reasoned programme to improve the breed of these trees is undertaken, we shall need figures of that kind on a pretty large scale. So I am merely, as I have said, revealing my ignorance for which I apologise.

A lot of the work which my wife and I hope to start here will have no very immediate practical value. Let me give two examples. We are particularly interested in genetics. And the local cows, not only those which you see in the streets, but those you see living under considerably better conditions at the branch of the Institute in 206 B.T. Road, have various colours. There is a good deal more variation in colour than will be in any breed in Europe, though less than I have seen 30 or 25 years ago in a herd in a village in the Soviet Union. Since then I know that they have very greatly improved their cattle breeds. Now, take these cows. A few of them have a pattern of small spots. How is that pattern inherited? There are two probable alternatives. Perhaps a spotted bull and a spotted cow mated together will have nothing but spotted children even if the grand-parents were not spotted. On the other hand, most of the calves of spotted cattle by unspotted ones will not inherit spots. In that case we would say that the spotted was recessive. On the other hand, it may be that one never gets spotted calves unless at least one parent was spotted. In that case, we would suggest that spotting could be dominant. And I would bet 2 to 1 on the later hypothesis but certainly not 20 to 1. It won't be quite so simple to determine the inheritance of the very common white or near-white colour. But I hope we shall know that in a couple of years. Now you may ask what earthly use could that be. I do not know.

### Some statistical questions

But I am going to suggest another statistical question. And you will see in it the kind of way in which my mind is running. If a man wears black or dark brown clothes when the sun is shining brightly, he gets appreciably hotter than if he wears white or pale yellow clothes. Now, I think, we ought to find an answer to this question. Does a white bullock pulling a cart in sunshine get appreciably less hot than a dark coloured bullock by his side pulling the same cart? Perhaps that experiment has already been done at Izzatnagar or somewhere else. If not, it ought to be done. But if it is a matter for statistical investigation, I don't think the difference would be very great.

But if there were a favourable difference we would say that the gene for white was advantageous, at least where bullocks are used for pulling carts or ploughs. That is the kind of way my curiosity works, and the kind of really rather simple statistical questions which I am going to try to persuade someone to answer. They may be more important for India than some more high-brow, if I may say so, investigations, which are also no doubt valuable.

### Research on silk moths

Similarly my wife is trying to breed *tasar* silk moths. Of course, she is concerned with the colour, weight and quality of the silk. But she is also interested in the colour of the moths, which is, as far as we know, of no economic importance, and in how long the moths live after coming out of the cocoons. We have got the beginnings of a life table. As these animals neither eat nor drink after coming out of the cocoons, they don't live very long. In fact, the males live for about 6 to 7 days and the females from about 8 to about 11 days in different races. Now, as far as we know, this is of no importance. But I want to suggest to you why it might be worth knowing. These moths, as I said, can neither eat nor drink after they come out of the cocoons, and perhaps those which made most silk are healthier than the others and live longer. Or perhaps just because they made so much silk they have less reserves of food in their own body and don't live for so long. So we might find a correlation, either negative or positive, between the length of time the moth lives and its performance as a maker of silk. That can, and I hope will, be determined statistically within the next few months. You see that if my wife did not count and measure all she can, she might miss something quite important. And that is the moral which I hope we may be able to persuade people. As soon as you look at my animals or plants, think what you might count or measure about them.

I would like everyone working in this Institute to get the habit of classifying and counting. Considered as a game it is quite good fun. Galton, who was one of the founders of statistics, used to play this game. In his remarkable book, "Enquiries into Human Faculty", which every statistician should read, he tells us how he used to take a little slip of paper with three divisions on it and prick holes in it with a pin. And he did this because he did not want to take notes, and he did not want to take notes because sometimes they might have been rather embarrassing. For example, as he walked



down the street he would prick holes in three different parts of the paper according as the last woman he had seen was classified by him as attractive, neutral or repulsive. And I may add, it was no reason why a woman should not do the same; if she is doing something with the pin it may attract even less attention than if a man is doing it. But I would say that in fact such a record tells you a good deal more about yourself than about others. But it may nevertheless be worth doing.

Now I am going to try an experiment of that kind. I am sorry to have to introduce the experimental method into a meeting of this sort. One of the characters in poultry which is easily transferred from one breed to another is the capacity of laying eggs with blue shells. Now I am thinking of starting an experiment next year to see if we can easily transfer this character to some Indian poultry. But before I do so I want to know whether such eggs would be eaten. And I, therefore, ask you. If you would be willing to eat blue-shelled eggs, will you please hold up your hands? (Oh! that's a very poor response! Would you not even be willing to do so in the honour of Krishna?) Now let us have those who would be unwilling to eat a blue-shelled egg. (Well, there are certainly more pros than cons but is rather too like the United Nations - there are too many abstentions!) Nevertheless there are a hopeful groups of affirmatives.

Please don't think that such statistical work on animals and plants as I spoke of, is only important in connection with heredity. Mr.S.K. Roy of this Institute has just got out the first measurements of the amount of work done by earthworms in India, and it is the first record of this kind made anywhere in the whole continent of Asia. The Japanese have usually, I think, repeated most of the types of observations which have been made before in Europe, but so far as I know that particular kind of record has not been made in Japan.

Now Professor Mahalanobis in his speech said that in including Palaeontology here he has taken a rather liberal view of statistics. I can say that I have published three papers on Statistical Palaeontology. And perhaps you may be willing to excuse a venture into Palaeontology when I tell you something about it.

### Palaeontology and statistics

First of all, it can be used to get at least a rough measure of the rate of

evolution. If we have a reasonably continuous record as we have for horses and for some kinds of molluscs we can ask how much a measurable character, such as a length, changes with time; and I regret to say that evolution is not a very rapid process because a representative rate of change was something like 3 or 4 per cent per million years. If we start improving the coconuts here, we hope to do it a little quicker than that.

That is one point, a point perhaps of merely academic interest. But there is a point of considerably greater importance. If we study the British coal measures, a seam is often associated with a bed of clay containing fossil molluscs, something like mussels. I don't know what the Indian name is. Now in two neighbouring coal-seams you could not say that they belonged to different species. You could not say they were as different, let us say, as horses and donkeys, but you could say that there was a statistical difference. And if you counted twenty or thirty you could be reasonably sure from which population they were taken. Dr. Robinson thinks that perhaps it ought to be as many as a hundred. All right, if you take an adequate sample, that means that you may be able to identify a coal-seam in a different part of the field. And that may be of very considerable importance.

That is why it seems to me that starting palaeontological work here needs no justification whatever, even though in the first few years it may not be possible to obtain data on a sufficient scale to do any statistics. (I am sorry I am frightening these young ladies away. I will stop in a moment or two.) I want to say that that is not all. If I were imprisoned for life in this compound, I should find enough to keep me busy, although I should be an abominable nuisance to our librarian and still a greater nuisance to the *malis*. I would start systematically counting and measuring leaves and flowers on the various plants in this garden as is already being done in this Institute. I would also try to estimate the abundance in various years of the caterpillars and other noxious insects which damage some of the plants, to see whether there is a periodicity in this and whether we can explain it. And during the nesting season, I should watch one single nest throughout the hours of daylight, recording the times during which the mother was present and absent from the nest from the time of the laying of the first egg to the departure of the last nestling. This has been done elsewhere and has given results of extraordinary interest.

But now I want to come back to my first point. If you are employed by the Indian Statistical Institute, you may regard it merely as a source of

income. If you are not employed, you may regard it merely as a place where you get a free *tamasha* of some kind. But I personally regard it as one of the glories of India and even one of the glories of our planet. Whether it can be regarded as a glory of our solar system I do not know because I do not know enough about the cultural conditions of *Mangal* or *Brihaspati* – but I think it is quite probable that it can be so regarded. It is certainly an institution which is benefitting not only Indians but the whole of mankind. It is because I believe that, that I have come here. Some of you, I know, feel the same way as I do about this Institute. And if so, I wanted to suggest that it is your duty to begin thinking statistically about a few more things. Because by thinking statistically about anything you can help your country and the world. If you get the habit, for example, of thinking statistically about how long your razor blades or your *sarees* last, you may help to spread the habit and thus among other things help to save the lives of some of your countrymen.

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

**1992**

**THE PLACE OF NATURAL SCIENCES  
IN A STATISTICAL COURSE**

**J.B.S. Haldane**

Extracts from the lecture delivered on the occasion  
of the inauguration of new degree courses, 16 August, 1960

The Institute is today starting a course in statistics leading up to a degree. There is nothing unique in that. What is unique is that, besides statistics and mathematics, we are going to teach the natural sciences, and some of the social sciences to statisticians. I am in charge of the teaching of biological sciences, and hope to teach some chemistry. So I am vitally concerned.

Now, why should a statistician learn anything about science? There are two reasons. First, some knowledge of natural science is just as much a part of general education as the knowledge of history in the narrow sense. An Indian who has never heard of Asoka or Akbar is uneducated. But the history of India goes back far beyond Mohenjodaro. The Deccan trap is the record of one of the most terrible series of disasters which we can imagine, in which a huge area was repeatedly buried under red-hot molten lava, and every living creature on it destroyed. The great plain of the Ganges valley and the Punjab was formed comparatively recently. An arm of the sea south of the rising Himalayas was filled up with silt from them. Probably the area around Lucknow was once very like that around Calcutta before men had made canals and bunds, and a little earlier was like the Sunderbans today. To realise this, however dimly, is an important part of a liberal education. We cannot adjust ourselves to the great changes taking place around us unless we know a good deal, not merely of what science has achieved, but what it is likely to achieve. This is equally true if we are traditionalists who regard change with abhorrence. We cannot resist it unless we understand its causes.

But a statistician has other reasons to study science, and our course will be designed primarily to meet the needs of statisticians. What are these needs? Some of our students will find posts under the central and state governments, some in the private sector. A few will take posts in the Institute, and others will go to universities. It is my earnest hope that not all of them will teach statistics, but that some will become physicists, geologists, biologists, and so on. We must, however, think primarily of the needs of those who are going to work in government offices or for firms, since they are the majority. Both of these groups may have to deal with numerical data arrived at by scientific methods.

Now, Professor Mahalanobis' desire is that our scientific course should be integrated. My emphasis is on its being quantitative. We are not quarrelling.

The shape of a tree is, at present, a matter of what may be called pure botany. The moment we ask about its size, why, for example, it can grow to 20 metres, but not to 50, we are involved in fairly elementary physics, which are not very different from the physics involved in the design of tall buildings. The moment biology or geology becomes quantitative it necessarily becomes integrated with physics, chemistry, statistics, or all three. One can read a textbook of zoology without learning why no birds are as heavy as a cow or as light as a bee. I hope nobody will go through our course without doing so. I hope that we shall instill into our pupils a feeling for the meaning of numbers applied to anything whatever. I want our students to say 'nonsense' if they are told that the area of forests in Madhya Pradesh is 8 lakhs<sup>1</sup> of square kilometers, that a lakh of people died of cholera in India in 1959, that the density of lead is 45 times that of water, that the temperature in a blast furnace is 400° Centigrade, that a certain sample of pig iron contained 6% silicon, and so on. This does not mean that they have to memorize the correct figures, but they have to get a feeling for numbers. If such a feeling were widespread in Delhi, I doubt if, to take one example almost at random, the total area under *sal* in Part 'C' states in 1954-55 would have been given as 22,504 square miles when the total of the columns concerned was in fact 2,504. This is no doubt a misprint. But I find it a little hard to believe that between 1953 and 1954 the area of the Punjab under *sal* forests fell by 15%. However, both these statements are found in 'Indian Forest Statistics', issued by the Ministry of Agriculture. Such publications certainly make the task of a biologist who takes planning seriously rather difficult.

A feeling for numbers can only be acquired by practice. What should the practice be? As an example I want our students to make a census of all the trees in the compounds of numbers 203 and 204 B.T.Road. They will come up against real difficulties. Is this a tree or a bush? Is this one banana plant or a dozen? This is no harder than deciding what is a factory or a household. I estimate that there are rather under 100 betel-nut palms in the compound of No. 203. I may be wrong, I haven't counted them. But I want our boys and girls to get the feel of what a hundred trees look like, and constantly to be asked 'How many?', 'How much?', 'How often?', 'How powerful?' and so on.

A statistician in a government office may have to deal with figures on a

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<sup>1</sup>One lakh = 100,000

vast variety of topics. Whenever he gets a set of figures he ought to know at least roughly what they are about. My colleagues are busily planting a garden with the more important Indian crop plants. Our students, when they leave us, may have to deal with figures about *jowar* and *bajra*. I dare say a number of Bengalis have never seen either, and Punjabis have never seen jute or tapioca. They will; and they will learn at least a little about them. I doubt if many of our students know the exact meaning of such words as anticline, bauxite, a reversed fault, and monazite. But if they have to deal with mineral resources they will need to.

A statistician concerned with quality control in a factory requires a much more specialized knowledge; but at least we hope that each one of our graduates will have made some physical and chemical measurements not too unlike those whose results he has to analyse. If he has not, he may either take the analyst's results as something not to be questioned, or regard them as nonsense which he is bound to tabulate. The first thing to ask in such cases is how accurate the results are. The analyst may say that the mean difference between duplicate measurements is under one per cent. I got an answer of this sort a few months ago. It turned out that the worker in question had merely measured some photographs twice. He had not taken the photographs twice. So the error measured was perhaps only a small part of the total. Unless our statisticians have made measurements of this kind themselves, they will not be able to improve the performance of the experts. Of course they will live much quieter lives if they do not ask awkward questions, until their firm goes bankrupt.

Now, the inevitable criticism of such a course as we are proposing is that it will be hopelessly superficial. It is true that our graduates will be unable to pass a B.Sc. examination in zoology, botany, or physiology in any Indian university, or its equivalent in any British one. It is also true that by the third practical exercise in the course which I have designed, our students will be doing something which is not part of any biological course in India, and is a part of very few elsewhere; a systematic study of variation in plants and animals. Later, I hope, they will do a good deal more quantitative biology of various kinds. It is most unlikely that a gold medalist of an Indian university in any of the biological sciences would secure a 50% mark in our biological examination.

The reason for this is two-fold. In the first place, in Indian universities at the moment, 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. Secondly, while in England the biological teaching lags about fifteen years behind research, the corresponding lag in India is about forty five years. The growing points of European biology today are no longer the study of form with a microscope or otherwise, but the quantitative studies of animal and plant physiology, animal and plant populations, and animal behaviour. These do not require much higher mathematics. One can use the ordinary methods of statistics without knowing point set theory, just as one can use  $\sqrt{2}$  or  $\pi$  without having mastered Cantor's theory of irrationals. But they do require a mathematical outlook.

Biology is a science in which innumerable methods can be applied. In the U.S.A. there is a tendency to use as expensive methods as possible; for example, electron microscopy, measurements of nuclear magnetic resonance, and so on. These are needed to solve certain problems. But there are equally important problems requiring no more apparatus than a foot rule, a cheap balance, and a stop-watch; and, as I shall show later, some of these are more important for India. In our biological course we shall ask for very little apparatus; and if we use advanced physical methods, they will, I hope, be the methods of electronics, in which my colleagues on the ground floor are experts. We shall also, I hope, do better than university teachers of zoology (though not of botany) in familiarizing our students with the common animal species around them, many of which are of great economic importance, either by eating crop plants, or by eating the eaters of crop plants.

I have strong views on the teaching of chemistry, which, I believe, should be quantitative from a very early stage. But I do not wish to impose my views on my colleagues. As for other subjects, I have sometimes acted without consulting my superiors. Some of you may have noticed a graduated post in the tank of No. 203. I hope this will give us a graph of the annual variation of the tank level; though unfortunately the most interesting part of the annual change, the rapid rise of level during the first month of the monsoon, will occur during vacation. I consider it of the utmost value that our students should make quantitative records of such simple phenomena as changes in water level, which are, of course, of immense importance in India.

During the three years that I have been a member of the staff of the Institute I have been building up a small biological research department. In



doing so I have had five principles in mind. First, the work done should require statistical methods at least at one stage, and the more statistics the better. Second, it should not overlap in excellent work done by my other colleagues. It should not even appear to do so. Thirdly, it should require little imported apparatus, and should, therefore, serve as a model which could be copied by biologists all over India. Fourthly, it should, so far as possible, have practical applications, or look like having them. One of the founders of the Royal Society three centuries ago wrote that it 'valueth no knowledge, save as it hath a tendency to use', and I have kept this principle before me. Fifthly, it should be intelligible to students without a highly specialised knowledge of biology.

I give an example of co-operation with a biologist elsewhere. A scientist of the Saha Institute of Nuclear Physics in Calcutta, has been photographing bacteriophages with an electron microscope, and measuring the photographs. His paper in *The Nucleus* aroused my attention, because I happen to have a taste for numbers, and 10 Angstroms and 100 Angstroms mean something nearly as different to me as 10 metres and 100 metres. He was kind enough to give me further details. I will remind you that a bacteriophage is an organism which is or is not living according to the criteria one adopts, which parasitizes bacteria, and is much too small to see with ordinary light. We find that the average length of the so-called head of this strain is 964 Angstroms, but the standard deviation is only 22.3 based on a sample of 400. These results are startling for three different reasons. They are the smallest biometrical figures ever obtained. A human skull is about two million times as long as a bacteriophage head. Secondly, the coefficient of variation, 2.3% is not significantly above the lowest value known to me for any metrical character in a living organism, and is far lower than most. Thirdly, 22.3 Angstroms is only about 14 times the diameter of a carbon atom. And a good deal of the observed variation was certainly due to errors. It seemed possible that the bacteriophage was standardised not as an organism, but as a molecule.

The scientist concerned knows little of statistics, and had not seen the full importance of his discoveries. I have therefore arranged for him to collaborate with one of our research scholars, in analysing his results as thoroughly as possible, and perhaps tracking down some of the sources of error. I hope that we shall turn out at least one student a year who can help any Indian biologist with any problem requiring statistical treatment. Many of the so-called statisticians employed by agricultural research stations have not the

needed qualifications.

I consider that it should be an important part of the education of our students to follow the research being done around them. It is only so that they will see how a need for statistical treatment arises in any particular case, and how the most appropriate methods are or are not chosen. These are only samples of the work which our students will see being undertaken. Some of it is just as interesting statistically, but I have mentioned research of general interest. I hope that my physical and chemical colleagues will also carry out research which will be equally, or even more, stimulating. I know that my colleagues on the economic side are doing so.

Not only will our students spend some time at Delhi, Giridih, and so on, seeing aspects of applied statistics which cannot be studied here, but in Calcutta at least an afternoon a week is to be devoted to visits. I think the most important of these will be visits to factories and other establishments where statistical quality control is practised. But I shall certainly take parties to the Botanical Garden, which is world famous, and the Zoo, which deserves to be; and I am trying to make arrangements for visits to hospitals. We must certainly go to the Indian Museum for palaeontology, and I venture to hope we may also go there for more humanistic studies.

Teaching is a kind of activity, requiring a different kind of organisation from either the collection and interpretation of statistics, or the ordinary kinds of scientific research. It is quite essential that this should be understood. Let us take such a simple matter as punctuality. If the same punctuality is expected from research workers as from computers, many kinds of research are impossible. An experiment may last for 18 hours; if so, two such experiments a week, with some preparatory work and calculations in the intervals, are all that a man can do. If he or she must sign books between certain hours, as my colleagues have to do, such work cannot be done. A computer should be fairly punctual, but no harm is done if he arrives ten minutes late; and if he finds a mistake which takes him some time to track down, he had better be late than inaccurate. But in a teaching course both teachers and students must be punctual within a minute or so, not only in starting work, so long as the demand for lecture rooms is high, in ceasing it. This is not the case at present.

To sum up, the Institute is embarked on a great adventure. If it succeeds, we shall set an example, not only to India, but to the world. But it will require effort and even self-sacrifice. I, for example, see no prospect

of doing serious research, even of a theoretical kind, in the next two years. Unfortunately, some workers in the Institute appear to be making deliberate efforts to prevent this course involving them in any increased work or even any change of their habits, and are therefore, in effect trying to wreck it. They may succeed. If so they may have very serious adverse effects on the intellectual and economic development of India. There are others, both in the RTS <sup>2</sup> organization, and outside it, who are making every effort to get our scheme to work, even though this annoys some others. But we are already behind schedule in regard to various facilities for teaching. For myself, I can only promise to do my utmost to fulfil my duties to the students whom I welcome today.

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<sup>2</sup>RTS = Research and Training School (of the ISI)

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

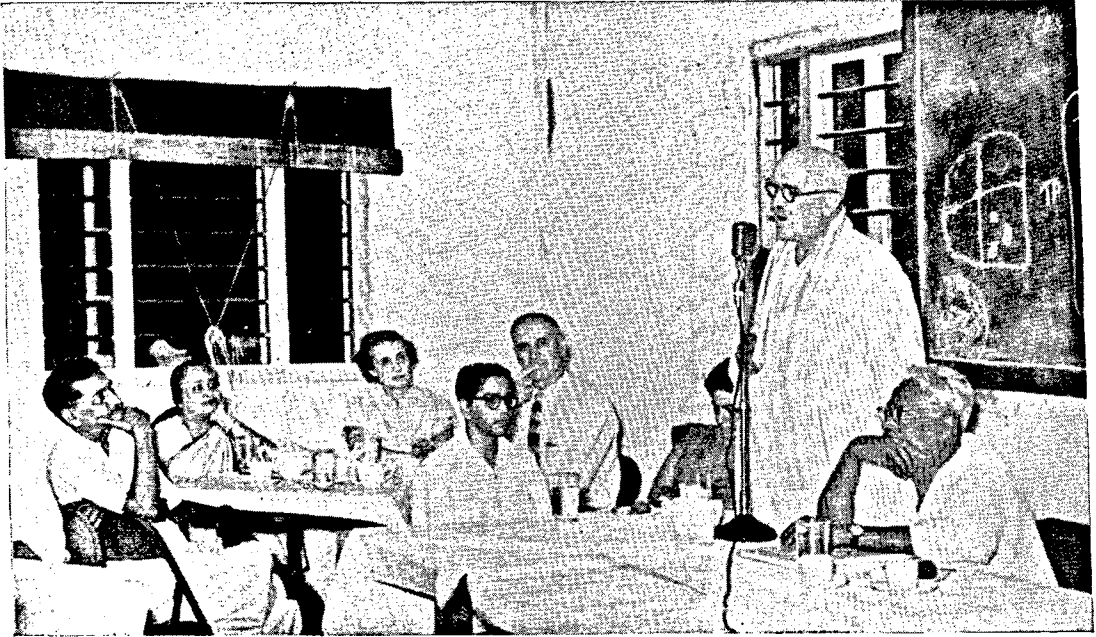
**FAREWELL TO R.A.FISHER**

(16 March 1959; Indian Statistical Institute)

**J.B.S. Haldane**

## Speech by J.B.S. Haldane

I am very glad to see Professor Fisher again. For a number of years we were colleagues at the University College London. Then he went away to Cambridge and I didn't see as much of him as I could have wished. When we were at the University College, we were chronically in slight disagreement. But the disagreement was not so great as to prevent collaboration, and that, after all, is what matters. I produced some rather messy figures about alleged linkage in man, and Fisher tidied them up. Then I said, I believe I can trim that tidying up a little bit more and so it went on. But although formally we were each quarrelling with the other, the net result, I think, was fairly constructive. I would also like to say that some of my juniors, including my wife, said that Professor Fisher was much kinder than I when they brought statistical problems. The reason, I think, is that I know very little statistics now, and in 1938, the time in question, I don't think I knew any at all. As Professor Fisher knew quite a lot, that gave him an unfair advantage and he won away the hearts of several of my juniors. But, I would like to say this. Although Professor Fisher may sometimes have been rather hard on his contemporaries or his seniors, he has, at least among those I know, a reputation of being extraordinarily kind to junior workers. And that, I think, is the reputation which matters, because the junior workers will be alive after all the others are safely disposed of and it is they who will hand out the tradition of what sort of a man Fisher was. It is, therefore, more from the point of view of my juniors than my own that I welcome Professor Fisher here. I have occasionally used his method, and much more commonly, he would say, misused them. He has occasionally used mine also. I do, most warmly, welcome him here and I hope that he will come back fairly frequently and stay, if I may say so, for a little longer than he did this time. I also hope that he will bring Mrs. Fisher with him.



At his reception in the Indian Statistical Institute in 1957



At the farewell ceremony of Sir Ronald A. Fisher at the Indian Statistical Institute (16 March 1959)

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

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**FAREWELL TO J.B.S. HALDANE**

(Indian Statistical Institute, Calcutta; 1961)

P.C. Mahalanobis

J.B.S. Haldane

C.R. Rao

## Speech by P.C.Mahalanobis

*Professor Haldane and friends:*

We are having this function to say farewell to Professor Haldane and Dr. Spurway arranged from the Research and Training School ... I'm glad that yesterday we placed on record our great appreciation of the invaluable services rendered by Professor Haldane to the advancement of Indian science. In India, we have to think of India as a whole, it is the advancement of science as a whole which is the essential point. From the letter which I received from Professor Haldane this afternoon, I'm very happy to note that he is looking forward to come back to India, and in that sense he will continue to be with us, which makes me feel very happy indeed. So yesterday, not even knowing that precisely, we stated that we greatly appreciate what he has done for the advancement of science in India. And, of course, we do appreciate his having been here. 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. Having been born here, I'm perhaps a little more aware of the difficulties of implementation. But the decision even would have been difficult. Therefore, I should like to again express my own personal appreciation, and also, if I may put it, my most sincere thanks for the trouble he has taken, for the time he has given us here. He will, of course, still be our colleague in India. I need not mention that he and Dr. Helen Spurway would be always welcome to come here, or, if they like, even for a spell of longer work here. Our doors would always not only be open, but looking forward to his visit here, if it suits his or her convenience. That is really all I came here to convey on my own behalf and on behalf of all my colleagues, to Professor and Mrs. Haldane. We wish them all success in their endeavour wherever they may be. Also, since they will be leaving tonight at 10, I wish them a comfortable flight and a happy landing in Rome — that ancient city. And shall I say, as we say in Bengali, 'I hope you will come here again'. Thank you.

## Speech by J.B.S. Haldane

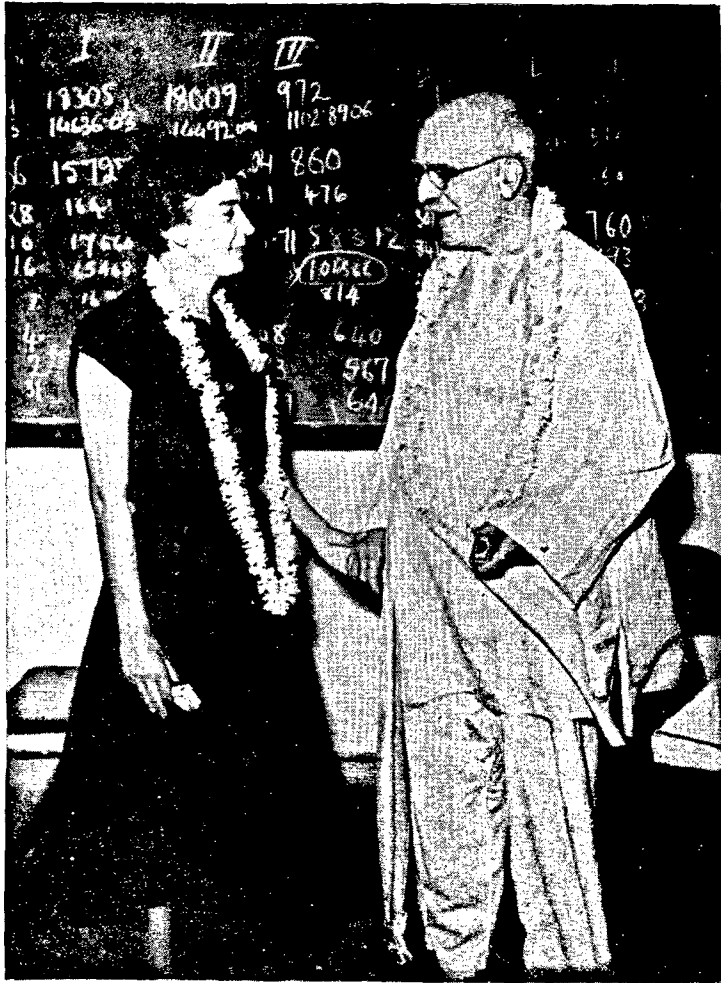
I thank Professor Mahalanobis for so much of his speech as I was able to hear. Unfortunately, deafness is encroaching on my ears to some extent and



I may have missed much of his speech. I owe a great deal to this 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. I'm not going to mention any names; some are inside now. I'm enormously impressed by the great fund of scientific ability which exists in this country. ... That has been the thing for which I thank the Institute most, and I hope that when I come back to India I may be in a position to find more young men, and one or two women, of the same calibre. If that is so, I'm an important discoverer.

### Speech by C.R. Rao

*Professor Haldane, Professor Mahalanobis and friends :* We are extremely thankful to Professor Haldane and Dr. Spurway for attending this function today. This was arranged at the last moment as sort of get-together to enable the staff and some of the students to meet Professor Haldane and Dr. Spurway on the eve of their tour abroad. They will be away for about four months. Many of you are aware that Professor Haldane received many distinguished awards during this year — the Kimber Gold Medal of the United States National Academy of Sciences, the Linneaus Centenary Medal. He will also receive an honorary doctorate from the University of Oxford. He was awarded a prize from an Italian genetics society — I'm sorry I don't remember the name of the society. I hope he will personally receive some of these awards during his tour abroad. On behalf of the Institute, I wish him an enjoyable tour. As I told you, he is coming back to India after four months. I have requested him to give a few lectures in the Institute after he comes back. I'm glad to say that he has kindly agreed to do so. We will, therefore, continue to get his advice and some lectures from him from time to time. I would like to convey our gratitude to Professor Haldane for this. Thank you, ladies and gentlemen.



*With his wife Helen Spurway (28 September 1956)*





J. B. S. Haldane's birthday celebration in *Amrapali* (5 November 1957)

J. B. S. Haldane,  
P. C. Mahalanobis and  
Niels Bohr  
(19 January 1960)



J. B. S. Haldane with  
journalists after his  
joining the Indian  
Statistical Institute



J.B.S. Haldane receiving the Diploma of the U.S.S.R. Academy of Sciences (25 August 1959)



J.B.S. Haldane delivering a lecture at the Indian Statistical Institute (19 December 1959)





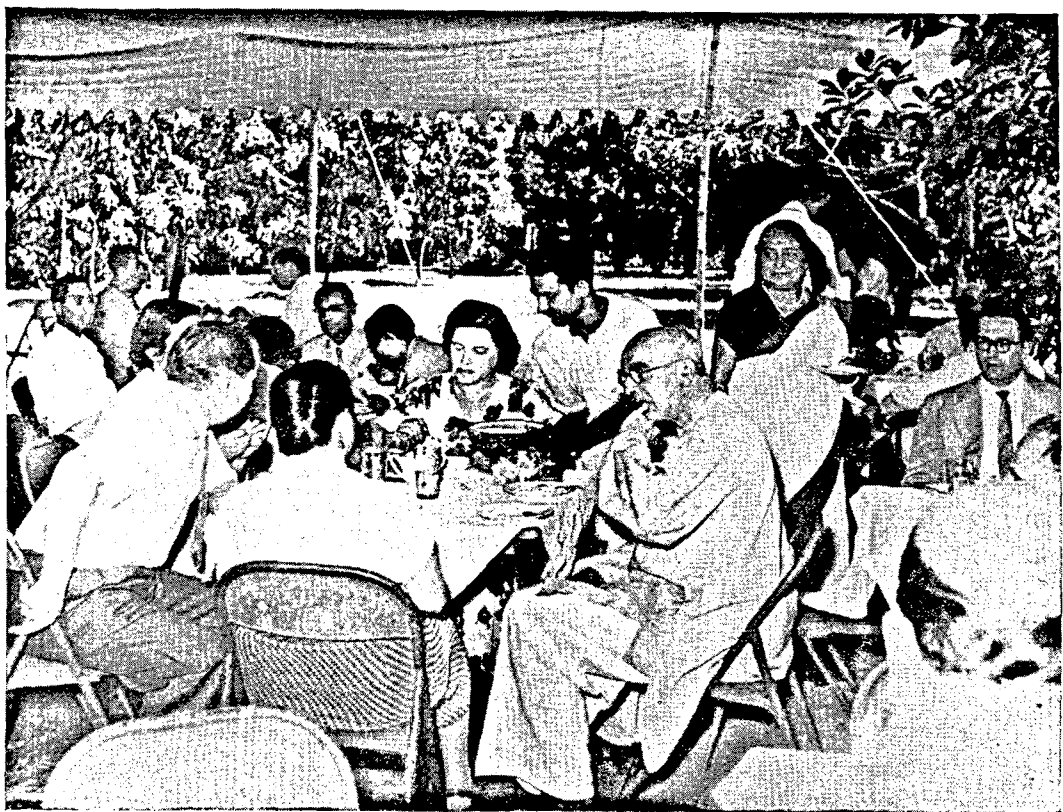
J.B.S. Haldane addressing a gathering on the occasion of the 26th anniversary of the Indian Statistical Institute (19 December 1957)



Inauguration of degree courses of the Indian Statistical Institute, 16 August 1960  
*From L to R* : P. C. Mahalanobis, F.R.S. ; S. N. Bose, F.R.S. ; P. N. Banerjee ;  
J.B.S. Haldane, F.R.S. ; C. R. Rao, F.R.S.



J.B.S. Haldane planting a sapling in the gardens of the Indian Statistical Institute (11 March 1958)



At a garden party organized by the Indian Statistical Institute in honour of a Soviet parliamentary delegation (3 March 1958)

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

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**REMINISCENCES OF HALDANE**

*Asit K. Bhattacharyya*

**Asit Kumar Bhattacharyya**

**'KORAK', Purbapalli**

**Santiniketan**

**West Bengal 731235**

**India**



It was August 1, 1956, my twenty fifth birthday. I was then engaged in some editorial work. Professor Nirmal Kumar Bose, the renowned anthropologist who had also worked as Mahatma Gandhi's Secretary for sometime, introduced me to Mrs. Haldane. A few days later I received a telephone call from her to say that her husband, J.B.S. Haldane, wanted to meet me and she invited me to dinner at their home in *Amrapali*.

### The First Meeting

On the appointed date I arrived at *Amrapali* dressed in Bengali attire — *dhoti*, *khadi kurta* and laced shoes. Mrs. Haldane was waiting for me at the entrance and took me upstairs to the spacious dining-cum-sitting room. A little later, Haldane came up after his evening swim, all wet, dressed in saffron underwear, and went into his suite dripping water all over the floor. A few minutes later he came and stood before me — a tall and swarthy man — dressed in white *pyjama* and *kurta*, and *kabuli chappals* without socks. As he stood before me, I said to myself, "why, this is Siva." That instinctive glimpse of his personality that I got at the very first meeting proved to be true in the years that followed. He could be easily pleased, was indeed of a happy disposition and liked other people, especially young people around him, to enjoy themselves. Yet, from time to time he staged temper tantrums at small provocations or sometimes even without any provocation. At that point it was best to tell him what one thought about the matter and then leave him alone.

During the dinner in August 1956, Haldane told me that he would be coming next year to ISI, Calcutta, and settle here permanently. At that point, I offered to teach him Bengali if he could find the time for it. He gave it serious attention. He also told me of his resolve to become a vegetarian on settling in India, which he did. After dinner, he questioned me closely about Bengali language and literature and was evidently happy to learn that in modern Bengali, the spoken language had established itself as the literary medium. He could see that this had infused our literature with a new life that has vastly expanded its scope and powers of expres

### My 'Student'

At the end of July 1957, the Haldanes came to the ISI, Calcutta, and took

up permanent residence in this country. Almost immediately, he contacted me and I started giving him Bengali lessons. He took copious notes, in Latin, on the structure of the Bengali language, and explained to me that structurally Bengali has considerable similarities with Latin, an Indo-European language, in which he felt at home. To illustrate the use of words, I would occasionally compose couplets in Bengali. On one such occasion, he told me, "You are always telling me what is happening in your own mind; but science begins with an interest in things outside yourself."

These Bengali lessons lasted for about six months. On the first day, when I arrived at 8 a.m. sharp, Haldane invited me to breakfast with them. I thought it to be a formality and politely declined. When I said 'no', he exclaimed that in that case he was not going to have his breakfast either. I felt embarrassed and agreed to join them at breakfast. Since then, breakfast with the Haldanes before Bengali lessons became the regular practice. Thus, on the very first day of my work with him, I realized that he meant what he said and said what he meant. This, as I subsequently found out, lay at the root of his difficulties in social life.

### Experience as Secretary

At the end of December 1957, Haldane offered me the post of his Secretary. In a letter written on December 24, he explained the nature of my duties.

*Dear Mr. Bhattacharya,*

*Here are a few reprints some of which you might care to read with a view to possible translation into Bengali. Meanwhile, let us consider your duties. My Dharma is as follows.*

1. *Kamadharmā. I am happily married. You may open all letters. It is unlikely that I shall have any extramarital love affairs.*

2. *Arthadharmā. This is an intolerable nuisance. You will have to keep me up to it, for example to see that my income tax returns are made, cheques paid in, and so on, not to mention the Journal of Genetics.*

3. *Sundaradharmā. You will find that my main interest here is poetry. I may be able to introduce you to some European literatures. I shall expect your help with Indian ones as time goes on. I have a moderate appreciation of architecture, sculpture and painting (I think in that order) and none of*

music.

4. Mokshadharma. *I should like to spend as much time as possible doing mathematics and scientific work which is valuable in so far as it is impersonal in the sense that my results are valid for everyone. Of course it expresses my personality, but I try to suppress this. It will be your main job to make this possible for me by guarding me from the various people who want to distract me from it. I do not mean people with whom I can exchange information. They are not a nuisance. I mean people who want me to appear on public platforms, or make a 20 minute speech after travelling 200 miles.*

*My wife's aims are not dissimilar. You will have to do various jobs for her particularly as she will be your employer. I am sorry for you. But at least it will be a change.*

*P.S.: The paper<sup>1</sup> sent is not so much to test your knowledge, but to get an idea of what English writers are known in Bengal. You can try it on friends if you wish to lose their friendship.*

Unlike what is said in his biography by Clark, the above letter shows that Haldane was interested in painting. In retrospect, I find it strange that he could state so easily that his "wife's aims are not dissimilar" — perhaps he should have let her speak for herself as his own principles demanded.

My work as Haldane's Secretary started with helping him in rearranging his library. One day when we were at work, a number of rare and valuable scientific books slipped out of my hands and fell noisily on the floor. Panic gripped me. Before I could mumble an apology however, Haldane said, "It is my fault."

Many have known Haldane as a great scientist, some may have known him as a writer of English prose, but few may know that he had readily accepted the responsibility of preparing the English course for the B. Stat. students of the ISI. In this connection, he wrote to me on March 7, 1960, seeking my help and assistance.

*Dear Asit,*

*I have talked to C.R. Rao about the English course. He agrees that you should take part in this under my general supervision. You will then be employed by the Institute like S.K. Roy, T. Davis, etc., but not for so many*

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<sup>1</sup>The paper mentioned, was a list of quotations from English poets and prose writers and I was told to identify the authors quoted.

hours per week.

*As always, there is a cloud round this silver lining. He wants an English Reader prepared, for our course. I can think of some constituents, from Aubrey, Darwin, Wallace, Galton, etc. which are not copyright. But I shall need your help. I shall begin, I think, with the passages from the Bible (e.g., Exodus 30, Numbers 1, 3, 26 1 Sam. 11, 15; 2 Sam 24, especially the last) which deal with demography.*

*Of course all this is still at the spoken, not the written level. However, we may begin to think seriously about the Reader.*

*N.B. Please keep this for biblical references.*

### Haldane's Love of Literature

Haldane had an intense love for poetry. He had once told me that he would have loved most to be a poet if he were not a biologist. It is therefore appropriate that his verse 'Cancer is a funny thing' find a place in the Oxford Book of Twentieth Century Verse.

He had immense admiration for Shakespeare and great regard for Dante. He considered the 17th C. to have been the best period in English history and had a high appreciation for the 17th C. English literature. Aubrey's *Short Lives* was his favourite. Among the moderns, he admired Auden most and referred to some lines in the 'Ascent of F 6' as "reaching almost Shakespearian heights." However, he showed little enthusiasm for T.S. Eliot. He highly appreciated the prose of Isherwood.

Haldane had a high regard for the poetry and prophetic writings of William Blake. Among the Romantics, he admired both Shelley and Keats. The radical ideas of Shelley appealed to him, though he quoted Keats more often. Among the 20th C. English poets, it was W.B. Yeats whom he admired most. He would quote at length the verse and whole pages from the verse dramas of Yeats as he did from Shakespeare's. Among the poets he had read in his youth, he admired James Elroy Flecker most. He also admired the radical strain in the verse of Swinburne. He had a high appreciation of Samuel Butler, and his modern Utopia *Erehwon* (Nowhere) was his real favourite. Among the Victorians, he admired Browning and to some extent Arnold. Among the writers of English prose, apart from the Bible (A.V.), his greatest admiration was for Swift. He made me read all four books of *Gulliver's Travels* and the third book on Laputa revealed to me why he ad-

mired Swift so much. Indeed, Swift had foreseen the development of scientific civilization. In the same way, he considered David Hume's *Essays* as a model of English prose. He had recommended Benjamin Franklin's *Autobiography* to me.

Apart from Latin he read Greek, but the language he loved was French. He loved the language and also the literature written in French. He once told me that because of its succinctness, French was preeminently suitable for mathematical texts. My knowledge of the French literature was too meagre to discuss the subject with him. He admired Heredia's sonnets, and loved the poems of Rimbaud, Balzac, but showed no interest in Victor Hugo. He corresponded with Sartre though the non-availability of a French typewriter in the ISI created a problem. He shared my view of Chekov as one of the greatest playwrights of European literature. Among the German authors, he was fond of quoting certain lines from a poem by Hugo Von Hoffmansthal.

Among European novelists, I had found him reading Dostoevsky and Tolstoy, as well as Balzac. Among modern English novelists, he mentioned Joyce Cary approvingly. He also considered the neglect now shown to Arnold Bennett as rather unfair. He saw in James Joyce a modern master who was beyond imitation.

He knew G.B. Shaw and H.G. Wells personally, and knew them well. His feelings for H.G. seemed more warm. He appreciated H.G.'s attachment to the sciences and sex life.

### Haldane and the Journal of Genetics

Haldane would perhaps be remembered most for his work for the *Journal of Genetics*. He edited the Journal which he had gifted to his wife Helen Spurway. I became the publisher of the Journal sometime towards the end of 1958. *Journal of Genetics* had no board of referees. Haldane alone could carry on the responsibilities that such a board usually does in case of scientific journals. This was a unique phenomenon. As an editor, he performed two important jobs. First, many scientific workers were baffled by their own observations and did not quite understand their theoretical implications. Haldane would explain to them the significance of their own observations and thus help them to write their papers and carry on their research further. As a corollary to it, he would often refer a scientific researcher in one corner of the world to another in some other country doing comparable work and thus help

further the cause of science and, of course, the scientists concerned. In publishing a paper, he often suggested changes to the authors and obtained their prior permission to incorporate the suggested changes before publication.

### Daily Routine

A glimpse of Haldane's daily routine may be of interest. By Indian standards, he would wake up late, i.e., sometime after sunrise. He would get ready for breakfast between 8 a.m. and 8:30 a.m. The usual breakfast consisted of buttered toasts, boiled eggs and bananas, with tea or coffee. The lunch was interesting: Indian food taken the European way. Rice was consumed only with *dal*, but all other preparations, vegetarian or non-vegetarian, were taken straight without adding any rice or *chapati*. Haldane liked fried aubergine, local greens and green jackfruit curry. He also liked slightly treated cottage cheese. He loved yogurt. He increasingly grew fond of south Indian vegetarian food and in October 1960 he stated so in a letter to his sister, Naomi Mitchison. However, he was always happy to miss his lunch and have only a number of bananas, may be some yogurt and plenty of water. The afternoon tea was an enjoyable time — the Haldanes were joined by their laboratory staff, one or two of his research students and sometimes visiting scientists. *Singaras* (Potato pies) from the ISI canteen was the standard fare, washed down with endless cups of tea with milk and sugar. Haldane was a little bewildered by the Indian practice of serving tea in cups with milk and sugar added. "Nowhere have I seen it except in the British army," he often commented. At dinner, usually attended by guests, plenty of alcoholic beverages were placed on the table. Guests were requested to help themselves to beverages. Haldane rarely consumed hard liquor, but would sometimes take a little whisky before retiring around 11 p.m.

Haldane would generally work for at least two hours after dinner. It still remains a mystery to me how he could wake up in the morning and go out to work after keeping late hours the previous night. During the winter months, Haldane liked to sit in the sun with a straw hat and work for hours till lunch. He read the morning newspapers regularly before he started his work. Quite often, he discussed political questions with me during this time. He had seen in manuscript my article in the *Economic Weekly*, Bombay (December 14, 1963), predicting the decline of Stalinism through the process of economic development in the erstwhile Soviet Union, and agreed with my views.

The Haldanes left Calcutta for Bhubaneswar in the summer of 1962. During one of my frequent visits to Bhubaneswar, I found him eating out of cheap aluminium plates and glasses at lunch, while none else eating together with him did so. When asked, he said that in all countries, he somehow came to like the food and drink the proletarians take and with it the kind of crockery they used. Apparently, he wanted to break out of the isolation that resulted from his eminence. Indeed, what characterised Haldane was his deep urge to be a part and parcel of the common mass.

### **Haldane and His Juniors**

Haldane's refusal to be put on a pedestal and be worshipped by lesser mortals came out even more clearly in his relation with his juniors. He went out of his way to encourage us to contradict him, and to argue with him. Nothing seemed to please him than when one of us proclaimed 'you are wrong, Professor.' Indeed, he pampered his juniors. He was prepared to do all he could to help solve their personal problems as well.

### **His Friends in India**

Haldane had a number of friends among scientists in India. Prominent examples are, Nirmal Kumar Bose, an eminent anthropologist, Gandhian and activist; Meghnad Saha, a world-famous physicist with strong left-wing sympathies; P.C. Mahalanobis, the founder of the Indian Statistical Institute; and, Salim Ali, the renowned ornithologist. Haldane never ceased to regret the fact that Meghnad Saha passed away suddenly even before the Haldanes settled down properly in India. Salim Ali often stayed with the Haldanes on his visits to Calcutta. Mahalanobis was a close personal friend, but factors beyond their control led to a termination of that friendship.

### **Haldane and India**

Why did Haldane come to India to settle down permanently? What led him to become an Indian citizen? He had fought for Britain in two world wars and never regretted it. Still he always had a deep aversion for the British establishment and its imperialism — his conversion to communism in the thirties showed it clearly. However, the Lysenko affair after the second

world war, disenchanted him. He realised that absolute power wielded by the erstwhile Soviet State under communism inevitably led to abuse of power. He found it imperative to distance himself from it. It was at this juncture that he was drawn to Nehruvian socialism in India. Its rationalist ethic, based on the deep reverence for life bequeathed by the Hindu-Buddhist tradition enshrined by Gandhi, appealed to him. So did the wide tolerance of different life styles and cults in India.

Indeed, he had a profound appreciation of the Indian culture. His popular articles on the subject relating it to developments in modern science that came out regularly in *The Hindu* and later compiled in the volume *Science and Indian Culture* bring it out clearly. The idea of non-attachment to material possessions appealed to this philosophical materialist. To my mind, his definition of *moksha* — the need to go beyond all-needs — remains final. That was the need he felt within and finally renounced much of his past, leaving his concern for science and humanity as his legacy.



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1992

**HALDANE, FISHER AND WRIGHT**

*James F. Crow*

James F. Crow  
Laboratory of Genetics  
University of Wisconsin  
Madison, WI 53706  
U.S.A.

Of all biologists of his period, or perhaps any period, Haldane came closest to the ideal of a polymath. His interests were incredibly wide — western classics, Hindu philosophies, several languages, Marxist theory, economics, to mention only a few, along with almost all the sciences. His depth and breadth of knowledge; his retentive memory, his habit of hard work, and — equally important — his self-confidence and lack of inhibition led him to write on all manner of subjects. He wrote as if he were equally at home in population genetics and astrophysics; and indeed his knowledge of the latter was amazing. Haldane's popular writing was remarkably lucid. He presented complicated results in a simple way, but his simplifications never distorted the meaning. This is all the more remarkable, since he wrote so much and so rapidly. Our lives are the richer for it.

Haldane's deepest interest and best known contributions are in the mathematical theory of evolution. I have been asked to write something about the relationships among Haldane and his two contemporaries, R.A. Fisher and Sewall Wright. Remarkably, these three founders of population genetics were almost the same age, having been born within a three year period from 1889 to 1892. When have three scientists with the ability of Fisher, Wright, and Haldane simultaneously and to a large extent independently founded a new subject? But that is what happened: the subject of population genetics and the mathematical theory of evolution was started by these three, and they almost totally dominated the field in its first quarter century. Furthermore, each wrote his definitive contribution at about the same time. Fisher's *The Genetical Theory of Natural Selection* was first published in 1930. Wright's extensive paper, *Evolution in Mendelian Populations*, appeared in 1931. Haldane's book, *The Causes of Evolution*, came out in 1932. Although all three continued to produce important papers, the cream had been skimmed by this time.

Although each knew of the work of the others, their work followed paths that were quite different. In particular, Haldane used a notation different from the other two; he emphasized gene ratios rather than proportions, which made his work easier to follow in some respects, but harder to generalize to multiple alleles.

Fisher showed that natural selection, in the presence of dominance, epistasis, and environmental variability, causes changes in allele frequencies such that the mean fitness increases at a rate given by what he called the genetic variance, the variance of the additive component as measured by least squares regression of fitnesses on allele frequencies. Since the environment is steadily

deteriorating, if for no other reason than that, competing species are also evolving, the increase in fitness due to change of allele frequencies is largely offset by such deterioration and by overcrowding. To Fisher, the steady genetic improvement of a species by allele frequency changes, brought about by natural selection, was the major direction-determining force in evolution. Although he wrote on many other subjects, such as stochastic changes and polymorphism, his name is most strongly associated with the view that he continuously maintained — that fitness increases in a manner analogous to entropy in a physical system. Even the minutest fitness improvements would eventually be incorporated, he said, for example genes modifying the dominance at other loci. On Fisher's view, evolution would proceed most surely and rapidly in a large, panmictic population where each gene is tested in many combinations and accidents of chance are minimized.

Wright took a very different track. Impressed by the failure of the Fisher model to produce combinations of genes that are collectively beneficial while individually deleterious, Wright argued that the most favorable condition for evolution lies in a structured population. A population composed of many nearly isolated subgroups has a larger variance than if the population were panmictic. Within each subpopulation there is an opportunity for random changes in gene frequencies, and occasionally a particularly harmonious combination of genes can arise in this way. When this happens, the happy combination can be exported by migration and eventually spread through the population. This "shifting balance" theory then offers a chance for the incorporation of favorable combinations, even when the individual components are unfavorable.

This difference in viewpoint led to a strong disagreement between Wright and Fisher that started around 1930 and lasted through their lives. Each was insistent on his view: Fisher that steady improvement (or maintenance) of fitness in an ever-deteriorating environment was most important; Wright that incorporation of harmonious gene combinations was the key. The argument soon became personal and Fisher and Wright were not on speaking terms.

Where did Haldane stand? What did he do? And why is his name not associated with any global theory of evolution? The answer, I believe, lies in his eclecticism and interest in the work of others. Haldane worked out in great detail the way selection acts on gene frequencies. He anticipated Fisher's work on the probability of fixation of a favorable mutant gene. His paper on metastable equilibria paralleled and anticipated much of Wright's work. But rather than push any particular view, Haldane saw good in all

of them. His openmindedness, his detailed knowledge of the work of others, and his breadth of interest kept him from the staunch support of a particular view that characterized the writings of many others. So, in a way, the fact that Haldane's work has led to no school of thought is to his credit. As an example, the approach to inbreeding through identity by descent, which owes a great deal to Haldane, is replacing the correlation approach of Wright, although Wright's method completely dominated the field in the early days.

How does one compare the styles of these three? Haldane was a good mathematician. His approach was to formulate a problem and then grind out the answer, and he solved a number of important problems. He didn't seem to try for elegance. I think he worked at breakneck speed on any problem that interested him, often doing it at odd times such as in railway stations, and published when he had an answer even if he might have gotten it in a more elegant way if he had devoted more time. Haldane solved many difficult problems, but the problems solved by Wright were deeper. Despite his much more limited mathematical training, Wright somehow managed to get answers to very difficult stochastic problems, almost all connected with his shifting balance theory. Wright and Haldane were alike in one regard. They both ground out answers in a straightforward way. Fisher, in contrast, had a touch of genius, of special creativity. His solutions were new and highly original, devised for the particular problem; many of the methods later became standard.

Both Haldane and Fisher were good mathematicians, much better trained than Wright. To paraphrase a remark made about the physicist Richard Feynman, attributed to Bethe: With Haldane one has the idea that given mathematical skills and sufficient time — far more than Haldane took — one could have gotten most of his answers. To a lesser extent this was true of Wright. Fisher, in contrast, was sheer magic. In no amount of time could an ordinarily competent mathematician have produced his results.

On the other hand Fisher had nothing like the breadth and depth of knowledge in all areas that Haldane had. Neither did Wright, although by ordinary standards he was a learned man. Haldane's restless curiosity and willingness to delve into any subject under the sun diluted his contributions to any single subject. He learned easily and remembered essentially everything, and he worked hard and wrote easily. I for one would not have wanted it otherwise. He would have produced more population genetics if he stayed to his last, but his total output would have been less varied and less interesting, and we would have been the losers.

What were these men like personally? I knew Wright intimately, having seen him almost daily for more than 30 years. I also knew Fisher well. I first met him in 1946 and saw him several times, especially in the latter part of his life when his daughter lived in my city and he often visited her. Haldane I knew less well, mostly from casual encounters at meetings and from correspondence. But one visit stands out. He came to the University of Wisconsin during the last year of his life. We were able to take advantage of the fact that the rules at another university precluded someone with Haldane's outspoken revolutionary views from speaking there. He was at his charming best during the entire visit of several days.

As I said earlier, Fisher and Wright were not speaking to each other. When Fisher visited me in the crowded Genetics Building at the University of Wisconsin, we were always careful to bring him into the building when Wright did not happen to be in the hallway. Wright was the gentlest of men, except in one regard — Fisher. Although he admired Fisher's contributions to statistics, he had little good to say of Fisher's evolutionary views or of his character.

Wright and Haldane had great mutual admiration for each other. When Haldane lectured at the University of Wisconsin, he was introduced with high praise by Wright, which Haldane reciprocated when it was his turn to speak. And they enjoyed talking to each other, for of course they had many interests in common and much to talk about. All three men had one feature in common, not much interest in material things. Fisher grew mice and all manner of other experimental creatures in his home. Wright was indifferent about his salary. Haldane lived meagerly and often gave money to his students, especially after moving to India.

I have never seen Haldane and Fisher together, but stories abound. I think they had a love/hate relationship. They seemed to enjoy arguing with each other on any subject whatsoever. They must have had a certain amount of grudging admiration for each other. In particular, although he enjoyed winning a debating point with Fisher, Haldane was always generous in his descriptions of Fisher's work. An oft-quoted anecdote is typical of the behavior of both men. After one young scientist showed that he did not understand some of Fisher's work, Fisher said that it would be a good thing for young geneticists to spend more time studying the work of their elders; whereupon Haldane rose to second Fisher's suggestion and urge all young geneticists to read Darwin.

So, we have a study in contrasts, three outliers in orthogonal directions.

Wright was personally gentle, kind, and modest. He was ill at ease with strangers and not given to small talk. But he became extremely talkative on any subject that interested him, and there were many. And he could be stubborn in arguing for his shifting balance theory or the superiority of his correlation method of defining inbreeding. Fisher was an eccentric genius. He could be charming and he could be insulting, often with wit in either case. His statements about Karl Pearson were masterpieces of stiletto jabs. He, too, strongly upheld his own views. Wright ordinarily argued by repeating his own convictions, Fisher more often by putting down his opponent. Haldane was unpredictable. With students and young scientists he could be generous to a fault, but his unpredictable outbursts meant that they were frequently anxious, not knowing what to expect. In scientific discussions he was more likely to offer a new point or make a clarifying comment. He did not argue for his own scientific views, and often made a point of emphasizing the relevance of the work of others. I might mention that Haldane was always extremely generous about my work, even in instance when I unwittingly took credit for something he had discovered long before. At the same time, I think he enjoyed being insulting. At a meeting in The Hague, I recall his saying something insulting about the Dutch, but excusing himself by saying that he was impartial; he insulted everyone.

All three men had good memories. Wright could remember the minutest details about a particular guinea pig or about one of his ancestors six generations back. But Haldane's memory exceeded all normal bounds. An example I have often cited happened with my late colleague Klaus Patau. Patau loved to recite Virgil, in the original Latin of course. At one party he was doing this and after some minutes forgot his lines. Haldane finished it for him. Such a memory was a great asset, for it relieved him of such humdrum chores as remembering references or equations, so that he could take up his work at any time and place. It enabled him to write with seemingly equal ease at his desk or on a railway car.

Haldane was a man of paradoxes. I think the greatest paradox is this. In science, Haldane was the most open-minded of men, able to see and appreciate all points of view, and treating them all generously. He was as undogmatic as anyone could be. Yet in virtually every other walk of life, and in politics in particular, he was dogmatism incarnate.

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

**1992**

**THE REAL MAN IN J.B.S. HALDANE**

*E. Davis*

Eunice Davis  
Haldane Research Centre  
Little Flower Street  
Carmel Nagar  
Nagercoil 629004  
India

The late Professor J.B.S. Haldane was a man of massive contradictions. He could be the rudest man as well as the kindest. Only his close associates were able to perceive the greatness and nobility of his soul, that shone forth through his superficial wanton roughness.

At his table, people with salaries ranging from Rs.120/- to Rs.1800/- enjoyed the same privileges. He judged people by their sincerity and seriousness in work, and not by their social or even intellectual standing. Discrimination of people on the basis of colour, community or religion greatly annoyed him. In almost everything, he identified himself with the persecuted minority. He condemned wealth earned without effort and believed that too much money can suppress individual initiative. He could also never tolerate overconfidence and pedantic attitude. On one occasion, while attending a lecture he was irritated by the tone and style of the speaker. So, he purposely went to sleep and fell down from the chair with a crash, much to the amusement of those who knew him.

He never tolerated anyone who showed him any preference or gave him special importance; he, therefore, rejected such attentions and solicitations with annoyance. For example, when he was in the audience listening to a lecture, if someone offered him a good seat or turned the pedestal fan in his direction he became restless. On such occasions he often lost his temper and stood up and gesticulated with his hands violently or stamped his feet in irritation.

Even when he was a guest in our house, he protested and grumbled when he was offered even the elementary hospitality a host was obliged to offer. He usually took several cups of coffee at breakfast and I usually refilled the coffee pot until he got up from the breakfast table. Once he shouted, 'Don't pamper me.' So I obeyed his command and did not bring more coffee, but I felt very sorry when I saw him trying to pour out coffee from an empty pot.

He always got annoyed when he was treated in any way better than his junior colleagues or even his students. Once on a visit to the Botanical Garden, Calcutta, with some students, he felt that the man in-charge did not treat the students properly. So, when the man in-charge later approached and extended his hand, Haldane refused to take his hand by putting both his hands behind his back like a sulky child.

When Haldane was preparing to visit Ceylon in 1960 he was issued an Indian passport, but he refused to take it until his junior colleagues who were supposed to accompany him received theirs. Again, as the guest of honour



of the Ceylon Association for the Advancement of Science, the Ceylonese immigration authorities offered to waive the quarantine formalities for JBS. But he emphatically declined this privilege when those who followed him were denied it. In Ceylon, he refused the five-star hotel accommodation arranged for him and started to walk along the streets of Colombo enquiring for some cheap accommodation for himself and his group, because he did not wish to enjoy any comfort that was not given to his colleagues.

Though he was compassionate and generous by nature, he often appeared to be stingy and mean. Once he took some students to see an exhibition. He gave Rs. 100/- to Davis <sup>1</sup> and asked him to keep the money for buying snacks and drinks for the boys. As there was no need to buy anything, the money remained with Davis. Early next morning he sent a note saying 'Davis, you give my money back. Not that I suspect you will take it away, but I want my money.' During the same period he gave Davis Rs.1000/- of his personal money to make improvements on the insect detector that Davis had devised. He also gave his personal money to buy an air ticket for a student to attend a conference.

Haldane was thrifty and never wasted anything. From a banana bunch, he always started with the most ripe banana, so that nothing will be spoilt and thrown away. During air trips abroad, he often collected cheap razors, blades and other things from the airplanes, and offered them as gifts to his friends back home. Once on his return from abroad he announced gustily that he had something to give away. Many of his colleagues assembled around him. Davis in his usual shyness kept quiet, while another person moved forward to collect the present. It turned out to be a tooth brush! On a similar occasion, upon returning from Europe he announced that he had brought chocolates for us. We stood around, the children expecting at least a bar each. Finally, he pulled out one bar of the famous *Toblerone* chocolate from his pocket and said 'Don't expect that I am going to give the whole thing to you.' Then we knew that each of us were going to get only a small piece. Davis told him, 'Professor, this will only get in between our teeth.' I don't remember what his reply was, but I do remember that he did not give us more chocolate.

His living habits, while in India were, on the whole, very simple. He preferred south Indian vegetarian food, like *masala dosa*, vegetable curries

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<sup>1</sup>The late T.A. Davis was one of Haldane's closest associates in India. The authoress of this article is his widow. - *Eds.*

with coconut and vegetable *pulav*. He took *paan* after every meal. He always wore loose pyjamas and a *kurta*, and sometimes *dhoti* in the south Indian fashion. He condemned and ridiculed people who lived in the tropics but wore European clothes.

He disliked formalities and always meant business. He detested social visits and non-scientific conversations. A couple of months after Davis joined the Indian Statistical Institute, we felt we should pay Professor and Mrs. Haldane a courtesy call and convey our respects to them mainly because it was JBS who brought Davis to the ISI. So, one day along with our three small sons we went to their house and waited at the foot of the staircase and gently pressed the call bell. The *kurta*-clad gentleman descended the staircase and let us in. As we followed him upstairs we heard him call out to his wife 'The Davises are here. Honestly, I don't know why they have come.' He talked to us warmly, but we made our stay rather brief. That was the only formal visit we ever paid to the Haldanes.

He was a keen observer of people, although many around him would not notice it. Once we invited them for lunch. Unfortunately, a piece of chilli played havoc on Mrs. Haldane. She screamed loudly, and we were thoroughly upset. JBS quickly realised our lack of knowledge of food habits of foreigners, and profusely apologized for his wife's behaviour. On another day when the Haldanes had invited us for dinner, Mrs. Haldane, unaware that I avoided alcohol, offered me a glass of orange juice with plenty of gin. Innocently, I emptied the glass in a few gulps. Before long, volcanic eruptions started in my stomach and I began to sweat profusely. The old gentleman was watching me closely. He sensed my discomfort very well. He then called his wife and chided her, for offering alcohol to an unsuspecting young Indian woman. His bushy eyebrows concealed his eyes. But with a bent head his eyes keenly observed everything around him.

Haldane wrote that he was not a Christian, but the first book that he gave to Davis was a copy of the Bible. For all practical purposes he was an atheist, but science was his religion. He considered the scientific point of view as God's eye view. However, during the last days of his life his thoughts centred more and more around religion and God. He told Davis on a dreary, lonesome evening 'My great grandfather was a priest, my father used to read the Bible daily, but I am opposed to the practice of the majority of Christians and I hope to meet Christ in a far different manner. I know, the person Christ, was a far better person than we are informed through the

scriptures.' That indicated his belief in a spiritual life. Though he did not profess any religion or attack any religious sect, he was, in spirit, a true man of God who dedicated his life to the service of humanity.

After he left Calcutta and moved to Bhubaneswar, he was a frequent visitor to our house. We were occupying the same house on B.T. Road where he had lived formerly. Whenever he went abroad, he always stopped at our house. I presume that he must have felt at home in our house, not only because Davis was like a family member for him, but also because of his association with his former residence. Being an important guest, both Davis and I always tried our best to make his stay comfortable.

Haldane the man was much different from Haldane the great stern professor (that he wanted everyone to believe). He zealously guarded from the outside world his innate generosity and soft-heartedness. Only those who were close enough to him could get a glimpse into that heart of gold.

Some passages of his letters written to Davis from 1959 till about the time of his death reveal his simplicity, humility and love for his junior colleagues. He had attention even for trifling details and took nothing for granted.

*January 14, 1959 (written from Calcutta)*

'..... if our first unorthodox experiments really succeed we shall be able to get money and land for all sorts of queer experiments. That is why I want you, because you will not be afraid of trying things which have not been tried before ... .'

*March 16, 1960 (written from Calcutta)*

'In view of your capacity for original thinking and planning in the field of elementary mechanics, you will be needed. ... My aim is to make people think quantitatively on all subjects, and not to think in compartments.'

*February 19, 1962 (written from Calcutta)*

'I have been asked to give a public lecture to a Botanical Society here. I can only do so if I speak about the work of my colleagues and in particular your own. I should like to describe some of your published and unpublished work. With regard to the latter you have an absolute right to tell me that you would rather I did not. If so I won't mention the work on coconut yields.

If on the other hand you agree to being the subject of about 20 minutes lecture (which will probably do you no harm) I should like you to lend me some slides.'

*January 14, 1963* (written from Bhubaneswar)

'I hope to be in Calcutta on January 17th and to see you. I propose to arrive by the Puri Express in the morning on my way to Europe. May I come and shave in your bathroom?'

*April 1, 1963* (written from Bhubaneswar)

'... a mongoose considers that the eggs are more suited for food than for research, so the latter may end prematurely.'

*May 14, 1963* (written from Bhubaneswar)

'The stupidity of the *mynah* shows that in birds, as in men, linguistic and practical abilities are not very highly correlated. A student who can repeat a page of a text book may get first class honours, but may be incapable of research.'

*April 7, 1964* (written from Bhubaneswar)

'Did you see Piel's speech in Delhi? He devoted a good deal of space to you and Subodh Roy as examples of Indian scientists.'

'I am feeling much better, and certainly do not mind the heat. But one wound is still oozing a little, and I have not yet got quite accustomed to the diet.'

*September 7, 1964* (written from Bhubaneswar)

'As you may have been told, I am now alleged to have a short time to live. When I have dealt with some 4 papers now in my hands, I may have the strength to look at your paper for the J.O.G.'<sup>2</sup>

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<sup>2</sup>Journal of Genetics

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

**RECOLLECTIONS ON THE HALDANES  
FROM THE DIARIES OF  
SHYAMAL KRISHNA GHOSH**



Manjari Ghosh  
230B Prince Anwar Shah Road  
Calcutta 700045  
India

In the 1950s and 1960s, Bhubaneswar, the ancient temple city, was fast transforming itself into a modern provincial capital. New organisations were coming up. My father, Shyamal Krishna Ghose, was directly involved in building up one, The Orissa Mining Corporation, but he also had other, varied interests. When we heard that the Haldanes were soon going to be our next door neighbours, to set up a Genetics and Biometry Laboratory, we were both excited and apprehensive. For, by then we had heard of the “dark side” of J.B.S. Haldane, “represented by an old-womanly fussiness, an irascibility which he took pains to cultivate, and an unpredictable rudeness to juniors and servants as well as to men of power, which contrasted strongly with his underlying kindness”, as his biographer Ronald Clark later described.

Ironically, the “dark side” of Haldane’s image preceded his arrival. We were a bit hesitant to make the customary friendly overtures towards a new neighbour. However, Professor Haldane himself paid the first visit. A deep and lasting friendship developed between the two families. I was just a freshly recruited Lecturer in an undergraduate college – subject History – and felt very insignificant before the great scientist. But from the very beginning, his soft voice and gracious manners helped me feel at ease.

In his department at the Agricultural University, Professor Haldane installed his personal library of some 60,000 volumes. Besides scientific books and journals, the library contained books on a wide range of subjects. He was very pleased when anyone made use of his library.

I must also say a few words about Mrs. Helen Haldane, as I knew her. Socially, J.B.S. was a ‘liberal intellectual’ elite, but politically he had veered to the left. Helen shared his mores. But perhaps, because of her working-class background, she did not have the sophistication of her husband. She was generally misunderstood, and sometimes maligned. Her complete disregard of fashion and appearances, her direct and often forthright style of talking, were in a large measure responsible for the kind of impression she created. For instance, she would casually say “Professor Haldane says Helen’s two great addictions are books and booze!” However, people tended to ignore the fact that Dr. Helen Spurway was a distinguished scientific worker. Perhaps the knowledge that her formal academic credentials were better than those of Professor Haldane, who ironically had no formal qualifications in science, would have made a difference to them. She gave up a secure position in England to follow J.B.S.’ ‘voluntary exile’. As a widow, she bore her loss with a stoicism that was misconstrued by many, her ambiance became un-

congenial, and she was unable to hold together the nucleus that had formed around Professor Haldane. When she died of rabies in Adilabad in 1978 at the age of sixty one, she was engaged in research on wild jackals.

My father had a life-long habit of maintaining diaries. Extracts from them on the short-lived 'Haldane family' in Bhubaneswar, reproduced below, may be of interest to some readers.

*July 14, 1962*

K.C. Roy has gone but J.B.S. Haldane has not moved in.

*August 16, 1962*

Haldane's wife was trying to make a plan for the garden. We have not exchanged a word yet.

*August 29, 1962*

A crowd of students and Mrs. Haldane were seeing off the Prof. who travelled in the same compartment with me. He was going to attend an international conference at Geneva. (He) spoke cordially; (seemed to have) great admiration for Raju and Jayakar.

*August 30, 1962*

He (Prof. Haldane) asked if they used naked light in any of the Indian collieries. I said 'no' (I did not really know). He said that there was no gas in some of the Scottish coalfields.

*September 10, 1962*

As my wife refused to go the club, I induced her to call on J.B.S. Haldane and his wife. They introduced us to a bright research scholar, Jayakar. Mrs. Haldane's cackling voice and forthright style of speech irritated my wife, but she was most impressed by the aged scientist who offered her books on history and spoke humourously. I was offered whisky and my wife tasted some wine brought by him from Switzerland. Insects attracted by a strong lamp

were lovingly watched.

*September 15, 1962*

(We) returned at 4 p.m. and dressed up for the Government House party. We met N.R. Dhar and Dr. A.K. Ray. (I) introduced them to J.B.S. Haldane.

*October 21, 1962*

(I) saw Nirmal Bose in Haldane's home from a distance. I learnt later that he had come to see me twice. Earlier, I had met Haldane and Nirmal Bose on the road and was introduced to a young scientist called Raju.

*January 4, 1963*

The Haldanes and Jayakar called just when we were setting out for Mrs. Sen's house. We had to receive them cordially and offered drinks. Mrs. Haldane was delighted to see Scotch whisky still available. We talked about *go-sap* (Varanus monitor) which visited their house.

*May 17, 1963*

(I) met Nirmal Bose and Ajit Ray on the road, accompanied them to Haldane's house and met Mrs. Haldane. Nirmal wanted to know from her as to whether there has been any change in the quality of British Civil Servants in the recent years. She thought they are just the same. Hours of work and some other topics came up for discussion, when a number of visitors came over to meet Nirmal Bose and I took leave.

*June 13, 1963*

(I) visited the Haldanes in the evening. (I) was received cordially with a peg of whisky. Helen went on drinking gin, neat. Ajit, the anthropologist, was also drinking. Jayakar's brain is always clear. After some discussions about *Jains* we spoke about dreams. Helen said, "Why don't you come of-tener?"



*February 2, 1964*

Helen Haldane and Jayakar basked in the sun for bird watching. They got fairly scorched in the afternoon. We could not help but admire their devotion to work.

*March 4, 1964*

Helen Haldane was still watching birds, when I got out at 2.30 (p.m.). She did not mind getting scorched in the sun. (I) found her in the same position when I returned at 5 (p.m.). She said that the type of research undertaken called for constant watch from dawn to dusk.

*April 26, 1964*

The squirrels to be fed have been reduced in number to two. Quite tame, (they) would stand and beg. (They) came very close, but were much too shy to take from (our) hand(s). The bat had re-appeared on the scene. It found two fruit seeds on the *verandah* (balcony). Helen Haldane and Jayakar came over to try bird watching from the eastern side of our house and found those two seeds. When I explained that I used to find as many as 17 or 18 in one morning a few months ago, Helen said in a simulated weeping voice, "Why do they not come to our house?" There were four eggs being hatched by the *Hat-timā-tim-tim* (Red wattled lapwing) birds, but they did not get a grand view from our *verandah* and left.

*May 9, 1964*

I was in the bath when Haldanes and Jayakar called. Haldane likes a small dose of Vat 69. His wife drank Gordon's Gin. J (Jayakar) and I shared a mixture of Scotch and Old Tavern (Indian whisky). J.B.S. spoke about antiquated mining in U.K.

*July 6, 1964*

Winnie and I called on the Haldanes. Winnie sought Haldane's opinion about Israel and a very interesting discussion followed, including Holland and

Denmark.

*July 25, 1964*

Jayakar telephoned, requesting information about geology of Orissa for one Dr. Robinson. I wanted to meet this lady and asked him to send her up to my office. (I) gave her a geological map to study and (was about to) send her to P.K. Chatterjee, when she started prying me with technical questions.

*September 1, 1964*

Cora said she saw Haldane at the airport yesterday. (He) got down from the plane with a great deal of difficulty. He had become very weak. Cora wondered what would happen to Helen if he died.

*October 3, 1964*

I called on the Haldanes. Helen and Jayakar were away and Pamela Robinson received me. I found that the old man laid on the divan with a lot of support. He looked shockingly reduced since I met him last. He spoke in (a) low but clear voice. (He) said cancer had spread and he had been told that he would soon die, but a Calcutta doctor was now treating him for arresting further spread and he expected to live two more years. He added that he did not mind dying – perhaps one day he would go to sleep and not wake up. His face became animated when he spoke about the possibility. J (Jayakar) and H (Helen) returned at this stage and spoke buoyantly about their latest work. H (Helen) pressed a drink of whisky which I had earlier refused. She even joked about the response among us who anticipated her husband's death.

*November 29, 1964*

(I) spent an hour holding the hands of Prof. Haldane. He offered his hands after smiling warmly and asked Jayakar to give me some flowers from the 'cup and saucer' (*holmoscaldia*) plant for Beena. (He) spoke about the Journal of Genetics. He was just skin and bone, ate a spoonful of ice-cream with difficulty every five minutes and held on to my hand until Jayakar came

over to say that I had a visitor.

*December 1, 1964*

(I) saw some vehicles at Prof. Haldane's house at mealtime. (I) learnt later from Bahidar that he passed away this morning and that the body had been donated to the Cancer Research Institute. They wanted one of our vehicles to go to Kakinada with the remains. I was shocked. (I) could not forget how he smiled and held on to my hands so affectionately just the night before last. He had asked Jayakar to give me some flowers. I found the body removed to Meaker's house when I called at 4-30 (p.m.). Jayakar said he had started coughing yesterday and had a hard night. (He) died around 10.30 (A.M.). The C.M. (Chief Minister) had given an assurance that the research work started by J.B.S.H. will continue under Jayakar. Helen sent for me and thanked (me) for coming. She said that he did not want any fuss but they (Indians) were overwhelmingly kind. I said India was like this. The body was sent packed with blocks of ice at 5-30 (P.M.).

The wireless did not give the news of Haldane's demise. (I) had called on Helen later during the day but she was away at the Meakers.

*December 4, 1964*

I called on Helen Haldane in the evening and found Nirmal Bose and Pamela Robinson with her. As usual she pressed drinks. (I) tried beer, Jayakar showed us a letter written by Prof. Haldane towards the end of October in reply to an English geologist who sent him a religious book. It was biting.

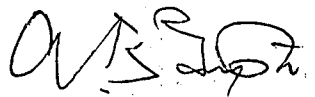
**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

**MY REMINISCENCES OF  
PROFESSOR HALDANE**



A.B. Gupta

Indian Statistical Institute

203 Barrackpore Trunk Road

Calcutta 700035

India

The words 'J.B.S. HALDANE' immediately call up in my mind a personality of awe, wonder and admiration. I was fortunate to hear the name of this giant when I was a schoolboy. Those were the days of world war II. (JBS had a definite objection to the use of capital W's in writing the name of this evil). The air-raid protection (ARP) measures taken up by the government animated the atmosphere. Even the school boys were not spared. In this context our mathematics teacher once remarked that a renowned biologist by name Haldane proved mathematically that the argument of ARP authorities that a number of people must not be concentrated in one place in order that a single bomb should not kill hundreds was fallacious. The matter was beyond our comprehension at the time but it acted as a magic to cast away much of the dejection we were suffering from the anticipated horrors of war. Since then the name HALDANE was imprinted in my mind.

Hardly could I imagine at the time that within years I shall see the giant in person. The opportunity came in 1952, the year in which the 39th session of the Indian Science Congress was held at Calcutta. The venue was the Presidency College where I was then a student of the third year Physics Honours class. Our Principal Dr. Sengupta was the Organising Secretary and many of us were enthused to become Student Members cum Volunteers. It was here that for the first time in life I could see a galaxy of scintillating scientists, both from India and abroad. My cherished hero however was Professor J.B.S. Haldane. Taking advantage of being a volunteer I used to closely follow his conversations with other scientists, track his movements during the Congress and attend the lectures that he attended or delivered. It was a unique experience. I could not however muster enough courage to talk to the giant on any plea whatsoever.

In the evening of the second day of the Congress, January 2, 1952, J.B.S. was to deliver a lecture on the "Relations between biology and other sciences". All the chairs under the huge *shamiana* on the field in front of the Baker Laboratory were occupied. I took meticulous care to occupy a prominent seat in the third row. The lecture was a masterpiece of its kind, a grand guided tour through the maze of diverse scientific disciplines that brought forth unmistakably the undercurrent of unity among the sciences. The elegance and ease with which he was leafing through the golden book of science compelled me to feel that here was a seer and not a myopic specialist. He began with the relation of biology with mathematics, the most abstract among the sciences, and spoke at length on the symbiotic relationship of

biology with physics, chemistry, geology, agricultural science, anthropology and ended with logic, and moral and social sciences.

I was wondering at the living encyclopaedia standing just in front of me. In his speech he often referred to the Indian scene – her problems and prospects. This attracted me the most. Like a religious fundamentalist I was, in those plastic years of life, a fundamentalist of a different kind but no less harmful. The lecture was a revelation to me and I started developing a new outlook on science to which I was neither familiar nor even initiated.

Yet another surprise was awaiting me. Professor Haldane joined the Indian Statistical Institute, Calcutta, in 1957 as Research Professor in Biometry. By an enactment, the Parliament declared ISI as an “institution of national importance” and empowered it to confer degrees in statistics. Curricula to start the B.Stat. and M.Stat. courses were ready. A unique feature of the B.Stat. course was an integrated science teaching programme that included teaching of Physics, Chemistry, Biology and others. The main architect behind all these was Professor Haldane himself. The ISI authorities requested some of the universities to suggest suitable names for possible recruitment to the faculty position for teaching the different sciences. The salary offered was handsome. I was then working as a Senior Research Fellow in Physics at the University College of Science and my name was suggested to ISI by the Calcutta University.

I was not aware of these developments till one day, to my surprise, I received a letter from Dr. R.R. Bahadur, Professor of Statistics at ISI, requesting me to appear for an interview on a specific date and, if possible, to see him prior to it for an informal discussion at my convenience. At the request of my guide, I reluctantly went to meet Dr. Bahadur. It was a hot and sultry summer day of 1960. Dr. Bahadur greeted me with unusual cordiality. With a meaningful smile on his face, he said “Mr. Gupta, it’s not me but Professor Haldane with whom you are supposed to make the informal discussion. Let me accompany you to Professor Haldane’s office on the second floor. ” I got so terrified and nervous that I felt as though I was entering the den of a lion. With few introductory remarks Dr. Bahadur left me to the mercy of J.B.S. never to return during the day.

It in fact was not a room but a spacious hall, covering almost half the floor space of the present Biological Sciences Division. There was an unending row of almirahs studded with books, ranging from anatomy to astronomy, from physics to philosophy, from history to classics. It was the precious

personal collection of J.B.S. I was closetted at one corner with Professor, dressed in white khadi *pyjama* and *panjabi*, sitting in an inclined chair with an extinguished cigar between his lips. He signalled me to take another chair in front of him and the discussion started.

‘Well, you are a physicist. Could you please tell me the difference, from the thermodynamic point of view, between a bullock cart and a motor engine?’

Having been brought up in agricultural farms I had only enjoyed riding bullock carts in my boyhood days. Never did I think of any such unusual comparison at any point of my life. Undaunted (for he called me a ‘physicist’!) I took shelter under the umbrella of the mathematical expression for thermal efficiency of heat engines and it worked well.

An uncanny silence prevailed for a while. Meanwhile, I noted that Professor started quite audibly but the intensity attenuated to near-inaudibility when he finished. I was therefore cautious to receive the second cannon ball.

‘You are a Hindu. You must be knowing what is *rahu* point and what is *ketu* point’.

Thanks to my astronomy teacher at the Presidency College, I could cross the hurdle without difficulty.

The third question was innocent. ‘Where do you stay?’ Quick came my reply : ‘Barasat.’

‘Well, then you know a little bit of agriculture. What are the characteristics of leguminous plants?’

He was hinting at symbiosis – the fixation of nitrogen by a special kind of bacteria colonised in nodules of the roots of such plants. He also asked about photosynthesis. Being a son of an agriculturist and having had Botany as a subject in my intermediate science classes, I replied with confidence.

My self-confidence however did not last long. ‘Could you give me an estimate of the amount of Carbon-di-oxide exhaled by an adult per day?’

Perhaps ignorance sometimes generates a kind of boldness and I boldly said - ‘Sorry, I do not know.’ Seeing me somewhat pained, he added generously : ‘Never mind, many physiologists even cannot answer it, for this requires quantitative thinking which unfortunately is rather rare. If you want to excel in science, try to develop the habit of quantitative thinking.’

The last sentence had a lasting impression on me. It was 1 p.m. and the great man took me to lunch. On the way he said many things, all about science and nothing personal. I thought my ordeal would be over with the

lunch. Soon I realised that I was a fool! The second session of discussion started at 2.30 p.m.

'I hope you have heard the name of the English physicist Robert Hooke' – asked JBS.

I nodded and with a show of smartness uttered a few uncalled for sentences about Hooke's contributions to both physics and biology. I soon realised that by doing so I had dug my own grave.

He said, 'Well, tell me then, if one goes on increasing the size of a small bird proportionately, would it be possible to convert it into an elephant?'

In a desperate bid to answer the question, I falteringly started: "We are to see how much load is borne by the two legs of the bird and ...." God helps those who help themselves. Professor rose from his seat, went to an almirah and brought out a book. It was a small Penguin series publication 'The Possible Worlds' by J.B.S. Haldane. He handed the book to me and requested to go through it till he came back. What a predicament I was thrown into! Leafing through the book I found the problem nicely discussed over there. Professor came back after about an hour and, happily for me, wound up the discussion. He then took me round his lab, showed me some copies of "Journal of Genetics" of which he was then the editor. He even showed me the manuscript of a paper written by him for the journal and asked me to comment on it if I so desired.

Finally he said, "Good bye", when it was 4 p.m. His parting sentence was very assuring – "You are the only person among the candidates I have interviewed who came in proper scientific dress for tropical India". I was in cotton *dhoti* and *panjabi*.

On returning home, I was reflecting on the day's incidents. Here was an unconventional personality, interesting and awesome, I did not see him smiling or in a light mood at any stage during our interview. Yet he was plain and simple, not only in dress and conversation but also in accepting other's attainments. It was enigmatic why he wanted me to comment on his paper. Was it his simplicity or a deliberate attempt to enthuse a budding scientist? Here was a scientist to whom the scientific outlook was not something to nurture within the four walls of the lab, but in one's life style itself, from dress to diet; in fact, in all actions from dawn to dusk. Here was a scientist urging us to think quantitatively and seeking in the diversity of the phenomenological world a unity and an order; a scientist to whom seeing things in slices was a kind of ignorance and knowledge lay in seeing only in



totality.

On July 18, 1960, I joined the Institute and came in closer contact with him. But familiarity did not breed any contempt. Whether in the lab or in the class room or outside, he continued to remain an awesome, interesting and attractive personality. It was a common sight to see him – a powerfully built, impressive, robust figure in Indian dress – coming to the Institute walking gracefully all the way from his residence near Baranagar railway station via the Gopal Lal Thakur Road.

To the students he was friendly but commanding; he had a genuine feeling for their well-being. Whenever he found a group of them eagerly awaiting the arrival of the lift on the ground floor for being transported straight to the class-room on the third, he used to encompass them by stretching out his long right arm and shout, “Come along with me, use the stairs and you will live longer.” Since he left the Institute, I have never heard anybody else shouting thus at a similar sight.

One day I found on the notice board an announcement by Professor Haldane of cash prizes to a number of students. I became curious to know the untold story behind it. Those were the students who responded to an earlier announcement by Professor that whoever would submit self-contradictory statements from the day’s newspapers would receive such cash awards. Often he used to take them to local educational excursions – from botanical gardens to meteorological stations. I also used to accompany the party. It was indeed a unique experience – delightful and delicious intellectual feast for the whole day. His interest was universal and the range of knowledge phenomenal.

Those were the days of integrated science teaching and all the science teachers were expected to attend every other’s class. Imagine a physics class I am teaching with J.B.S. sitting in a corner and asking questions like a student. Basking in the sun is pleasant only when the sun is about 90 million miles away. But the sun here was only a few feet apart and the sensation was truly a burning one!

But Professor was kind to me. Days in the Institute were very different then. Almost every fortnight there was a get-together of scientists either to welcome or to bid farewell to dignitaries of the scientific world. In such congregations, Professor used to introduce me as the young physicist of the Institute. How to make class lectures stimulating was the frequent advice I received from him. He used to say, “You must constantly be returning from

the unfamiliar facts of science to those of everyday experience." As if to illustrate that examples are better than precepts, one day after I finished my lecture on 'diffraction grating' in the class, he slowly stood up and brought something out of his pocket. It was a small piece of gramophone record. I was wondering what the old man would do with it. Suddenly it struck me this was a living example, drawn from the everyday experience, of 'reflection grating', which was, at the beginning of the day's class, a fact of science unfamiliar to students. He brought the piece more for me than for the students and I learnt what he actually meant by "returning from unfamiliar fact of science to those of everyday experience!" Professor had an unusual capacity to correlate observations which were at-first-sight unconnected.

J.B.S. wanted that his students should be given every opportunity of browsing among books and journals. His personal library was so open to students that anybody could take books at any time from the shelves without permission of either J.B.S. or of anybody else. My naughty mind once provoked me to test if and to what extent Professor himself practised 'quantitative thinking'. One day I asked him, "Does not the free access of the students to the shelves of your personal library invite the risk of disappearance of books on a large scale?" Sharp came his reply : "It was about 15 per year in London but less than 10 here. The utility of a book lies in the dissemination of its contents and not in its proud possession." I had my answer and learnt an additional lesson. He specifically mentioned that one of the books that was lost was Kamashastra (translation) and remarked, "I suppose the thief was less ashamed to steal than to buy. Shame is a strange emotion." I was impressed by J.B.S.'s sense of humour.

During his stay at ISI, J.B.S. was deeply engrossed in Indian Philosophy. Indian mythology was at his fingertips. He had also a good knowledge of Sanskrit. As a matter of fact, he wanted to give the Patel Memorial Lecture "The Unity and Diversity of Life" in Sanskrit if he were to deliver it three years later. He came to know from our friend and colleague Professor Davis that I knew a little Sanskrit. This prompted him once to discuss with me the 'Awakening of *Kula-Kundalini*.' His range of knowledge and interest was truly astounding! His friend and celebrated biologist Julian Huxley rightly remarked that this gentleman did everything on earth except putting his head on the rail-road.

To the massive mute world of plants and animals, J.B.S. had a special feeling. He believed in non-violent approach to experimental biology. He

had never done an experiment with an animal of a kind which he did not do previously or subsequently on himself. He dissected dead animals and hence left the instruction that he should also be dissected by medical students after his death. He believed that by using oneself or a friend, far greater experimental accuracy was possible than by using animals. He used to say, "In my experience, kindness to human beings and to animals usually go together. Those who ignore suffering in animals find it easier to ignore human suffering."

In this context, J.B.S. used to often quote from Francis Darwin's reminiscences of his father, Charles Darwin. "I used to like to hear him admire the beauty of a flower; it was a kind of gratitude to the flower itself, and a personal love of its delicate form and colour. I think he sometimes fused together his admiration of the structure of a flower and its intrinsic beauty." When observing animals he often stood completely still. "It was one of these occasions that some young squirrels ran up his back and legs, while their mother barked at them in agony from a tree." J.B.S.'s own feeling, I believe, was also similar and he remarked that "similar incidents of concentration are, of course, recorded of *rishis* in India."

He used to say that we can learn moral lessons from animals. Wolves and ravens even in their fights with formidable teeth and beaks always end the fight abruptly if the vanquished surrenders. Unfortunately men are not always so merciful as wolves and ravens. J.B.S. was deeply pained at the sight of collection of date-palm juice in rural Bengal during the winter. He described this as the most cruel scene he ever observed. To him it was worse than death, the denial of life.

Soon I realised that he was a tough man to work with, exacting in all his undertakings and uncompromising in matters of principle. He would not let anybody pass any misleading views without merciless criticism. He hated superficial knowledge and more so in its dissemination. Once I attended a seminar on the "Effectiveness of audio-visual teaching" in the lecture theatre of the Saha Institute of Nuclear Physics, Calcutta. I found Professor Haldane and his wife Dr. Helen Spurway in the audience. Speakers, one after another, spoke at length in favour of the audio-visual method. The seminar was presided over by Dr. Priyada Ranjan Roy, the doyen of Indian chemists, who invited comments from the audience. Professor Haldane stood up and asked a simple question whether any of the speakers had the experience of conducting controlled experiments on the matter. An uneasy lull prevailed.

He then narrated the experiments carried out by him, which did not support the views expressed by the speakers. It appeared that the seminar was a flop and the time spent was totally abortive.

About Indian science and scientists, his remarks were often devastatingly provocative, sometimes even explosive. About the manuscripts he used to receive from authors for his comments he said, "Most of them display a fantastic inaccuracy whenever a statement is made which purports to be scientific. I have the choice of being rude to their authors or trying to teach them elementary science by correspondence." As to why science in India was developing with disappointing slowness, his conclusion was - "It is not because Indians are stupid or lazy. It is because they are too polite and courteous. They spend hours daily in conversation with others, not on professional matters, but on personal topics. But in science efficiency is more important than courtesy." "A large number of Indian scientists have no pride in their profession, though they are proud of their salaries and positions. The opposite attitude is common in Europe as it was in ancient India. In India today the unworthy successors of Durvasa and Visvamitra invite governors, vice-chancellors and the like, to address them."

Once he got infuriated by reading a statistical report that appeared in a leading daily about floods in the Damodar valley and remarked, "if these figures were invented by a statistician, he would be of more use to his country if he were carrying earth in a basket to make *bundhs*."

On one occasion I myself got the bitter taste of his acid tongue. I had gone to him for some discussion which went on smoothly and his response was sensible. On completion, I did not leave immediately but overstayed for about a minute out of sheer politeness. Suddenly I heard the roar of the lion : "Leave me, I have my own work; I rushed out of his room in a dejected mood. But in the choice between politeness and efficiency, he was always vocal for the latter. Such a person runs the risk of being misunderstood. And J.B.S. was widely known as a 'rude' person. In this context Professor N.W. Pirie's analysis appears to me to be very sensible. "I associated with him regularly on various activities from 1928 until the end of his life, we were never in political agreement, but he was at no stage rude to me. I can say that of few other productive scientists with whom I have associated so much. He was often abstracted or preoccupied but, if approached sensibly, gave a sensible response. Those who did not like him were apt to say that he was 'immature' in his occasionally violent reaction to what seemed to them trivial

harassments. The traits could as accurately be described by saying that he postponed senility for longer than most people do – this is neither an unusual nor an unattractive character in many great scientists. Explosions of anger were usually brought on by someone's foolish behaviour or the expression of an obscurantist point of view, but sometimes by solicitude. When offered by some hospitable person a service that he did not want, he would refuse it gently, if the offer were repeated the refusal would be more forceful and so on. He acted here on the sound biological principle that you increase the stimulus until the required reaction is achieved; the only valid criticism is that the increments were sometimes unconventionally large."

While growing up in the Haldanean environment at ISI, I heard one day that Professor Haldane resigned and would leave the Institute. Many stories were in circulation about the immediate cause of the resignation. It was a matter of regret to many of us. J.B.S. was not pulling on well with Professor Mahalanobis, the founder of ISI, and the resignation was an outcome of frictions that developed due to clashes of personality. There cannot be two kings in the same territory.

After he left the Institute in 1961, I had hardly any contact with him except during some of his stray visits to Calcutta. I also did not write to him for I knew his dilemma. Once he remarked: "If I am to answer all the letters I receive, I shall have no time for my work. If I answer no letter, I shall get a reputation for rudeness."

My last contact with him was indirect and somewhat unusual. Along with some of my other colleagues in the Institute one day I received a poem "Cancer's a Funny Thing." To my amazement I found that the poet was none other than J.B.S. It began as

*"I wish I had the voice of Homer  
To sing of rectal carcinoma",*

interspersed with vivid details of its first suspicion, and subsequent confirmation by medical test:

*"The microscope returned the answer  
That I had certainly got Cancer",*

followed by the surgeon's operational details and humour at his own cost:

*"So now I am like two-faced Janus  
The only god who sees his anus",*

and finally towards the end:

*"My final word, before I'm done,  
Is 'cancer can be rather fun'.*

.....  
*I know that cancer often kills  
But so do cars and sleeping pills;  
And it can hurt one till one sweats,  
So can bad teeth and unpaid debts.  
A spot of laughter, I am sure,  
Often accelerates one's cure".*

What a mental frame the man was composed of ! It is not philosophising over death as the golden gate to a new life, nor a cold and dispassionate indifference to what is so natural, nor even accepting it as an immutable decree of fate. Einstein once remarked in a chat with Infeld "Life is an exciting show. I enjoy it. It is wonderful. But if I knew that I should have to die in three hours, it would impress me very little. I should think how best to use the last three hours, then quietly order my papers and lie peacefully down." J.B.S. also enjoyed life and its associated wonder. It was no less an exciting show to him. But he was a fish of different water and went a step forward to make fun with Death. No ordinary balance of assessment could weigh him. When he knew he was dying, his resentment was directed at medical secrecy. He had a feeling that the severity of his condition was not properly reported to him. Had it not been so, he could have planned his work during the last year more fruitfully and productively.

Haldane is no more in his mortal frame. But such a life is never extinguished. Posterity will, for all time to come, evince intense interest in this extraordinary life. Personally I shall derive, particularly in weaker moments of life, strength and courage by mental immersion in that brief but golden period of my association with the giant.

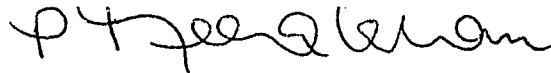
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1992

**J.B.S. HALDANE  
AS AN INFORMAL TEACHER:  
SOME PERSONAL REMINISCENCES**



P. Meera Khan  
Department of Human Genetics  
Leiden University  
P.O. Box 9503, 2300 RA Leiden  
The Netherlands

*“To the memory of Professor J.B.S. Haldane, – the man who bought a ticket for me and rushed me to the band-wagon of human geneticists more than a decade ago ...”*, was a part of the inscription of dedication printed in my academic thesis more than two decades ago.<sup>1</sup>

An elaboration of that inscription, I believe, would be appropriate as a personal-remiscences article for the Haldane Centenary Album. The invitation of the Indian Statistical Institute (ISI) to contribute to the Album makes me happy for two personal reasons: (a) my great honour of association with Haldane started in the campus of ISI, and (b) it has strongly motivated me to travel back through the marvels (at least to me) of my past.

In India, Haldane had only a selected number of associates working with him. On the occasion of his election as a foreign member of U.S. National Academy of Sciences, in a letter of acceptance,<sup>2</sup> Haldane listed six<sup>3</sup> and stated *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. I regard the help which I have been able to give to young men of great ability who would have had little chance without me, as a service to science as important as, and perhaps more difficult than, the first estimation of a human mutation rate or the discovery that oxygen at seven atmospheres' pressure, has a taste.* Of them, Krishna R. Dronamraju was the second to join Haldane at the ISI. Dronamraju visited me in 1959 to explain a research programme in which Haldane proposed to involve a medically qualified person as an active participant.

### How did it all come about?

That was about two years after Professor Haldane's migration to India. Haldane's popular writings in *The Hindu* newspaper, were becoming a regular feature of his teachings to hundreds of thousands of serious minded students of science in India. In one of his articles he described the work of his disciple

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<sup>1</sup>Meera Khan P. (1971) *Enzyme studies in the interspecific somatic cell hybrids with special reference to the mapping of the human X-chromosome.* Academic Thesis, State University of Leiden, Drukkerij-Beugelsdijk, Leiden, p.5.

<sup>2</sup>Written from Bhubaneswar to Harrison Brown Esq, Foreign Secretary, National Academy of Sciences, (Washington, D.C., U.S.A.) dated May 9, 1964.

<sup>3</sup>The six scientific associates to whom copies of this letter were marked alphabetically, were T.A. Davis, K.R. Dronamraju, S.D. Jayakar, P. Meera Khan, Ajit K. Ray, and S.K. Roy.



Dronamraju on the pollinating behaviour of butterflies and its relevance to speciation. During the same year, Haldane visited Andhra Medical College, Visakhapatnam, Andhra Pradesh, and delivered a lecture on high altitude physiology and physiology of deep sea diving. As a student of that college I had the privilege of attending his lecture and the opportunity of learning more about Dronamraju.<sup>4</sup>

I wrote a congratulatory note to Krishna for his achievements. On his next visit to Andhra Pradesh he came to see me and told me that he was in Andhra Pradesh to gather data on the pattern of inheritance of hairy pinnae. He tried to explain the significance of that study. His work on hairy pinnae did not impress me, probably due to my 'medical student's' ignorance of human genetics in the year 1959. Moreover, I was busy with my final examinations. I was more bothered about peptic ulcers, muscular dystrophies, refractory anaemias, organ specific cancers, diabetes mellitus, hypertension and the like. We did not have genetics in our medical curriculum. Mendel's laws of inheritance that I had learned from our botany teachers at P.R.G. College in the year 1953 did not help me to continue a reasonable conversation on hairy pinnae. Then our talk moved on to the widespread practice of consanguineous marriages in Andhra Pradesh. Their relevance to the recessive diseases made me rather enthusiastic. I believe that, that was the seed which grew into our joint studies on the frequencies and the clinical effects of consanguineous marriages in Andhra Pradesh.

A few weeks later Dr. Helen Spurway (Haldane's wife) and Dronamraju visited Visakhapatnam and discussed the terms of collaboration and the data collection forms for the collection of clinical data and marriage information from individual patients in the wards of King George's Hospital, the teaching hospital attached to Andhra Medical College at Visakhapatnam where I was to continue to work as an Intern or a House Surgeon for the next 18 months as was the practice during that period. The discussions, especially those

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<sup>4</sup>Dronamraju and I were class mates at P.R.G. College at Kakinada, also in Andhra Pradesh. The college was one of the premier institutes of learning originally established by the aristocracy of the region, the *Rajahs* of Pithapur. Our teachers of botany in that college were specially gifted and their lectures on Mendel's work were particularly inspiring. Incidentally, it may be interesting to note that Professor R.S.K. Chaganti, now at the Memorial Sloan-Kettering Cancer Center, New York, and Professor R. Kucherlapati, presently at the Albert Einstein College of Medicine, Bronx, New York, were students of botany in the same college around the same period.

with Helen Spurway, were clear, unambiguous, elaborate, critical and very educative to me. They motivated me to the extent of 'total sacrifice and complete surrender.'

After obtaining the required permissions from the appropriate authorities, and with the spontaneous help also of senior and junior colleagues in charge of patients in various wards of the nearly 1000-bedded hospital, I started the investigations during my spare time. Of course, my 'spare time' included all the off-duty hours during afternoons, evenings, nights, weekends, holidays and days of vacation, if any. After the completion of my investigations on the first 143 cases,<sup>5</sup> I was invited to Calcutta. The visit was arranged for Haldane to examine and to analyse (or, in Haldane's words, "to squeeze maximum" out of) the data.

The ever enthusiastic Mrs. Haldane and Dronamraju received me at the Howrah Station<sup>6</sup> and drove me directly to the ISI. On reaching the campus, while I was being introduced to the colleagues and the labs, the pile of my data sheets were quickly channelled to Haldane for his inspection, prior to our meeting with him. Haldane joined us that afternoon in the library for a quick but delicious lunch arranged by Mrs. Haldane. During that lunch, among other things, Haldane spoke about Julia Bell who gathered and analysed information on the incidence of consanguinity in England and Wales and mentioned briefly about similar work done by others elsewhere in the world. He enquired about the most common diseases in Andhra Pradesh and among the in-patients of King George's Hospital, Visakhapatnam. I stayed in Haldane's house, as I did on all my subsequent visits. Mrs. Haldane was a fabulous hostess. Haldane was extremely kind and gentle to his guests.

It was almost a 16 hours-a-day schedule, about 80% of which was either work, study or discussions. On that visit I was there for 4 days and returned home with about 4 months' worth of fruitful experience. The first gifts I received from Mrs. Haldane were two books: one, Curt Stern's classical book *The Principles of Human Genetics* and the other, *Principles of Genetics* by Sinnott, Dunn and Dobzhansky.

The work continued uninterruptedly till I completed my tenure of House Surgeoncy in July 1961. Four months preceding that, in February 1961,

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<sup>5</sup>This part of the work was reported in *Journal of Heredity* 51 : 238-242, 1960.

<sup>6</sup>The main railway station of Calcutta

Haldane wrote<sup>7</sup> to the Commission which was to consider my claim to a post as an Assistant Surgeon in Andhra Pradesh Government Medical Services: *Dr. P. Meera Khan, has been working on human genetics in his spare time for about a year, so far in conjunction with Mr. Krishna Rao Dronamraju. The discoveries which they have made in their first year are, in my opinion, the most important yet made in India in this field. Mr. Dronamraju has, so far, done more than half of the work. But Dr. Meera Khan has done a very substantial fraction. He has stayed in my house and I have discussed the work with him. I have no doubt that he understands clearly enough what he is doing, and can be trusted to develop it, to some extent at least, in new directions. I am also sure that he will be willing to discuss his work with me; and to consider suggestions which I may make for further work. I wish to add that neither in India nor in Britain would the vast majority of young medical men be capable of doing what he has done. They have neither the needed intelligence and intellectual integrity, nor the energy and ambition to do hard work in their spare time.*

*In addition Dr. Meera Khan has played a large part in the collection of data on the frequencies of the blood groups, and of the different types of colour-blindness, in Andhra Pradesh. It is my considered opinion that if Dr. Meera Khan has opportunities of continuing this work, he will be known all over the world (though of course in a restricted circle of specialists) within a few years.*

Haldane's letters on such occasions were designed to serve simultaneously several purposes. Invariably copies of such letters were sent to the colleagues concerned. The letter may contain one or more important hints about the work, that for some reason, could not be communicated more directly. It may include Haldane's impressions on the progress of the work, suggestions on a new line of research, means of providing funds for the work, a set of conditions that might be required to improve or implement a given project, etc. The 1000-worded letter, only a part of which is quoted above, did contain all of them.

Every visit to Haldane was a new exposure, a new crash course and a new chapter in my growing book of learning. The study facilities provided by this extra-ordinary teacher included the continuous flow of his ideas, unrestricted

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<sup>7</sup>From Calcutta to The Secretary, Andhra Pradesh Public Service Commission (Hyderabad) dated 2 January 1961.

access to his sufficiently large personal library of books and periodicals, his numerous thought-provoking scientific as well as popular articles, uninterrupted stimulating correspondence, and most importantly a guaranteed protection from the ravages of bureaucracy of the day. Moreover, Haldane's written comments, suggestions and letters had been extremely effective as methods of teaching science and scientific outlook to his junior colleagues. He was extremely critical about the results of his colleagues and sometimes devised new statistical tests to evaluate them. The drafts were returned to the concerned almost always with a number of constructive suggestions. Our data on the effects of consanguinity in Andhra Pradesh (Dronamraju and Meera Khan, 1963) sufficiently inspired Haldane to write:<sup>8</sup> *These results are of the very greatest interest, and break entirely new ground. For this very reason they require a highly critical examination.* He, then, developed a test to work out the standard error of an estimated coefficient of inbreeding. Sending a copy of a draft of its description, in an accompanying note he wrote, *Please don't think that this paper means either that I think your and his (Dronamraju's) way of marshalling the data is wrong, or that your conclusions are incorrect. What many Indians do not realise is that in Europe scientific papers are criticized fairly sharply. This is needed to keep up the standard. So don't think I don't admire your work. On the contrary, I propose to boast about it at Monaco in May.*<sup>8-10</sup>

As per the suggestion of Haldane, I joined the Andhra Pradesh Government Medical Services to work in a rural area where I would continue studies more thoroughly, on the clinical effects of consanguinity. But a few weeks later, there came a letter from Haldane:<sup>11</sup> *When in Rome and Naples I saw Dr. Siniscalco, who is working on the genetically determined abnormalities which are alleged to give protection from malaria*<sup>12</sup>, namely abnormal

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<sup>8</sup>Haldane, J.B.S.: Notes on Dronamraju and Meera Khan's data on consanguinity in Andhra Pradesh. (Manuscript, March 1961)

<sup>9</sup>From Calcutta to K.R. Dronamraju (Glasgow) dated 3 March 1961.

<sup>10</sup>From Calcutta to P. Meera Khan (Visakhapatnam) dated 11 March 1961.

<sup>11</sup>From Calcutta to P. Meera Khan (Venkataramannagudem) dated September 23, 1961.

<sup>12</sup>In 1949, in a paper entitled, "Disease and evolution" Haldane suggested that it is an advantage for a species to be biologically diverse, and even to be mutable as regards genes concerned in disease resistance. He suggested explicitly that genetic (serological and biochemical) diversity among species may play a part in disease resistance. Haldane believed that few of these ideas can be followed profitably except on the basis of much field work (Haldane, 1949). Such studies were well on the way in several populations, including

haemoglobins, thalassaemia in heterozygotes, and glucose-6-phosphate dehydrogenase deficiency of the red corpuscles. This latter condition leads to haemolysis from drugs such as primaquine, and from some species of beans, such as *Vicia fava*. Siniscalco has been working in Sardinia, and finds that the frequencies of thalassaemia and enzyme deficiency are both high in the formerly malarial areas of that island. He wants to work in an area of India where malaria (and particularly *P. falciparum* malaria) is not yet eradicated. He would therefore like to work with you if you go to a malarious area. He therefore suggests that you should come to Italy when you can, and learn the techniques, first in the laboratory at Naples, then in the field in Sardinia. This would imply your getting three or four months' leave. I propose to pay for your journeys to and from Italy, and for your expenses there, up to 120,000 lire (about Rs. 1000) per month, and more if needed. I shall, I hope, be able to afford this easily, as I have been awarded a Feltrinelli prize of more than a lakh.

Of course, I agreed to take up that challenging turn. Haldane gave me a new set of instructions<sup>13</sup> to get properly prepared for the next chapter: *I think the most useful thing you can do is to look for suitably malarious areas in Andhra Pradesh. With regard to other diseases, Indian workers have found that smallpox is more dangerous to blood groups A and AB than to O and B. There is also evidence that anti-syphilitic treatment is more effective on members of group O than the other groups. I do not know if untreated syphilis is less common or less severe in group O. But I know little of human genetics. That was how I was directed to Siniscalco. Siniscalco will be able to help you. As however you will come across plenty of untreated cases of smallpox and syphilis you may be able to confirm or refute these statements. I hope to get a new institute next month, but I am aware that such things take a long time.*

I started preliminaries to go to Italy. I applied to my superiors for sanctioning a leave of absence for 4 months starting from January 1, 1962. In spite of repeated requests there was no response from the bureaucrats at

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one in Sardinia by Professor Marcello Siniscalco who was investigating the genetic basis for malaria resistance. Haldane realised that India can offer an excellent field where such work can profitably be performed, and believed that a collaboration with Siniscalco would be invaluable. Haldane had a great admiration for Siniscalco's scientific capabilities and organizational abilities. He hoped that an eventual long range collaboration with him would make a substantial contribution to the establishment of human genetics in India.

<sup>13</sup>From Calcutta to P. Meera Khan (Venkataramannagudem) dated October 27, 1961.

Hyderabad. In those days the Andhra Pradesh bureaucratic machinery was known to be too complex, too slow and rarely efficient. For me it was an extremely difficult and painful exercise to deal with. More so because I was standing in the middle of a long rope held by two 'extremes' in every sense. Bureaucrats at Hyderabad could pass over forever. Haldane could see the danger and quickly thought of alternatives to save me:<sup>14</sup> *I have telegraphed to Thacker<sup>15</sup> and am writing. But if you cannot get leave I want to ask the following questions.*

1. *If you resigned your post, could you go to Italy as arranged, or do you have to give notice of resignation?*
2. *If you did so, would you subsequently be able to arrange an expedition with Siniscalco in a malarious district?*
3. *If the answers to 1 and 2 are in the affirmative, I am prepared to give you .... Given this, will you consider resignation?*

*I have a great deal more money than when I saw you last, and no more needs. So do not hesitate to say "Yes" to 3 if the answers to 1 and 2 are "Yes." This matter is of course, urgent.*

Fortunately, I did not have to answer the above letter. The unbreakable could be shattered. The leave of my absence was sanctioned. I worked in Naples and Sardinia. Siniscalco's Sardinian campaign included also the mapping of the human X-chromosome using the then available X-linked markers G6PD, different forms of colour blindness, haemophilias A and B, and Xg(a) blood group. On hearing also about that part of our work, Haldane remarked:<sup>16</sup> *It is funny to think that Bell and I were in at the start of this human X chromosome work. Though in fact I am much more of an ancient monument than that. I heard my first lecture on genetics at Oxford in 1900, and did not understand much of it.*

In the same letter<sup>17</sup> Haldane wrote: *I hope you will continue to take the Feltrinelli money, particularly as I should like you to go to London, if*

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<sup>14</sup>From Calcutta to P. Meera Khan (Venkataramannagudem) dated December 18, 1961

<sup>15</sup>M.S. Thacker was the then Director General of Council of Scientific and Industrial Research, Government of India.

<sup>16</sup>From Calcutta to P. Meera Khan (Naples) dated April 17, 1962.

<sup>17</sup>From Calcutta to P. Meera Khan (Naples) dated April 17, 1962.

even for a few days, to see K.R. Dronamraju (and others) before you get back. The others were Professor Harry Harris then at King's College and Professor L.S. Penrose at Galton Laboratory. Both the visits had left lasting impressions on me. Harris was investigating dosage compensation in patients with Klinefelter syndrome by using G6PD as a biochemical genetic marker. Penrose's group was engaged in the work on Down syndrome due to translocations involving chromosome 21. Both the problems were equally intriguing in those days. Also in the corridors of Galton Laboratory I met Dr. Bowman (Chicago) and Dr. Sheila Maynard-Smith (London) who were collaborating on another interesting aspect of dosage compensation phenomenon, employing females who were known to be heterozygous for G6PD deficiency. Dosage compensation of X-linked genes was a hot topic of the time, the time when Mary Lyon's paper on X-inactivation hypothesis was published in *Nature*. To the same end, representing the group of Barton Childs (Johns Hopkins, Baltimore), Dr. Ronald Davidson joined our campaign to measure G6PD activities in the obligate heterozygotes among the Sardinian families. Therefore, my conversations with Professor Harris, Dr. Bowman and Dr. Sheila Maynard-Smith were extremely enjoyable. Among the others I had the opportunity of meeting were C.A.B. Smith, H. Kalmus, and E.B. Robson. Thus, my first visit to London, though extremely brief, had greatly influenced my further scientific career. I am grateful to Dronamraju for taking extreme care in planning and organizing those visits in London to the full satisfaction of Haldane's desire.

I went back and joined as a Government Medical Officer at Polavaram which is located on the west bank of the Godavari, very close to the forest areas where epidemics of *Plasmodium falciparum* were reported, a few months hence. Siniscalco helped me in taking along minimum essential equipment and chemicals to set up a modest facility to perform preliminary work on tribals and non-tribals living in and around the malarial belt of the region. This was meant also to make preparations for an eventual large scale expedition.

Haldane played a major role in arranging that expedition. I was in charge of the expedition at the Indian end. From Europe we had Professor Siniscalco. World Health Organization had paid much of its expenses. Also Haldane contributed substantially to its implementation. Of course, he started the whole thing by sending me to work with Siniscalco in Sardinia and learn techniques.

During the expedition, my services from the Andhra Pradesh Govern-

ment were lent to the World Health Organization for 3 months. My wife, Prabha Khan, was in-charge of all the local arrangements. A part of our residence in Polavaram was converted into a temporary laboratory and was used also to accommodate some of the visiting participants. The visiting participants included Marcello Siniscalco, Luigi Bernini, Mario Rattazzi, George Stamatoyannopoulos, Loe Went, Ajit K. Ray, Sastry Mangipudi.

Haldane's financial support during the Andhra Pradesh expedition, though modest, was earned by him in a very hard way as can be seen from his letters accompanying his cheques. *I enclose a cheque for Rs. 5000 as requested in Siniscalco's letter of October 2nd. I gave a talk for the British Broadcasting Corporation on September 15th, and they promised to send you a cheque for £40, which is a little over Rs. 500. If they have not done so, please take any money which you need from the contingencies covered by the Rs. 5000. I am just off to the U.S.A. where I hope to earn another \$ 1000 or more to pay for the remaining expenses.*<sup>18</sup>

Then followed another from Tallahassee, Florida: *I enclose a cheque for \$ 975 (about Rs. 5000). I hope to earn most of the rest which you ask for before I leave here. It is an unpleasant way of earning money, but quick. I don't think I have learned much which is relevant to your work, but some. However Siniscalco will know it*<sup>19</sup>

In the same letter<sup>20</sup> he spoke about a hint of cancer in his large bowel, which he doubted, *I am protesting against American food with dysentery, passing a lot of blood but with no pain. They won't be treating me for amoebiasis, as they found no cysts. Indeed the local doctor hints that I have cancer.*

Then followed the most disturbing one.<sup>21</sup> *While I know that I am fortunate that my carcinoma was located in the rectum, which can be removed with lymphatics, rather than in most other sites, and am also aware that so long as cancer is part of the normal human condition, I had better have it if I live long enough. Nevertheless I venture to hope that you and your wife will escape it and live long enough to get a proper chemotherapeutic or serotherapeutic treatment when you do.*

He was disappointed that he could not join us during the expedition. He

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<sup>18</sup>From Bhubaneswar to P. Meera Khan (Polavaram) dated October 7, 1963.

<sup>19</sup>From Tallahassee, Florida, USA, to P. Meera Khan (Polavaram) dated Nov. 8, 1963.

<sup>20</sup>From Tallahassee, Florida to P. Meera Khan (Polavaram) dated Nov. 8, 1963.

<sup>21</sup>From University College Hospital, London, to P. Meera Khan (Polavaram) dated December 21, 1963.



knew that he was soon going to die of cancer. Yet he continued to teach the principles and practice of moral courage, scientific honesty, intellectual integrity and the gospel of "discovering new truths and spreading the old ones" (Haldane, 1965).<sup>22</sup>

*I may not be able to get to Polavaram. So I should be very glad to learn what is happening; and particularly whether your result that some G(6)PD (deficient) bloods reduce the dye<sup>23</sup> after a few hours, and others not till after 24, is being confirmed. If not it would be well to withdraw your paper on the subject, which, I understand from Jayakar, is now in press.*<sup>24</sup>

One of the last signed documents from him<sup>25</sup> was to tell me, *You should perhaps know that under my will, you and several other colleagues are to receive sums which amount to several years' salary. So don't hesitate to spend anything on your personal and family needs. If it amounts to more than Rs. 1,000 or so I might deduct it from the legacy.*

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<sup>22</sup>Haldane advocated the importance of encouraging the young scientists engaged in active research, to participate in appropriate conferences. He stressed this point in a reply to the letter of the Registrar General of India in connection with the 11th International Congress of Genetics to be held in The Hague in September 1963. In a note accompanying a copy of that letter Haldane insisted that *There is of course no need to go if you don't want to. But if a joint paper is read, you should go.* I did go. It was a thrilling experience. The Congress was overwhelming. It was one of the best congresses I have ever attended. Haldane's plenary lecture (Haldane, 1965) was a special feature and it dealt with "The implications of genetics for human society." He projected his thoughts far into the future. Even today it can be read with refreshing joy.

<sup>23</sup>In the so called Motulsky test the dye brilliant cresyl blue (BCB) can not be reduced if the enzyme glucose-6-phosphate dehydrogenase (G6PD) is lacking in the blood.

<sup>24</sup>From University College Hospital, London, to P. Meera Khan (Polavaram) dated 30/01/'64.

<sup>25</sup>From Bhubaneswar to P. Meera Khan (Polavaram) dated June 4, 1964.

A few years later I dedicated my thesis "To the memory of Professor J.B.S Haldane, - the man who ... rushed me to the band-wagon of human geneticists ..."

Because of his being so informal and subtle a teacher, still today, I do not know for certain, whether I was a student, a disciple, an associate, a colleague, a collaborator, a protégé or a beneficiary of Haldane.

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**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

**IN THE DARK HOURS**

*Naomi Mitchison*

Naomi Mitchison  
Carradale House  
Carradale, Campbeltown  
Argyll PA28 6QQ  
U.K.

In the dark hours my brother, J.B.S. Haldane, then aged 21 and almost certainly a virgin, would crawl out of the Black Watch trench, through the strategic barbed wire defence until he was near enough to the German trenches. Then he pitched in the bombs he was carrying. In the immediate sharp light of the explosion, if all had gone as intended, he would see arms and legs; bits of German soldiers, shooting up and falling over. Then black night and perhaps a counter-bomb exploding close. He told me about it, back on short leave, when at last he got into a bath and began to de-louse himself, while we went over the seams in his kilt with a hot iron.

This was in 1915. In this same war, a relation of ours, then in a fairly high military position, refused to land what he called his 'Glasgow corner-boys' into what would have been certain death on Gallipoli. And so it went.

In the summer of 1955, Jack and Helen Spurway were staying with me in Scotland where we have too many clegs - biting gadflies - and one settled on his hand. I was going to swat it but he stopped me, saying she is going to lay her eggs and needs a drink. While he looked on, she got her fill of his blood. So, what has happened?

1915 was the year of the first poison gas. Our father was sent for by the War Office; he demanded the only fellow scientist whom he knew to be totally competent - his son - to help with this crisis which might have lost the war. They identified the gas and possible masks. My brother hurried back to his regiment but fell, wounded, before he got there. Most of his fellow officers were killed that day.

It is difficult to think of that first war without bitter anger at the top brass, military or civil. Later wars do not confine themselves to the actual fighters. But in 1916 my brother, still with the *Black Watch*, was sent to another edge of the war, was wounded again but this time sent to a hospital in India. Here not only did he recover, but he became deeply interested in Indian ways of facing the universe, including mankind with its pains and ignorance, wanting things so much that wanting swallowed virtue. Yes, he thought, these people have put their fingers onto ideas and stories that fit the world better than those of the west. Being near death often makes people think. It also makes them discard a lot of moral and intellectual trash. In India JBS went through all this.

A new kind of thinking may change your ideas of what one ought — or ought not — to do. Few people who went through the first war remained morally unchanged. They might, for a little, swim in the warm lake of love

and gratitude and the old world, but reality was war. What you had done yourself. Or not done. This is what the survivors had to deal with.

Some did it in writing, letting their anger grow: 'He did for them both with his plan of attack.' Others went deeper, beyond blaming the Generals to blaming their own ignorance. For some, this meant digging into the secret life of the world: scientific research.

But it was also the whole structure of morality and that, quickly, became politics. By now we ought to understand what happens to people who go through a modern war. The strongest turn to action of some kind, often with enough danger to make it comparable with what they have already experienced. JBS plunged into science, which was often, and perhaps most sought after, dangerous, but an answer to a new question. All I can do is try and interpret. Sometimes survivors were only glad to be among the birds and flowers of peace and love. It was so with my husband who had also gone through that war. Jack and Dick, the two old Etonians, both of whom had taken *Firsts in Greats* at Oxford in the far off years before the war, always got on well, though they were very different people.

But those who had killed and been almost killed themselves could only take short holidays. For a time, working for a few years in his father's home laboratory with a good team, Jack often enjoyed himself, felt his strength. He also enjoyed his love affairs and sometimes confided in me. But his eventual marriage was not a success. Probably a bad attack of mumps in boyhood had destroyed his chance of fertility. Underneath he envied my child-bearing. We saw less of one another, stepped warily, exchanging publications but not dreams. That only ended when Helen, his second wife, knocked our heads together in India.

He had become very sensitive to other forms of life, preferring to use himself for interesting experiments rather than trying them on other animals. Like most of those who went through the first war, he was suspicious of all politicians, but less if they were not rich and powerful. The great Indian leaders could be admired because they had been persecuted. He kept contact with India through the next war, working mostly in London and, by that time, calling himself Communist, because of what they were against rather than what they were for. Most of the CP leaders were singularly nice people, do-gooders, making mistakes no doubt, but wanting deeply to help people who were not getting help anywhere else. Probably they could have gone wrong if they had come to power, as happened elsewhere, but when they

were fighting and suffering for others, they had great attraction.

By the end of the '30s, the politics of Europe were shaping. Events in Spain and Russia had shaken everything up. Those who had been in the first war were inevitably into politics and mostly against 'the Generals', the top dogs, politicians and moneyed classes. In science, JBS was doing increasingly dangerous things, answering deeper and deeper questions. Sometimes I thought that what he wanted was the genuine experience of death. His dealings with people he suspected of being top dogs became increasingly negative. By this time he had found Helen Spurway, as brave as he was.

But then came the disaster of the submarine and the Admiralty asked for his help. I doubt if the Army would have done so, or even would have known about him. It did not worry the Navy that he was a member of the CP. The experimental work he did on submarines left him with a strained back and pain of some kind for the rest of his life. But for many ordinary people, especially those associated with the Navy, he was a hero.

He was as lost about post-war politics as the rest of us. We saw cruelties and mistakes, but always too late. We saw good ideas perhaps being tried, or half-tried. But what Beveridge and his colleagues had worked into a solid policy during the war years was accepted, turning into a social structure which is still partly there, in spite of many attempts to get rid of it altogether. By now other countries have gone ahead of us, but we were the first.

But JBS was not happy at University college. When I visited him there, he swept me, scowling, past colleagues of whom he disapproved. Helen, meanwhile, had seen some improbable, but apparently true, happenings among small fishes. New importances arrived in biology. Also there had been the new kind of warfare, the dropping of the Hiroshima bomb. We may well consider that the alternative was an even more destructive invasion of Japan. But it left a curious sense of scientific guilt. Jack and Helen went back to India.

After all these wars, not quite knowing where we were, he and I played the dangerous game of half-believing in things like religions, as slippery as politics. In India that was very close to everyday life. JBS allowed himself to half-believe in such Indian religious ideas as fitted into his own non-religious ones. He saw there is bound to be a twist of good and bad in all human societies and their various religions. But above all, I think, what appealed to him in all religions was the throwing out of Brother Body if it was playing against Brother Soul - or Mind. He knew that all life has its own shape and

importance, although we cannot always recognise it. Meanwhile the Indian pattern included animals and Gods, not that either of them were treated any better, but they were accepted as being the same.

As most of us know, it is hard to put this into clear words, but he knew, as others do, that the usual political and social ideas are only one side of things and that power, either military, financial, or religious, interferes with the way of love which is also happiness and forces us into mistakes. In theory, democracy should be the way of love, but only, I am afraid, in rather specialised bodies, which do not yet exist.

JBS came back from India for conferences, joked with my husband Dick, his fellow Etonian, now an MP, insisted on wearing a *dhoti*, somewhat saffron coloured, for FRS receptions (but I had to put in the safety pins) and found what was going on in the world of science. But cancer was discovered. He was operated on but was not told that it was too late and he would die in a short time. Nor was his wife or any of his immediate family, including a doctor. None of us thought this was goodbye, nor did he. There were various scientific projects in India which he started, instead of finishing those which were already going. He died in great pain, leaving too much undone. But what he did do and become is still relevant, and so is his attitude to even the most inveterate forms of life. Including the gadfly that drank his blood.

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

**SOCIAL AND POLITICAL OUTLOOK OF  
J.B.S. HALDANE**

A rectangular stamp containing a handwritten signature in cursive script, which reads "N.W. Pirie". The background of the stamp is a dark, textured pattern.

N.W. Pirie  
Rothamsted Experimental Station  
Harpenden  
Herts AL5 2JQ  
England



The Haldane family had an established place in Scottish history for 700 years. That may make its members a little arrogant, but it protects them from blandishments by upstart Establishments. J.B.S. Haldane was precocious: he read reports of British Association meetings when 5 years old, learnt Latin through hearing others being taught, and memorised poetry unusually easily. He retained a prodigious memory throughout his life. That, coupled with an interest in nearly everything, except sport and gossip about the non-scientific activities of his acquaintances, made him an unusually interesting companion. Furthermore, his conversation, like his writing, was liberally enlivened by humour.

### Religion and other aspects of the imagination

His father, J.S. Haldane, had studied slum conditions in Dundee and worked on methods for improving conditions in mines and other confined places; his mother was similarly involved in activities aimed at relieving the 'human predicament.' Neither had any conventional religious belief. J.B.S. Haldane was equally concerned with human welfare: he was more outspoken than his parents in disbelief. Thus in *Daedalus* (Haldane, 1924a) he wrote "... Jesus left no code of law behind him like Moses or Muhammad, and his moral precepts are so different from those of ordinary life that no society has ever made any serious attempt to carry them out, such as was possible in the case of Israel and Islam. But every Christian church has tried to impose a code of morals of some kind for which it has claimed divine sanction. As these codes have always been opposed to those of the gospels, a loophole has been left for moral progress such as hardly exists in other religions. This is no doubt an argument for Christianity as against other religions, but not as against none at all, or as against a religion which will frankly admit that its mythology and morals are provisional. That is the only sort of religion that would satisfy the scientific mind, and it is very doubtful whether it could properly be called a religion at all."

Comments such as that distressed his parents but he said, in several places, that his disagreement with his father was a matter of emphasis and not of principle. The passage quoted shows that, from the start, he was concerned with the relative merits of religions. He retained that concern. Towards the end of his life he wrote (Haldane, 1962) "But my own belief is that though the religions are all untrue they are concerned with something very important."

In a letter at about the same time [quoted in Clark (1968)] he wrote "I agree with Lenin that the religions are sterile but genuine flowers on the tree of human culture." In these comparisons he drew sharp distinctions between the founder's outlook and the orthodoxy sometimes derived from it. For example he wrote (Haldane, 1959a) "... Christian theologians had drawn a sharp distinction between men and other living beings. In view of Jesus' remarks about sheep, sparrows and lilies, this sharp distinction may well be a perversion of the essence of Christianity. St. Francis seems to have thought so." By that date, Haldane had become a vegetarian and argued that the perverse distinction was similarly removed when Darwinian evolution was accepted, and that animals consequently had rights. Like many others, a little illogically, he did not extend that advantage to plants. Because of this concern for animals, he found many aspects of Hinduism attractive and wrote (Haldane, 1959b) "The revived and reformed Hinduism of Ramakrishna and Gandhi, though I do not think it is compatible with science in the long run, is much more nearly so than any form of Christianity which I have encountered."

When explaining his reasons for settling in India, Haldane wrote (Haldane, 1958) "... I am a materialist when it comes to belief in things, and an idealist as regards supernatural beings." That cryptic comment described his attempts to understand how peoples' religious beliefs affected their social and political actions. It explains some elasticity in his use of words. In a lecture in 1928 (Haldane, 1932a) he said "I am not a materialist" ; the title of a later article (Haldane, 1940a) is "Why I am a materialist." The former was mainly about ethics and mental processes; the latter was more physical and was in accord with his canon (Haldane, 1963) "... I try to act and think on the hypothesis that all happenings are in principle explicable, and that, in so far as they are not completely explicable, this is because they consist of too many details for a human mind to grasp, and not because either the details or their pattern are beyond the scope of human reason. If I am right, there is only one science, of which physics, biology, and psychology are different aspects."

Haldane foresaw (Haldane, 1924a) that people would become increasingly interested in mind-altering drugs and he was interested (Haldane, 1924b) in hallucinations experienced during personal physiological experiments in which he changed the composition of his blood and expired air. He suggested (Haldane, 1956) that apparent miracles could be the result of similarly al-

tered perceptions, by individuals or groups, of what was actually going on. He described (Haldane, 1956) a personal psychokinetic experience which he stopped by giving it the exact, intense attention that he gave to laboratory experiments. He was unconvinced of the reality of telepathy and similar phenomena, but suggested (Haldane, 1938; 1963) that some conclusions from quantum theory made them conceivable. As the amount of energy involved in a quantal event diminishes, its spatial extent increases; that could make it possible for some mental events to overlap spasmodically. He suggested that a sense of duty, especially within a group, could be the result of similar mental overlapping. A letter [quoted by Clark (1968)], mentions the trouble he took to get a pebble from the Elah, the brook from which David took the pebble which killed Goliath, and his habit of carrying it constantly in his pocket. He acknowledged that this was fetishism in which "There is something, but not much, ...". He said to me that such ideas, especially those connecting quantal events with thinking, and connecting secular change in physical constants with the origins of life (Pirie, 1965; 1968) were unfashionable. The ideas deserve attention because they demonstrate what may be called a generalised mystical streak in Haldane. They are part of a sustained but controlled attempt to encroach on the exclusion zone suggested in his well-known apophthegm (Haldane, 1927a). "Now, my own suspicion is that the universe is not only queerer than we suppose, but queerer than we *can* suppose."

### Political activity, mobility and opinions

Whereas Haldane's opinions about religions and an individual's duty towards others remained essentially the same throughout his life, his opinions about the most practical means for achieving the ends he desired were fluid. Initially he was a Liberal and supported the Oxford horse-tram drivers in a strike in 1914. After the war he moved towards the left, and was a steward at a Labour meeting in Oxford, and wrote in *Daedalus* (Haldane, 1924a) "Indeed as far as biological research is concerned labour may prove a better master than capitalism, and there can be little doubt that it would be equally friendly to physical and chemical research if these came to lead immediately to shortened hours rather than to unemployment." He did not immediately move very far left, and referred in *Daedalus* to Marx's "somewhat artificial solution of the problem" of the "tendency of applied science to magnify injus-

tices." During our almost daily contacts in Cambridge in 1929-30 he criticised my no doubt naive and dogmatic socialism. But he was moving left. In 1934 the British Broadcasting Corporation refused to let him broadcast because his script (at that date vetted beforehand) contained, among other dangerous comments, the phrase "After all, it was not Marx who said *Where your treasure is, there will your heart be also.*" He paid his only visit to the USSR in 1928, came back enthusiastic about the way research was managed, doubtful about other aspects of the regime, and wrote (Haldane, 1932b) "... Socialism has nowhere been tried." His comments on recent demonstrations that its simulacra cannot coexist for long with corruption in government, would have been interesting.

In 1936, German reoccupation of the Rhineland, and the revolt of army officers against the Spanish government, pushed him further left. Although he had left Cambridge, we still met because students thought I had some sort of humanising influence on him and sometimes invited me to the meal they organised before getting him to speak at a meeting. His rude bearishness has become part of folklore. I never noticed it. He now regarded me as inactive or even Laodicean, but was invariably courteous, encouraging and helpful.

During the 1914-18 war, Haldane had helped his father in work on protection from gas attacks and he kept himself well-informed about poison gas which he considered (Haldane, 1925) a relatively humane weapon. He therefore visited Spain three times to give advice in case the Germans and Italians, who were helping the revolting army, used gas.

These visits, and regular discussion with Communists in Britain and Spain, made him a Marxist. As a result he wrote *The Marxist Philosophy and the Sciences* (Haldane, 1938) and wrote a preface and notes for a translation of Engels' *Dialectics of Nature* (Haldane, 1940c). The latter had been left uncompleted in 1882. Haldane's notes make many interesting comments on the directions taken by research during the intervening 58 years, and on the extent to which progress could have been greater had scientists been aware of Engels' outlook. For example, he wrote "Had his remark on Darwinism been generally known, I for one would have been saved a certain amount of muddled thinking." Considering the date at which Engels was writing, it is clear that he was a profound and often original thinker. But, like many of my contemporaries, I was puzzled by the tremendous impact of Engels on Haldane - shown by the comment quoted above and by many similar comments in both books. Unlike Haldane, we had not studied clas-

sical philosophy and we had had the advantage of being taught by Hopkins and Haldane: both encouraged scepticism and regarded biochemistry as the study of processes rather than substances. To us, ideas such as the 'unity of theory and practice' and the 'transformation of quantity into quality' seemed no more than sensible aphorisms which set out parts of the mental processes of every competent scientist since Galileo and Boyle. The 'interpenetration of opposites' sounded like gibberish.

Haldane did not join the Communist Party until 1942 although he had earlier become chairman of the editorial board of the *Daily Worker*. He spoke several times a week at political meetings, and wrote 345 articles in the *Daily Worker* and 100 or more in left wing papers such as *Reynolds News* – these articles were on scientific themes, laced with political comment. On several issues there was disagreement with the CP and, for obscure reasons, it kept him from joining a scientific delegation to the USSR. He accused it of altering some of his articles to make them conform to the party line. The final break came over the suppression in the USSR of those aspects of genetical research which were not in accord with Lysenko's ideas. Haldane had written, and went on writing, in defence of some of these ideas: for example (Haldane, 1952) "... differences due to nurture are very seldom inherited. Even Lysenko agrees that this is rare. No one with any knowledge of genetics thinks that they are never inherited". There are similar words in an interview recorded by the BBC in 1964. But he could not agree with the Communist Party's total lack of scepticism and slipped out of it quietly (Haldane, 1949). I have discussed this episode at greater length elsewhere (Pirie, 1966).

Haldane's social and political outlook was controlled by his rigidly quantitative approach, his knowledge of genetics, and his sense of duty. The word 'quantitative' appears in his articles more often than is usual in scientific writing. He summed up his outlook succinctly in a radio talk in 1929 (Haldane, 1932c) "If I thought that the aims of science and art were merely material I should belong to some church" and later (Haldane, 1940b) "I am a socialist because I want to see my fellow men and women enjoying the advantages which I enjoy myself." However, he was well aware that tastes and aptitudes vary and quoted Spearman with approval (Haldane, 1932d) "Every normal man, woman and child is a genius at something, as well as an idiot at something": vocational guidance is essential. On recidivists he wrote (Haldane, 1932e) "The geneticist is quite as likely to be impressed by his persistence as his criminality." In repeated attacks on the simplistic

negative eugenics, often advocated early in this century, he pointed out that sterilising the overtly 'unfit' would have such a slow effect on the incidence of the abhorred traits as hardly to justify the social unease that the process would cause. He called (Haldane, 1924a) those chosen to administer positive eugenics "... a compound of the policeman, the priest and the procurer" and predicted (Haldane, 1964) that premature attempts at eugenics "... would lead to a distrust or even hatred of human genetics, and might possibly lead to genetic deterioration."

Although several prophetic articles envisage improvements in our mental and physical structure, his general social outlook was that effort would be better employed on suiting the environment to people, rather than people to the shoddy environment we have made. He wrote somewhere that if tiles constantly fell off roofs, a skull of normal thickness would be looked on as a dysgenic factor that should be eliminated: it would be more sensible to stop tiles falling. Because of this concern with living and working conditions, he read official statistics on occupational health and mortality carefully and discussed in several articles the ways in which they could be misleading. For example: sailors are often at sea during a census but come home to die, and people may drift into safe occupations after lives spent in those which are intrinsically more harmful. The first error minimises the number at risk, the second mistakes the probable real reason for illness. He urged socially conscious shoppers to avoid commodities which expose producers to extra risk. It is now surprising to find in these old articles little concern about the already recognised increase in atmospheric  $CO_2$ . Even genius has limitations.

### Humour and style of writing

To effect the social and political changes he wanted, Haldane knew that he had to get support from a wide and to some extent non-scientific audience which (Haldane, 1927b) "... has a right to know what goes on inside the laboratories, for some of which it pays." He had therefore to write clearly, briskly and, when possible, humourously. Clark (1968) records his fierce response to a colleague who commented on his lucid style "D'you think I didn't have to work for it?" He wrote (Haldane, 1941) a useful article on how to write popular science: it should be reprinted because most of it

applies equally to academic science. <sup>1</sup> He suggested (Haldane, 1961) that one reason for the neglect of his father's work was that he did not coin new words such as 'cybernetic' and 'homeostasis' or phrases such as 'oxygen debt'. J.B.S. Haldane was not a prolific coiner himself, but he suggested, to avoid a double negative, the reintroduction of Samuel Butler's word 'covery' for evidence that a generally accepted 'discovery' was wrong.

Humour is important because, besides enlivening reading and conversation, it helps memory by giving attention an extra jolt and stimulates others into thinking of further implications of what is being discussed. Haldane, like Falstaffe, was "... not only witty (him)self, but the cause that wit is in other men." Much of his humour was allusive. I often felt, as when reading James Joyce, that the phrasing suggested a hidden joke which I was only sometimes well enough read to see. For example: when I visited him in hospital after his first cancer operation he referred to the hand of Mr. Wolf, his surgeon, as a "privy paw" and smiled appreciatively when I hoped a 'two-handed engine' had not been used (cf. J. Milton, *Lycidas*). Some of his jokes have been widely quoted. One started a largely ill-informed, or even absurd, correspondence in *Nature* in 1989. According to my memory: in a review of a popular book by Sir James Jeans, he wrote "Sir James is an eminent mathematician, when he looks at the universe he decides that god is also a mathematician. I am a biologist, when I look at the universe it seems that god must also be a biologist, with a peculiar liking for beetles of which he made more than 300,000 species." Sadly, I cannot find that review. Haldane made essentially the same joke again at meeting of the British Interplanetary Society (Clarke, 1968) and it is printed in a report of the meeting (Slater, 1951).

Haldane's productivity depended more on his ability to see connections, or analogies, between at first sight unconnected phenomena than on his remarkable memory. The analogies often took the form of jokes. For example: he pointed out (Haldane, 1938) that the smaller viruses, which are not even analogies for processes involved in the origins of life because they depend absolutely on duping a preexisting host into copying them, may reproduce just as "... a limerick persuades a man to repeat it?"

Unexpected inter-connections are the essence of much humour, as is shown by the jokes I have told. In conversation, Haldane called scientific

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<sup>1</sup>This article has recently been reprinted in Smith, J.M. (1988) *On Being the Right Size*. Oxford Univ. Press. - *Eds.*

correlations "bad puns about nature", but he attached more importance to humour than that. Long before his own death he wrote (Haldane, 1940b) "Of all men whose deaths are recorded, I consider that Socrates' was the most enviable. He died for his convictions, - And he died laughing. His last words " were a joke." Haldane also wrote "... looking at ourselves objectively, the first thing we do is laugh, and that has an extremely good effect on our behaviour." He followed his own precepts and, when dying, wrote the poem *Cancer is a funny thing* which contains the couplet

A spot of laughter, I am sure  
Often accelerates one's cure.

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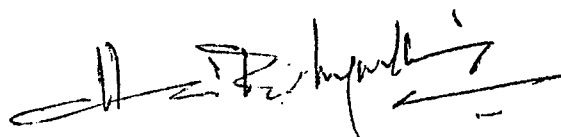
**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

**THE OTHER HALDANE**

A handwritten signature in black ink, appearing to read 'Hari Pulugurtha', with a long horizontal stroke extending to the left and a shorter one to the right.

Hari Pulugurtha  
Indian Statistical Institute  
203 Barrackpore Trunk Road  
Calcutta 700035  
India

Autumn, 1964; fourth of September, in fact. The cook announced lunch. Suresh (Dinker Jayakar) read the letter and passed it on to me with a questioning look. I glanced through it quickly – it was from Prof's (John Burdon Sanderson Haldane's) Calcutta doctor, Nairn. Nairn wrote that there was extensive metastasis of cancer and that Haldane's days were numbered, barring a miracle – the surgeon who operated on Haldane in London must have known Haldane's condition and must have had reasons for not telling him or his family. The decision of whether or not to inform Mrs. Haldane (Helen Spurway) and Prof. Haldane was left to Jayakar, Nairn concluded.

The Haldanes, John and Helen, did use their bodies in physiological experiments, involving likely injury and/or risk to their lives, for the British Admiralty during the World War II. Several decades earlier the Haldanes father and son team, John Scott and John Burdon Sanderson, subjected their bodies to self-experimentation. The question of withholding the Nairn letter did not arise – Helen was given the “death sentence.” She read through quickly and almost ran the length of the verandah to the bedroom. Suresh, Shastry (Ramsastri Mangipudi) and I trooped in after her. Prof read the letter. We stood around the bed. There was no change in his face – the news of his imminent death did not affect him at all.

Prof wrote later that his wife was a good biologist but not good enough to take “my pulse before and after I read the letter.” We could not take this news with such indifference. Prof said that his death might be “more of a shock to others than to me.” He recited from memory

*játasya hi dhruvo mṛityur  
dhruvaṁ janma mṛtasya ca  
tasmád aparihárye 'rthe  
na tvam śocitam arhasi. <sup>1</sup>*

(For the one that is borne death is certain and certain is birth for the one that has died. Therefore for what is unavoidable, thou shouldst not grieve.)

None of us could locate the *śloka* and Prof had to give the correct reference, and was immensely pleased that he could beat the upper caste Hindus

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<sup>1</sup>The *Bhagavadgita*, by S. Radhakrishnan, George Allen & Unwin, London 1963, Chapter II, Sloka 27, p.110

at their own game. Things began to move rather fast and the mood was “for what is unavoidable, thou shouldst not grieve.”

Prof peered into our faces in the semi-dark bedroom, with drawn dark curtains, and smiled and said “ask for something you like to have.” I asked for an Elah stone – Suresh’s and Shastry’s identical requests followed. These stones, worked to incredible smoothness by the harsh desert winds, are from the little brook Elah, Israel – the young David picked such a stone and “slang it and smote the Philistine (Goliath) in his forehead that the stone struck into his forehead and he fell upon his face to the earth.”<sup>2</sup> We would be needing the stones – the Elah stones – to sling figuratively at “little men occupying positions of power and influence.”

By evening things settled back to the normal pace; and the Haldane “normal pace” was, indeed, rather fast. We sat on, as the evening descended, lazing on the sofas. Gopal Dash (Secretary of the Department of Agriculture, Orissa Government) waddled in; the usual bubbling Gopal Dash. We recited the *sloka* that we had heard earlier. Dash was able to locate the *sloka* and was rather pleased – in a way he restored the pride of the upper caste Hindus! Haldane, busy with his work, peered through the glasses and with a charming smile said “Dash, I would be proposing that Jayakar succeed me as the Director.<sup>3</sup> Do you expect any problems?” Dash agreed and suggested that Haldane makes a formal proposal. As the evening wore on he actively supported the idea of Jayakar succeeding Haldane.

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A year ago we pulled the car on to the verge. We got down lead by a local – Haldane and the small group with Ajit (Kishore Ray) showing us around. We walked along in the monsoonish weather unsuccessfully trying to avoid puddles and slushy patches. Haldane strode along. Just as we were negotiating the clumps of bamboo groves a young impish face of a boy stared at us. The boy’s intelligent eyes glowed as he stared at Haldane’s giant frame draped in loose *khadi* garments. A friendly, equally mischievous, smile broke through the glasses and a lively conversation began. The boy knew as much English as Haldane knew Oriya; almost nothing. But the Haldane charm ended in the happy boy riding piggyback on Haldane – both enjoying the

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<sup>2</sup>I Samuel, 17, 49.

<sup>3</sup>of the Genetics and Biometry Laboratory, Bhubaneswar. – *Eds.*

ride hugely.

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Two years earlier, Shastry and I were waiting for the train to pull in on to the platform at Howrah. We were early. As the train steamed in and screeched to a halt, we rushed along. In the distance Haldane strode on carrying his big case and wouldn't easily let go of it; but greeted us with a smile while signalling and telling us that we need not rush head on. This was his return from one of the several visits he made to Bhubaneswar, often with Shastry, before we all moved out of Calcutta and the laboratory at Bhubaneswar was set up. The last trip, in this series, was just before the monsoon and the news reached us in Calcutta in code "Marriage arranged; arrange cocktails."

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In the early sixties the new capital of Orissa, Bhubaneswar, was a small town. For someone from Calcutta it indeed looked like a small hamlet. But Haldane fell in love - it was love at first sight. And he tried to convince the younger set that it indeed was the best place to live and work. The bonds of loyalty and affection were much too strong within the small group, and Haldane's attempts to convince that it indeed was "the place" bore fruit after the initial period of adjustment and acclimatization. Before the year was out, Bhubaneswar became our home - it was to remain so for the next four years.

Haldane was to call it a paradise - a paradise it was. Life was bursting all around. A monsoon shower brought forth myriad insects; and the elegant sleek black-and-white pied-crested cuckoo [*Clamator jacobinus* (Boddaert)] - the monsoon migrant from Africa. Winter was heralded by wagtails migrating from Siberia and skeins of duck formations flying south to spend the warm winter months in Chilka Lake before flying back north to Siberia to their breeding grounds. Another popular winter migrant was the Pied Harrier (*Circus melanoleucus*). The sight of a male paradise fly catcher (*Tersiphone paradisi* L.) with its gorgeous tail of plumes in the Chandka game reserve, hardly a fifteen minute drive from Bhubaneswar, was unforgettable. Thursdays were special days. Early morning expeditions to Chandka and the lake at the Nandan Kanan to watch birds and animals were always looked forward

to. Haldane joined these expeditions with infectious enthusiasm – and the bug bit everyone.

A *varanus* monitor in the bathroom is exciting news. Or a pair of Russel's vipers mating in the hedge rustling the dry leaves with a rhythmic swish. Or the lapwings. One summer a pair of yellow wattled lapwings [*Vanellus malabaricus* (Boddaert)] nested in the "garden." Helen and Suresh took complete records of daytime activity of the parent birds. Haldane took the ground temperature at noon (50°C); the parent bird brooding the clutch of eggs walked away to a dripping garden tap, wet its belly plumes and sidled back to the nest and sat on the clutch of eggs. That was the beginning of *The Origin of Lactation*<sup>4</sup>.

Or, the emergence of baby Indian starred tortoises (*Testudo elegans*) – extensive growth records were kept. So much to see, note and record! A notebook was kept – anyone of the "gang" could record any exciting event. Life with the Haldanes was exciting. There never was a dull moment. Things happened naturally – of far reaching consequences. The Haldanes had strong personalities, stronger likes and dislikes, and they were utterly incapable of dissimulation. They were proud of their colleagues.

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The Haldanes kept an open house to all colleagues and scientists, Fellows of The Royal Society of London (for the improvement of the natural knowledge). The steady stream of visitors moulded the very quality of intellectual life and social intercourse. Pamela (Lamplugh Robinson), Haldane's student and colleague of the UCL days, who was then helping the Indian Statistical Institute, Calcutta, with its work on Gondwana fossils, was a regular and a popular visitor. All of us looked forward to her annual visits.

Winters were special seasons. We, with the visitors, drove 100 km. south to Chilka and spent the daylight hours recording both resident and migrant species of birds – all the while negotiating slushy puddles, muddy patches and wading through narrow creeks. The successful bird-ringing expedition, with the Bombay Natural History Society, in the winter of 1966 was two years too late – Haldane had hoped to have it during his lifetime.

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<sup>4</sup>*Rationalist Annual, 1964, p. 19*

Haldane was free to meet whoever he chose to – there were no artificial barriers around him. Haldane was capable of judging character. He stayed aloof from administration and administrative irritants, and Helen would often say “H & S (Hari & Shastry): action stations” whenever Shastry and I had to manage and remove such irritating pinpricks.

Four winters after Haldane died, Professor Mahalanobis and I were slowly negotiating the stairs to reach the second floor of *Sudhir Bhavan* (the Eka Press building, Calcutta). Apropos of nothing Professor<sup>5</sup> said “Did Haldane suffer much?” I said “I do not know, Professor. He never showed that he was in pain.” I said “Prof (Haldane) did indeed regard you rather warmly.” Professor said “So did I;” I saw his eyes cloud over. During Rani Mahalanobis’<sup>6</sup> long sessions of nostalgia, she would often recall how Haldane had saved a fly stuck in a small blob of butter at breakfast and how Haldane gently disentangled it and let it fly away to safety and freedom.

Thus, a hundred years ago a baby boy was born in England and a few years before completing the biblical three score and ten years he sailed to this ancient land of India and made his home here and soon became one of the “natives.” Haldane would surely have been proud at Indira Gandhi’s (who was then yet to become the Prime Minister of India) message to the recently widowed Helen “Not only an eminent scientist ... a great Indian.”

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<sup>5</sup>The late P.C. Mahalanobis was addressed to as ‘Professor’ by all his colleagues and students in the Indian Statistical Institute - *Eds.*

<sup>6</sup>The late Nirmal Kumari Mahalanobis – wife of the late P.C. Mahalanobis. – *Eds.*



**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

**1992**

**REMEMBERING J.B.S. HALDANE**

*Ajit Ray*

A.K. Ray  
Department of Anthropology  
University of Toronto  
Toronto, Ontario  
Canada

JBS — intellectual giant, globally renowned scientist and above all a gentle humanitarian. To this day, his visionary thought and prophetic guidance continues to influence me in matters professional and personal.

I met him for the first time in Bhubaneswar in 1958. He had invited me to his ocean front hotel in Puri to show him the data I had collected on a primitive tribe from thirty villages in Orissa. He was not interested in mere data, but asked many demographic questions about the life-style and living conditions of the population. Immediately I was struck by not only his brilliant mind, but his genuine concern for humanity. To my surprise, a few weeks after our meeting I received a paper titled, "Theory of population growth" written by JBS, in which he mentioned the importance of my work in the last paragraph. Since 1958 I had opportunity to meet JBS at least once in two months at his *Basak Villa* residence in Baranagar, Calcutta, till 1961.

In 1961, Haldane went to Orissa at the invitation of Chief Minister Biju Patnaik, to set up a genetics and biometry lab there. JBS wrote to my mentor, Nirmal Kumar Bose, that he would like to have me with him as his colleague for five years; and so it was.

He was without vanity, intensely curious about the natural world. His profound respect for all living things was demonstrated to me by an incident in India many years ago. In 1958 we were on our way to a conference at the Indian Statistical Institute, Calcutta. JBS noticed a cow in distress, its neck raw and bleeding. He went immediately to the animal, stroking it and soothing it with his voice. The cow showed her gratitude by rubbing herself against him, leaving broad streaks of red on his all-white *pyjama* and *panjabi*. Rather than being upset by this, JBS was overjoyed that the animal seemed calm and declared "look ! I know the cow is feeling good and I do too." This kind of reverence for life was evident to all who knew him throughout his life.

During his seven year sojourn in India, his teaching had a great impact on the younger generation of scientists and scholars. His approach to learning and teaching was universal, unconventional and informal. He saw life in symbols, transforming the petty details of everyday life into a learning experience. One was constantly enriched and educated by his unique observations while in his company.

He was not interested in stereotypic work but wanted to see something new, urging the student to initiate independent thought and activity to chart

his own course, as it were.

His educational background was extremely eclectic, having acquired much first-hand experience on many subjects, from Astronomy to Zoology. He was a strong advocate of knowledge which he gained from direct experience. His mind was the rich fertilizer which has produced an abundant harvest in contemporary scientific communities.

I remember that hours after joining his lab in Bhubaneswar, he took me on a guided tour of his library. He insisted that I use this facility containing three generations of work on every subject. I was awestruck by his generosity. I had heard about both his kindness and his legendary acid wit. In answer to what I considered a normal question, "what will be my job here", I was told "I don't know, you have to tell me what you are going to do." This ironic tongue-in-cheek remark was typical of him. But I must say this approach of JBS helped me enormously in my future research.

He was a keen observer, insatiably curious about the human condition. During a population screening for colour vision, I had observed that 2 in 2,000 people in the native populations of Orissa has a short 4<sup>th</sup> toe. He was little surprised at the high frequency of this malformation and asked me to take him to another locale to observe the rural population. I took him to a nearby rural railway station. While I was observing the bare feet of the passengers coming out on the railway station, JBS joined me in the jeep with a pocket calculator, counting feverishly. We observed three people with a bilateral short fourth toe and took them to the hospital for x-rays. The x-rays showed that the metatarsal bone and not the toe itself was short. He asked me to follow-up on the work. I eventually collected data on 64 three - or four - generational pedigrees. I remember how happy he was with these findings and how his enthusiasm and humility affected me.

On November 20, 1963, just after his cancer operation in University College Hospital, London, JBS wrote me this letter which tells how he dealt with the pain of such aberrations.

*Dear Ajit,*

*I regret that I shall not be able to attend the course in Bombay. I am having my large intestine removed today for a small and quite painless cancer. Hence I shall not get back to India before 1964. I am told that when I do, I shall still be allowed swimming and various other activities. The readjustments of my anatomy and physiology involved will be an interesting handicap.*

*With a little consideration from my colleagues I should be able to overcome this.*

*I am reaching the age when natural selection on my ancestors no longer protects me. It is therefore necessary to find out how to deal with such aberrations of growth. And it is lucky when they happen in people like myself, who do not find them particularly distressing, as others certainly do. Apart from the pain, which may be very severe, though I have as yet had none. I may be paranoiac, but I think that each person who brings a little objectivity to such events makes it a little easier to deal with them in future. Objectivity in this context means the attempt to regard other people's pain as if it were mine, and consequently mine as if it were someone else's.*

*J.B.S. Haldane.*

In 1964 JBS was awarded a Fellowship of the U.S. National Academy of Sciences. In lieu of attendance, he replied that he would send a paper of one of his colleagues for publication in their *Proceedings*. This letter was addressed to Mr. Harrison Brown, Foreign Secretary, National Academy of Sciences, U.S.A. This letter shows how he valued the research work of young scientists.

*Dear Sir,*

*I have to thank you for your letter of May 4th, and to accept with great pleasure the honor conferred on me by your illustrious Academy. The pleasure is certainly increased by the fact that my father held the same position. You state that the Academy appreciates my services to Science. 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. I regard the help which I have been able to give to young men of great ability who would have had little chance without me, as a service to Science as important as, and perhaps more difficult than, the first estimation of a human mutation rate or the discovery that oxygen, at seven atmosphere pressure, has a taste.*

*May I ask, along with the diploma, for a statement of my rights and duties as a foreign associate, and in particular, whether I am entitled to communicate papers to the *Proceedings*. As these are shorter than the corresponding publications from London, and from Paris, they reach a very high level, and are read by a very wide circle throughout the world. At the moment I could*

*offer a three page summary of a human genetical investigation by a colleague whose full account may occupy twenty five pages.*

*J.B.S. Haldane*

I wrote three drafts of the paper and JBS corrected and edited the paper. He told me that he would name me as the first author of the paper. I objected as he had done all the math work. But he insisted and said, "after all it was your observation; you were the one who collected the pedigrees and you had also written the preliminary paper. All I have done is the mathematical analysis and editing." Unfortunately he did not live to see the paper entitled, "A common digital anomaly in India," in print, as it was printed posthumously. This is only one of many examples of his incredible generosity. I have heard similar accounts from diverse sources. Incidentally, this is the only scientific paper, JBS published in an American research journal.

I also remember an amusing incident that took place at this time. I was invited with my family to dinner at the home of JBS. While we were having a drink in the garden before dinner, my three years old son Mithu, accidentally kicked a ball which landed on the table full of drinks. A bottle fell and shattered on the ground. As a result, an American guest's hand was cut, and he had to go to the hospital for stitches. My wife, Anima, and I were upset and moved to reprimand my son. But we were stopped by JBS, who, unperturbed and with a slightly capricious smile, remarked "a little communist Bengali has attacked a United States capitalist."

On another occasion while I was collecting data in Calcutta, he wrote advising me to return to Bhubaneswar in order to go to Rome for an important career opportunity with a fellowship from the University of Rome. JBS wanted to offer considerable financial support for my wife and son which I refused, but I will always remember his kindness. He also insisted that I take my meals with him until I found a cook, as my wife was still in Calcutta. I tried, without luck, to protest, and was met with an offer I couldn't refuse, "I won't allow you to work in the lab unless you accept." Of course I accepted.

At times, I caught a glimpse of his devastating wit. A student came to work with him. As the student was interested in cocoon culture, JBS gave him money to implement a lab for study. One day, while the student went to visit his village to collect revenue from the land, JBS looked into the lab and found all the cultures dead. Upon the student's return he was told, with exquisite politeness, "Here is your cheque." On another occasion, a

student from Lucknow well-dressed and articulate arrived to work with him on marine culture. JBS casually asked him about the behaviour of the local fish. The unfortunate student replied that he had not yet observed them. With icy detachment and a look that could kill, he was instructed to, "Go and look!". He never returned.

He was intensely interested in people. In a discussion we had on the aboriginal populations of India, I mentioned that I was dissatisfied with the educational system among aboriginal populations. I said that these people were extremely sensitive to the environment, take better care of the environment than us and, could, therefore, be trained in the natural sciences which would be more indigenous to their cultures. The current academic system did not serve their needs; indeed, it made them dissatisfied with their lifestyle, but did not prepare them to enter any other stratum of society. I said that perhaps, it is more important for the aboriginals to have different kinds of opportunities than equal opportunities. As we are all different biologically and culturally, equal opportunities may bring more inequality in mankind. He agreed with me, asking me to take him to see the local villages to talk with the people and collect data. JBS told me that, the society where different kinds of genotype flourish in different kinds of environment enjoys the most.

JBS was extremely influential in my career. He had read my paper on "Gene Diffusion in a Primitive Tribe of India," at an international conference in Rome 1961, as I could not obtain any travel fund. It was the first study of its kind in India using the birth place and clan name of the population as variables for understanding human population structure. In a conversation with him on this subject, he agreed on the importance of statistics, but put more value on unique scientific observation, saying that in fact, if the observations were erroneous, then the statistics would also be.

In Rome on September 10, 1964, I received the unhappy news from JBS, in which he asked me to return to Orissa.

*Dear Ajit,*

*I fear I have some rather bad news for you. I was grossly and to some extent deliberately misinformed about my condition. It seems that several English surgeons knew that my cancer had spread, but left me with the belief that I should get better for some time. I shall never consult an English doctor again, nor will my wife. A local man, Mahapatra, of old Bhubaneswar, thinks*

*I have at least four months to live (i.e. till January) and perhaps six. Unfortunately I am very weak now, but this is probably from macrocytic anaemia, and I am drinking various things, apart from injections, of which I had the first today. These should improve the weakness.*

*Our joint paper can be made much better, because it shows that the frequency is a lot higher in Bengal than here. I will do this and send it to you as soon as I am strong enough, which could be in a fortnight. If you pass it you may send it to the Washington Academy with a covering letter.*

*Meanwhile show this to Montalenti and Siniscalco and ask their advice. I have several suggestions for fieldwork, but if you are back much after the end of the year, I may be alive but not very intelligent. However you and Siniscalco must decide.*

*Please do not sympathize with me. I am not in pain, though in some discomfort. If I develop pain plenty of pain-killers are available, but they are liable to make me rather stupid. So I am reserving their use until (if ever) the pain becomes severe enough to interfere with my thinking anyway. I think I can honestly say that I am not afraid of death. Actually the thing I like least at the moment is my wife's distress. I can't blame her, in fact if she showed none, I should not think too well of her. Nevertheless she is undergoing a double period of mourning, and some of her sorrow leaks over to me.*

*Yours sincerely,*

*J.B.S. Haldane*

The last letter, I received from JBS in Rome was on October 5, 1964.

*Dear Ajit,*

*My prospects once more seem a little better, so don't hurry to get here before November. I can then give you full instructions. But the sooner we get a copy of your pedigrees, the better. They can then be prepared for the next number of the Journal of Genetics. Without them it will be rather dull.*

*Yours sincerely,*

*J.B.S. Haldane*

It came as a great shock to me when I read the headline "British Scientist Dies in India," on the train from Holland to London on my way back to India. The headline should have been "Indian Scientist of British Origin Dies in India." A full page was dedicated to him in all major papers of England, I

had missed seeing him by one day, and realized that life without JBS would never be the same. I was deeply saddened, as were people around the world, particularly in India. He had become an Indian citizen, adopting the Indian lifestyle and became a vegetarian. He was also an adept of the Hindu concept of evolution.

For me, JBS was an inspirational teacher, valued colleague and mentor. JBS the charismatic genius of this century is greatly missed. JBS died in peace and tranquility in the land of Lord Jagannath in Orissa.





In a village near Bhubaneswar (1961)  
[*Photo courtesy A. K. Ray*]

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

**MY ASSOCIATION WITH HALDANE**



S.K. Roy  
AD-244, Sector I  
Salt Lake City  
Calcutta 700064  
India

One of the most remarkable persons to be intimately associated with in my life was the late J.B.S. Haldane. He was a stalwart both physically and intellectually. Such association was undoubtedly covetable for any student of science. For me it was coveted because it opened up a new horizon in my thinking and shaped my scientific as well as personal careers. In spite of the fact that I had to rely mostly on my memory to write this article, the task did not seem difficult because many events of my eventful years of association with J.B.S. Haldane are still as vivid in my memory as events of yesterday. To keep this article short, I shall, however, record only a few of these events.

It was late in 1951 when my colleague in Bethune College, Calcutta, Dr. S.B. Nandi informed me that the Calcutta Session of the Indian Science Congress to be held in January 1952 would be extremely attractive because J.B.S. Haldane was coming to participate. I was naturally excited because I had heard the name of the famous biologist J.B.S. Haldane. I was then a post-graduate student of botany in the Calcutta University, and was also simultaneously holding the post of a 'demonstrator' of botany in the Bethune College. I first saw him in the Presidency College, Calcutta, on January 2, 1952, delivering an evening lecture on the relations between biology and other sciences. As I can recall, he indicated the use of mathematics and statistics in biology, the relationships between physics and biology, chemistry and biology, geology and biology, and the like. He also discussed logic and moral issues in social sciences. I did not comprehend the lecture in its entirety, but the portions that I could comprehend were indeed inspiring. How could a single person have mastery over such a wide area of science? — I wondered.

After my final examinations of the post-graduate course, I went to my native village, Shyamagram, in East Pakistan (now Bangladesh), and was busy with various extra-curricular activities, primarily participating in plays. I was having a great time until one evening my late father showed me a newspaper advertisement inviting applications for a position. The name of the employer was unspecified, and I was very disappointed at the thought of having to return to Calcutta. I applied and in due time was called for an interview at the Indian Statistical Institute. The interview board comprised Professor M. Masuyama, late Mr. S.C. Sen and late Mr. S. Chakraborty. I was selected and joined the Indian Statistical Institute on June 1, 1954. I was to receive a consolidated salary of Rs. 200 per month.

When I joined the Institute, P.C. Mahalanobis was abroad, but the atmosphere of the Institute was charged with preparations for the imminent visit

of J.B.S. Haldane and Helen Spurway. I was entrusted with the responsibility of assisting Professor Masuyama in his work on the assay of antibiotics from higher plants. Soon the responsibility of organizing a laboratory for the Haldanes and helping them with their scientific work upon their arrival were added on.

Professor Masuyama and I went to receive the Haldanes at the Dum Dum (Calcutta) airport. I saw a tall, hefty man with two aspirator bottles in his hands proceeding towards the gate. Professor Masuyama waived and J.B.S. nodded in response. The two aspirator bottles contained solutions of NaCl and tartazole yellow. On our way to the Institute from the airport, I learnt that the solutions were to be used for urinary chloride estimation by a new method developed by Haldane's UCL colleague Professor Miss Grace Eggleton.

Upon his arrival in the Institute, Haldane interviewed several persons who graduated in physiology with extraordinary marks, to assist him in his work. He selected none. One day he entered Professor Masuyama's laboratory while I was busy with my antibiotic assay, and asked me "Are you interested in human physiology?" "Yes, but I have not done any physiological work", I replied. "Do you know chloride estimation?" "Yes, I do." He then told me about the modified method of Grace Eggleton for estimation of urinary chloride. I took Professor Masuyama's consent, and at once set out to work on urine samples as desired by Haldane. He oversaw my experiments, and was especially particular about the precautionary measures that I had taken to obtain accurate results. I continued the experiments for several days, but was not satisfied with the results. One night Professor Haldane entered the laboratory to inquire about the progress. I told him "Sorry, Professor Haldane, your new method does not work well." His face became red. In a low voice (I was to realize later that there was a negative correlation between the extent of his anger and the loudness of his voice), he said "You must be right and I am wrong as usual. But I do not suggest any method without trying it out for myself first." I did not know Haldane well enough, and I was quick to reply "I do not make adverse comments without being absolutely sure." (Indeed I had cross-checked the results of the Eggleton method with the conventional Volhard-Harvey method.) Professor Haldane left, and did not return for the next three days. On the third evening, he entered my office with a smile on his face and a cigar on his lips. "Mr. Roy, you're right, the method is not working well. I fail to understand why. I had tried this

method many times in the UCL laboratory, and it gave consistently good results." "Is it possible that the difference in temperature between Calcutta and London is creating problems?" I told him. The next few days were spent experimenting in the air-conditioned laboratory of Dr. Helen Spurway. The results turned out to be excellent. Haldane was very happy. What started out to be a conflict, ended with a pleasant relationship — a relationship that continued to grow for the remaining period of his life. He asked me if he could call me by my first name. "Of course", I replied. From that day he addressed me as 'Subodh'. He also asked me to call him 'Jack', as his friends did. But I could never bring myself to addressing him as 'Jack'!

J.B.S. Haldane returned to Calcutta in 1957 and joined the Institute as a Research Professor. I was busy estimating earthworm activity. I had already prepared a manuscript based on my findings. Haldane looked me up one day to inquire what I was doing. I told him of my work on earthworms, and gave him a copy of my draft manuscript. Within about a half-hour he returned the manuscript with two pages of comments.

A major scientific work of mine started with an innocent note from Haldane to Professor P.C. Mahalanobis. Mrs. Rani Mahalanobis often greeted visitors to the Institute with flowers. To J.B.S. Haldane she would send a plate full of small, fragrant, white flowers *Nyctanthes arbor-tristis* Linn. (Bengali: *Sephalika*) every morning after his arrival in the Institute. Haldane noticed that there was some variation in the number of petals in these flowers. He wrote a note to Professor Mahalanobis inquiring whether there was any seasonality of variation in the number of petals. Mahalanobis sent me a copy of that note marked "You may be interested." I undertook this study the results of which were eventually published in the *Journal of Genetics*, of which Haldane was then the editor.

J.B.S. Haldane also took a keen interest in the observations made by young researchers. From about the mid-1950's I became involved with some work on rice. The agricultural experiments were mainly conducted in Giridih, where the Institute has some farmland. In India rice is normally harvested when ripe by cutting off the leaves and stems near ground-level. In 1958, some plots in Giridih were planted with a photoinensitive, rapidly maturing variety of rice, but owing to late monsoon the crop was poor. Instead of drying and cutting as usual, the plots were not allowed to dry, and the ears were plucked by hand. On returning to Giridih after about six weeks, I noticed that the rice plants produced a second crop. I was immensely excited.

Even though I was aware that Haldane was extremely busy at that time, I wanted to share the excitement with him. I called him from Giridih, but could not talk to him directly. I left a message with his secretary. The same evening his secretary called me back to inform that Professor Haldane had already booked his train ticket and would be arriving in Giridih the next morning! Such was his love for unusual observations. He encouraged me to gather some quantitative data, and to publish these observations. These were later published in *Nature*.

Another incident that comes to mind goes back to the year 1959. Professor Mahalanobis was delivering his annual address to the workers of the Indian Statistical Institute. In his address he referred to the pioneering work done by Professor Haldane. At one point, Professor Mahalanobis mentioned that Professor Haldane has done some wonderful and useful work on rice. Professor Haldane, who was sitting in the audience beside me, immediately stood up and raised his hand. When Mahalanobis responded to his raised hand, he said in a booming voice that there is a tendency in India to glorify senior scientists for the work of juniors. He added that he had not done any work on rice himself, but had only suggested some problems and some methods to S.K. Roy, who after modifying some of the suggested methods, had collected some very interesting and useful data.

J.B.S. Haldane was extremely critical of science teaching in schools. We often discussed about this. He was of the opinion that science teaching can be made more interesting if school students can be given some projects. Such projects he thought can yield very valuable scientific data. Our discussions culminated in an article written jointly by Haldane and myself for school-science teachers entitled "A research project for some Indian schools" (*Vigyan Shikshak*, Vol. 11, pp. 35-37; 1958). In this article we had proposed a simple project on water hyacinth.

Haldane and I travelled together extensively both within India and abroad. He was a wonderful travel companion. One incident that comes to mind took place in The Hague where we were together participating in the XI International Congress of Genetics in September 1963. One evening he invited me to dinner in a Dutch restaurant, and proposed to place orders since he claimed that his knowledge of European dishes was better than mine. He ordered for an expensive chicken entree for me and an inexpensive vegetarian dish for himself.

My association with Haldane continued even after he left the Institute

and settled down in Bhubaneswar. On one occasion I wrote to him stating that I would like to visit him and requested him to suggest dates convenient to him. He immediately wrote back: <sup>1</sup>

*Dear Subodh,*

*I am far from well. Come, if you must, from Monday October 12 to Wednesday 14. But if you have nothing for the J.O.G. (not necessarily at all complete) I would ask you not to come. Unless a rather speculative treatment succeeds, it is a race between work and death for me. I should like to work to score a few points.*

*Yours sincerely,  
sd/- J.B.S. Haldane*

I visited him. I can never forget his departing handshake. He grasped my hand tightly and said "Subodh, please come again." "Yes, I will", I said. But I could never keep my promise!

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<sup>1</sup>letter dated October 6, 1964 from Bhubaneswar

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

**J.B.S. HALDANE AND  
PALAEOLOGY**

*T. K. Roy Chowdhury*

T.K. Roy Chowdhury  
Indian Statistical Institute  
203 Barrackpore Trunk Road  
Calcutta 700035  
India



J.B.S Haldane had a life-long interest in the evolution of life. As a devout Mendelist-Morganist he contributed greatly to microevolution, and as an ardent Darwinist he had a lasting interest in the macroevolutionary processes. Haldane's concept of the origin of life is known even to high school students and the reading of his work on the mathematical theory of natural selection is a must for students of genetics and biology. It is now widely accepted that he, along with R.A Fisher and Sewall Wright, laid the foundation of a modern theory of evolution. While delivering a series of lectures on Darwinism in 1931 he told his audience 'I can write of natural selection with authority because I am one of the three people who know most about its mathematical theory.'

Haldane never failed to mention the importance of palaeontology in the study of evolution; he considered fossils to be the first and foremost evidence of evolution. He, however, thought that without a fossil record evolution would still be a plausible hypothesis to account for the relationships between living plants and animals. But there would have remained a lot of uncertainty in determining the actual historical facts of evolution, such as the law of succession, which, in the words of Wallace, means 'every species has come into existence coincident, both in time and space, with a pre-existing closely allied species.'

Research on palaeontology has produced far more than a mere record of life, which incidentally is best known for the last 600 million years. It has actually enabled us to follow the course of evolution, the rates at which new species are formed and old ones wiped out, and the direction in which particular lineages evolved. Haldane, time and again, acknowledged that the information obtained from fossils have been most useful in combating attacks on Darwinism from all sides – geneticists, embryologists, psychologists, non-Darwinian palaeontologists, and others.

In a brief autobiography <sup>1</sup> Haldane wrote, not without some pride, that he had always been of some use to his colleagues and went on to describe how he was instrumental in introducing Boris Chain to Howard Florey, who later shared a Nobel Prize, primarily for isolating penicillin. All his biographers mention his ever willingness to encourage scientific pursuits. And the encouragement he gave to the study of fossils in England as well as in India stands as a glowing example of his benevolent attitude towards scientific enquiry.

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<sup>1</sup>This autobiography has been reproduced in this volume. –Eds.

J.B.S Haldane became the first Weldon Professor of Biometry in 1936 in University College London, but never got a building for his own activities. His Biometry Department was housed within the Department of Zoology, which was headed by Professor D.M.S Watson who was an eminent palaeontologist, and the Department of Zoology had a team of active researchers in palaeontology. Haldane came in close touch with them and at once started taking more intimate interest in their work. Soon, realizing that fossils are usually rare objects and that their discovery is mostly made in the quarries and mines, he quickly despatched an article to a journal widely read by quarrymen and miners. He took pains to explain to them what fossils are, their scientific value in learning the history of life and also how to collect and preserve them. Within a month he began to get good results. The specimens thus recovered were handed over to his palaeontologist colleagues for study. It may not be out of place to mention here some of Haldane's views on teaching of science. In *Everything Has a History* (1951, p.54), he wrote with lament and anger that 'Palaeontology is not taught in schools, and what is worse, men and women who regard themselves as educated are often totally ignorant of it. This is largely because our educational system is pre-scientific ..... Even if I become Minister of Education, we could not start teaching children palaeontology because it is quite possible to become a qualified teacher without knowing anything about it.' The concluding sentences of the article also enable us to have a glimpse of Haldane's world outlook. He ends thus : 'I want to see the miners learning all that is necessary to take over their industry completely. Economics is one thing they have to learn. Palaeontology is another.'

Haldane never missed an opportunity to promote palaeontological research. In the later part of his life he was more and more attracted to India and finally spent the last decade of his life in this country. The Indian National Science Academy (then National Institute of Sciences of India) invited him to a symposium in 1953 to put forward suggestions for evolutionary studies in India. Haldane used this platform to emphasize that foremost priority should be given to palaeontology, and urged upon the Indian geological community to study the fossil record. He also pointed out (Haldane 1955) specific areas where India had particular advantages. 'Neither Europe nor North America possesses any satisfactory Jurassic beds (213 - 144 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

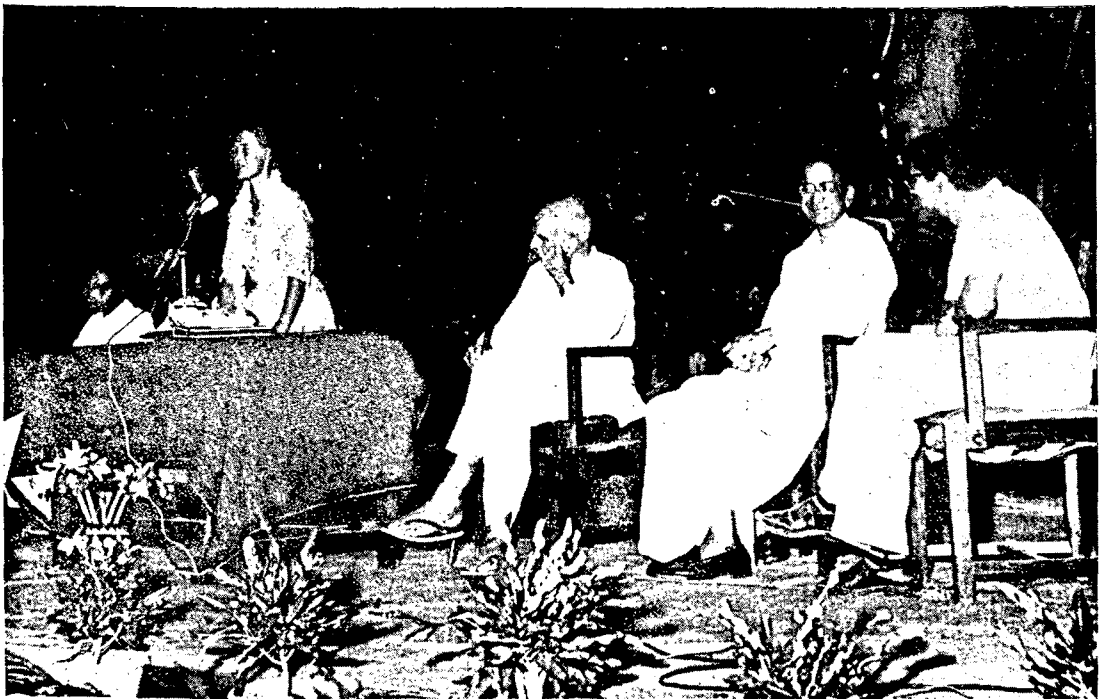
Jurassic strata of continental origin are found. So I think it quite likely that an Indian palaeontologist will find the first complete skeleton of a Jurassic mammal ..... .' It is not just a coincidence that during Haldane's brief association with the Indian Statistical Institute (ISI), one of his erstwhile colleagues from the University College London, Pamela Lamplugh Robinson was invited in 1957 by the Institute's Secretary-Director, P.C Mahalanobis, to initiate geological research in the Institute. A Geological Studies Unit was opened in the same year at ISI with emphasis on palaeontological research. As part of research undertaken by ISI scientists, Jurassic rocks were explored and a number of new animals, all extinct, were discovered, leading to the establishment of a Geology Museum at ISI. Indeed, within a couple of decades the first Jurassic mammal from India was discovered by an Indian geologist which was fittingly named *Kotatherium haldanei*. Palaeontological research continues to thrive well in ISI. The Geology Museum attracts a large number of visitors, including students from schools, colleges and universities. Moreover, there has been a resurgence of palaeontological research in various other centres of the country. This, I think, is a fitting tribute to J.B.S. Haldane's deep interest in palaeontological research.

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J.B.S. Haldane,  
P. C. Mahalanobis and  
Pamela L. Robinson with  
Sir Julian Huxley in the  
Geological Studies Unit of  
the Indian Statistical  
Institute (February 1959)



At the farewell of Pamela Lamplugh Robinson (speaking) on 8 April 1961  
*Sitting from L to R : J.B.S. Haldane, P. C. Mahalanobis and C. R. Rao*

**J.B.S. HALDANE : A TRIBUTE**

*Indian Statistical Institute*

*Calcutta 700 035, India*

1992

**MEMORIES OF HALDANE**

Cedric Smith

C.A.B. Smith  
The Galton Laboratory  
University College London  
4 Stephenson Way  
London NW1 2HE, England

My first encounter with J.B.S. Haldane was quite brief. JBS was a noted public figure when I was a schoolboy. My brother was an engineering student at University College London. One day I and my mother went to see what sort of a College it was. As we entered the North Cloisters, JBS passed at speed. I was duly excited.

By coincidence, another time my mother visited UCL she had been greatly impressed by a talk she had had with a lady from the Galton Laboratory (Dr. Bell or Miss Karn?) who explained the significance of certain family trees. We were not to know that in future I would spend all my academic life there.

My second encounter with JBS was more dramatic. At the end of World War II a friend told me that Professor Lionel Penrose was looking for a statistician, and urged me to apply. I went to see Professor Penrose, who in turn said that I should see Professor Haldane. (He should have explained that Haldane was the Head of the whole department.)

I made an appointment to see Professor Haldane one evening at 6 p.m., and duly turned up, only to find his room unoccupied and locked. I waited, not knowing what to do, when someone appeared. I asked,

*'Where is Prof. Haldane?'*

*'How should I know?'*

*'But I have an appointment,'*

*'Well, try that door there.'*

So I knocked timidly, and a voice said *'come in'*. JBS was there, sitting in a deck chair surrounded by masses of algebra.

*'I wasn't expecting you till 6 [it then being 6.15] You know why you've come here. Professor Penrose wants me to test you on your mathematics. He thinks we might have a job for you. But I don't think so.'* [pause] *'Have you read my paper on ..?'* [I forget the subject.]

*'No.'*

*'Have you read my paper on ..?'*

*'No.'*

*'Have you read my paper on ..?'*

*'I'm sorry ..'*

*'No need to be sorry. I didn't think you would have read it. Would you like to have supper with me and my wife?'*

*'Yes, please.'*

So we went downstairs.

*'Look, dear'* he said to a fellow scientist, *'what happened to that bit of yeast there ?'*

*'Luther threw it away.'*

*'That lad's got intellect, but no intelligence.'*

*'Well, Prof, it was 3 weeks old and growing moldy.'*

*'All right, come and have supper with Mr. Smith.'*

The supper, at Bertorelli's, went well until the waitress brought the bill.

*'That's wrong.'*, said Haldane. *'But, sir, ...'* *'That's wrong.'*

*'But you see, sir, ...'*

*'That's WRONG. You have charged me one pound too little.'*

The waitress unwillingly adjusted the bill, and we left.

During supper we had been discussing the question, 'If a perfectly rational man is placed equidistantly from several plates of food, will he starve because he will have no reason to choose one rather than another ?' Haldane said that that was not his idea of rationality. After we had left, we came to a fork in the road. Haldane hesitated, saying, *'Shall we go this way? ... Shall we go that way? ... Shall we go this way? ... Shall we go that way? ...'* *'Come on, Prof'*, said Helen. At this point I left them. And that is how I first got to know Haldane and his wife, Helen Spurway. (Much later on, Helen discovered that we once lived in neighboring roads in South West London. *'Then you were one of those nasty little boys who threw stones at me'*, said Helen, and we became firm friends.)

Months passed, without anything happening, so I came to see Prof. Penrose again, and asked him, *'Have I got the job, or haven't I?'* *'Yes, you have'*, said he, and rang the College Secretary. *'The letter of appointment is just being written. When will you come?'*— *'I suggest, July 23.'* So I went away. And many weeks later a letter did come from the College saying that I had been appointed Assistant Lecturer from 1946 October 1.

In fact, I came on July 23, as agreed. Professor Penrose appeared, looked at me, and asked, *'Are you musical ? I have a record of 25 common tunes played twice, in random order, once correctly and once incorrectly, and you have to say which is which.'* I listened, made one error, whereupon he said, *'That shows that not all mathematicians are tune deaf. Now I will introduce*

you to Dr. Kalmus.' Hans Kalmus thrust a liquid at me, saying, 'Does this smell of lemon or of almond?' When I wasn't sure, he said, 'That's where most people hesitate. Now I'll introduce you to Dr. Holt. She'll take your finger prints.' And so I started my first (and last) academic job.

A day or two later, J.B.S. Haldane came in, handed over some calculations, and said, 'Could you check these for me, please?' They were to do with the linkage between color blindness and hemophilia. At that time I knew very little about hemophilia, little about color blindness, and nothing about linkage. Haldane was one of the world's leading experts on these, and I had only started in the department 2 days previously. However, on looking at the calculations, I thought that there was an elementary error in the algebra. I told JBS, and he agreed, and was grateful for the correction. And at that point my opinion of him went up considerably. Unlike so many famous scientists, he was willing to admit to mistakes, and not stand on a false dignity.

'Linkage studies' deal with the problem of finding where genes lie on chromosomes. In 1946 that seemed a very difficult problem, as far as human beings were concerned, and progress would be expected to be very slow. Haldane was the very first person to discover an actual linkage in human genetics. At that time, hemophilia was simply the failure of blood to clot readily after a cut or a wound. It was a very rare condition which was restricted to the male sex, but studies of families showed that it was inherited through women who must have transmitted the gene causing it from one male member of their family to another, without showing any defect themselves. 'Color blind' individuals could not distinguish red and green colors, but saw the world in shades of blue and brown. It was inherited in the same way as hemophilia. That is, it occurred only rarely in females, but it was transmitted from male to male through female members of the family who did not show it. (Strictly speaking, it was already known that there is more than one type of 'hemophilia', and more than one type of 'color blindness', but in his first calculations Haldane left such complications for future investigations.) These facts were interpreted as showing that the genes producing hemophilia and color blindness were both to be found on the so-called X chromosome. Females have two X chromosomes (in almost every cell of their bodies), whereas males have only one. If a woman has a gene for hemophilia, i.e., the inability to clot blood, on one X chromosome, she will almost certainly have the normal clotting gene on the other X chromosome, which



will overcome the defect, and she will not show it. Males have only one X chromosome in each cell, and are not protected in this way.

The question arises, are the genes for hemophilia and color blindness close together on the X chromosome, or far apart? Haldane noticed that in families in which there was one man so unfortunate as to be afflicted with both hemophilia and color blindness, there often were other males with both defects, but few, if any, with only one defect. Without going into details, we can say that it was known that if the genes for hemophilia and color blindness were far apart on the chromosome, there was a mechanism by which they could be separated; a part of the chromosome could be cut away from the rest and joined onto a part of another chromosome. Since this only happened rarely, the (correct) conclusion was that the two genes were close together.

In the 45 years which have passed, the placing of genes on the chromosomes has changed from a very difficult problem to one in which a determined effort is being made to find out just where every human gene lies – a project which will take many years. Nevertheless, the techniques which Haldane used in 1946 to tackle the problem are very much still in use, as well as several new ones.

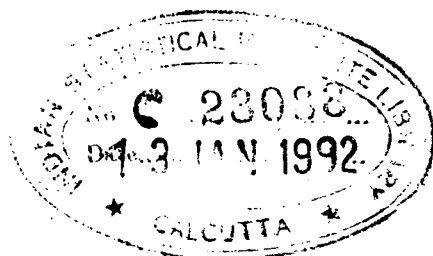
Another problem which greatly concerned Haldane was the role of natural selection in evolution. If a boy has hemophilia, he has a risk of serious bleeding which will lead to weakness and possibly premature death. (That was particularly so before modern medical aid was available.) So, on the average, hemophiliacs will have fewer children than normals. The result will be that the hemophilia gene will be passed on to future generations less often than a normal gene, and one can expect that within a few generations it will have completely disappeared. However, just occasionally, a 'normal' gene will change into a hemophilia gene, apparently spontaneously, and so hemophilia will be reintroduced into the population. Haldane tried to estimate from the extensive records of hemophiliacs kept in Denmark how often this was happening. The work of Haldane and others raises the question, 'If natural selection favors some particular characters, why do we not all have those favored characters? Why are human beings so very diverse, instead of being all alike?' This is still a very lively and controversial question. But it was Haldane who was the geneticist who made most of the first important contributions to the quantitative study of natural selection.

J.B.S. Haldane will be best remembered as one of the founders of mathematical genetics (with S. Wright and R.A. Fisher). But there was more to

him than that, including his biochemical work. He was one of the leading scientists of his time. (Who was it who said 'We are privileged to sit side by side with the giants on whose shoulders we stand?') But his qualities did not stop there. He was abundantly endowed with courage, both physical and moral. During World War II he and his colleagues conducted dangerous experiments on themselves, breathing various gases at various pressures, in the interests of submarine crews. He was never afraid to stand up for what he believed to be true or right, at the risk of unpopularity. As a true scientist, he based his beliefs on facts, and would willingly revise them when the facts contradicted his preconceptions. Perhaps this moral and intellectual stand could be considered of importance comparable to that of his intellectual achievements. His concern with compassion was shown by him becoming a vegetarian (after moving to India). His knowledge was wide. It is said that he addressed University College Classics students in perfect ancient Greek, confusing many of them.

There is one strange event which I have known on very good authority, and which I have never seen reported elsewhere. One day when Haldane walked into his office, he saw what seemed to be an exact double of himself already there, sitting in a chair. I would have expected his curiosity to lead him to investigate this odd phenomenon further. Instead, he simply sat down on top of his double, who offered no resistance and just disappeared.

To make one point plain,  
just let me explain,  
he pronounced his name ['hə:ldən]  
thus rhyming with Malden.  
He would view with disdain  
any rhyme with 'Great Dane'.



## COVER PORTRAIT BY

B.K. Sinha

32 Ashutosh Mukherjee Road, Calcutta 700020, India

*[Mr. B.K. Sinha was the official photographer of the Indian Statistical Institute. He has now retired from service. He was closely associated with J.B.S. Haldane. He is a member of many international photographic societies, and continues to serve as a judge of photography competitions. Painting is his hobby. Many solo exhibitions of his paintings have been held. The cover has been printed from an original pastel portrait done by him.]*

## COVER DESIGN & PRODUCTION

Courtesy:

**Ananda Bazar Patrika Private Limited, Calcutta.**

*We are especially grateful to Mr. Arup Sarkar for his personal interest and help in this matter.*

## PRINTED AT

Reprography Unit, ISI, Calcutta

Printing & Publication Unit, ISI, Calcutta

## ACKNOWLEDGMENTS

Cost of production of this album has been underwritten in part by:

**Council for Scientific and Industrial Research,  
New Delhi**

**Bhoruka Charitable Trust, Jaipur**

**Titan Watches Limited, Bangalore**

**Classic Financial Services & Enterprises Limited,  
Calcutta**

*We are grateful to these organizations for their support.*

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1 JUN 1993