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SCIENTIFIC AWAKENING

PROFESSOR A. V. HILL'S dynamic visit to twelve Indian cities between mid-November, 1943, and early April, 1944, gave much comfort to the scientific community, and he now gladly testifies to the great goodwill universally manifested towards his mission. This lay in acquainting himself with the state of scientific and industrial research in this country, and thus equipping himself to advise the Secretary of State on the organization of scientific endeavour as a part of Indian post-war reconstruction; and on its co-ordination with similar activities in Britain. His report* is rich in proposals directed towards development of Indian resources in men and material; its interest and importance are outstanding.

Immediately on his return, Prof. Hill procured an official invitation to a group of Indian scientists led by Sir Shanti Swarup Bhatnagar, Head of the Board of Scientific and Industrial Research, to visit British factories, laboratories and institutions concerned with linking scientific procedure to public needs. This embassy having later journeyed to the United States and Canada, returned to India in mid-February, and it is reasonable to hope that its members may come to be regarded as apostles of a new era; for their unique experience will authorise them to select and urge the adoption of such among Prof. Hill's proposals as they deem best applicable to Indian conditions.

The first of these relates to medical education, upon which as a physiologist Prof. Hill is highly qualified to judge.. and his verdict is that the development of scientific medicine requires one first-class department of physiology at which teachers and research workers of a new standard and a new outlook will be reared, and thence distributed throughout the country. There is the same need for intensified "anatomy and pharmacology in the medical colleges; and there is little provision for psychology. Biochemistry is in rather better case because it has developed a certain independence of medicine, has had a special part to play in relation to nutrition and has connections with agriculture and industry. It will be a pity, however, if biochemistry is encouraged to develop mainly as a branch of chemistry in order to avoid the narrowness and penury of the medical connection. It should be just as closely in touch with physiology, pathology and medicine as with chemistry, agriculture and industry."

This proposal calls for an All-India Medical Centre, "an Indian Johns Hopkins", throughout staffed by the ablest people available anywhere, employed full-time and adequately paid. The selected students should be graduates in arts or science, and when requiring monetary help should receive enough to cover their long training with the aim of producing future leaders among medical teachers, researchers and practitioners. Moreover, selection should be regardless of all considerations other than quality, because "if any reason whatever were accepted for admission other than ability and character the project would lose at once a large part of its value." Greatly improved health being India's first need, the All-India Medical Centre should be established at a cost of Rs. 7 to 10 crores in the capital city, and might form a suitable national memorial to the Indian Forces, whose gallantry in World

* *Scientific Research in India.* Professor A. V. Hill, M.P., S. D., Sec.R.S. (Government of India Press, Simla), 1944, pp. 40.

War II has evoked gratitude and admiration throughout the Commonwealth. A substantial part of the running cost might be met by accommodation for paying patients as at the Mayo Clinic, where fees are adjusted to the patient's income. A specialised section for the clinical study of malaria, with (say) 200 beds, would form an appropriate recognition of both India's Public Enemy No. 1 and the large part this country has already played in coping with tropical disease.

The second major proposal envisages a Central Organization for Scientific Research, which would embrace collectively the functions now exercised in England by the Medical Research Council, the Department of Scientific and Industrial Research, the Agricultural Research Council, the War Cabinet Scientific Advisory Committee, and the Surveys. It would work under the Hon'ble Member for Planning and Development and would comprise six Research Boards, namely, Medical, Agricultural, Industrial, Surveys and Natural Resources, Engineering, and the War Research Board. After outlining the composition and duties of these boards, Prof. Hill indicates the working of committees, including those for grants and studentships, showing also how a Scientific Consultative Committee, recruited from each Board and fortified by six unofficial members could usefully advise the Hon'ble Member.

It will be recognised that this proposal, if adopted, will separate research from direct control of the departments under which it is at present practised, a policy which has been closely examined by Prof. Hill and for which he adduces cogent arguments. He believes that any temporary disadvantages caused by the detachment would be liberally compensated by "more and better research", following improved co-ordination of the various branches of inquiry resulting from disclosure of existing gaps and weaknesses. Moreover, departments now benefiting by such research as they do control could retain this advantage through a Development or Improvement Council set up within the department to apply research results to the various practical problems in view. Such a council, if including members of the relevant Research Board, would offer the twofold benefit of (1) keeping the Board aware of practical needs and (2) ensuring that research results come to the notice of those whose duty it is to apply them. The "more and better research" would follow release from the trammels of departmental need, as it is "a mistake in general to tie up research too directly to the solution of immediate practical problems."

Furthermore, assemblage of all research branches in a central organization provides one inestimable advantage which is not mentioned in the report. It would greatly facilitate that association and consultation among the scientific personnel which Indian distances now preclude, and which have been immensely helpful to geographically more fortunate nationals. The Indian Science Congress Association dating from 1914 was designed to mitigate the distantial handicap from which most Indian scientists are compelled to suffer: but even that provides only one fleeting annual alleviation of a few days, and cannot embrace all the juniors, who are the very people most needing the benefit. A Central Organization for Scientific Research located at Delhi with an adequate library would supply an increasingly fertile pool of science personnel and practice which might ultimately be comparable with those of London, Washington, Moscow and Paris. From this concentration of effort and opportunity special benefit would accrue to investigators of those regions in which two or more branches of science are intermingled. Looking further into the future, inevitable social exchanges between members of the science group and their governmental neighbours may be calculated to produce reciprocal enlargement of sympathy and outlook.

It cannot be denied that there is unlimited scope for this bilateral broadening of outlook and sympathy. Owing to the common exclusion of sciences from school curricula, many people attain highly responsible positions in the community without any clear idea of the mental processes which yield scientific discoveries, and with no conception whatever of experimental methods. They could not, for example, describe the very simple operation of resolving air into nitrogen and oxygen although they depend on air for every minute of their existence. It is even more significant and regrettable that they have no curiosity in the matter. A glaring example of this unhappy principle has lately emerged in a popular book whose world-renowned author—presumably serious for a moment—roundly charges researchers with manufacturing their evidence; in laboratory slang, with "cooking their results" The shocking aspect of this almost incredible episode is that, owing to the high entertainment value of the author in question, and his usually penetrating vision, this calumnious dictum will reach a very large circle of readers, most of whom will fail to diagnose the mental aberration and will rashly assume that because he is a super-sparkling playwright his opinion of other matters must be trustworthy.

From an early stage of the report there springs the question, Where shall we find the men? On a much larger scale it haunts the Sargent Scheme, and is foundational to both compulsory national education and scientific awakening. Among intellectual disasters consequent on the war has been the isolation of India during five years, and "one of the most urgent needs, therefore, of Indian science, medicine, technology and industry is for young teachers, research workers and members of technical staffs to be provided once more, as soon as conditions allow, with facilities for advanced study abroad; if possible, on an enlarged scale in order (*a*) to make up for recent restrictions and (*b*) to meet the greater needs of the future." Following the lately returned Foreign Mission of Indian Scientists there is happily no doubt that carefully selected Indian practitioners will be welcome in the laboratories of Britain and the United States, the only obstacle to their acceptance being limitations of space arising from arrested training of those nationals, and consequent overcrowding of laboratory accommodation,

accentuated by the priority claimed in England for domestic housing.

Any outlay on this project by Government within the limits of available space will be a splendid investment. During many decades preceding World War I it had been common practice for advanced British and American students of science to enter German universities, even after their own teaching personnel and laboratory equipment had attained the German level: besides improving their knowledge of the language such students benefited by observing another way of life. Many years —perhaps another generation—must pass before German universities again become harmoniously accessible by foreigners, and meanwhile Indian students must be liberally subsidised to enjoy such facilities as may be obtainable elsewhere. This would not only provide India with a pool of technicians trained in all branches of science and medicine, but would lead to an improved mutual understanding of East and West. To promote these and other contacts, Prof. Hill advises establishment of an Indian Scientific Office in London, cooperating with the British Central Scientific Office in Washington, and thus enabling India to profit by American experience in soil-conservation, irrigation, hydro-electric developments, pest-control and many other problems common to the American Continent and India. Another factor in assembling a reservoir of trained technicians suggested by Prof. Hill is the provision of facilities for technical training at all important centres, ancillary to a few technical institutes of the highest possible standing; either newly constructed, or developed from existing ones, of which he considers the Indian Institute of Science, Bangalore, to be the one approaching most closely to the ideal sought. The principle is the same as that underlying the proposal for an All-India Medical Centre noticed above, and "the cost will be considerable, but if Indian industry and agriculture are to be developed to the highest level by Indians, and if Indians of the required quality are to staff the new national laboratories to be built under the Board of Scientific and Industrial Research after the war, then Indians must be trained to the highest level themselves. Nationalist fervour cannot replace first-class scientific ability and technical training."

Scientific awakening has come to other nations through the war, and India must not lag behind. Addressing the East India Association in July 1944 on the results of his Indian mission Prof. Hill gave his emphatic summary in the words, "Scientific Development or Disaster". Faced with the standing threefold menace of ignorance, ill-health and malnutrition, India is threatened with the future calamity of a population overflowing the limits of her agricultural resources, because one immediate result of improved nutrition is reduced mortality. "In quality and calories together India needs at once at least 50 per cent. more food than she now has; give her that and her population will increase not by 15 per 1,000 per annum but by 20 or 25—it is already 20 in the Punjab. Then in 30 years or so the food supply will have to be doubled again, to be three times what it is now." A threefold increase in thirty years demands a stupendous national effort. New land must be brought into cultivation involving irrigation, and proper maintenance to avoid erosion. Roads, railways and bridges must be built, and transport multiplied. Wide improvement in the breeding of plants and animals must be effected, and insect-pests mercilessly combated. Soil chemistry must be studied and applied. Every known means for battling waste must be operated, so that all useful ingredients may return to the land. Afforestation must be stimulated, if only to avert the lamentable destruction of cowdung as fuel and redirect it to its proper destination, the soil.

There are many other matters discussed by Prof. Hill in his report, including Indian scientific societies and the various ways in which Government might assist and encourage them; for instance, by purchasing a certain mileage of air-travel for distribution among such bodies. His fruitful, sympathetic and stimulating visit followed by this wealth of practical proposals, will provide abundant material for reflection, discussion and construction during many years to come, the whole event being unique in the scientific life of this country. In conclusion, it is worthwhile to quote a significant passage in Prof. Hill's preface to the report: "I have assumed throughout that the scientific method, rightly and confidently used, will provide the framework within which national development will be planned by Indians for India. In their task they can be sure of the co-operation and goodwill of their scientific colleagues elsewhere. No other method can possibly succeed."

M. O. F.

ADVANCED STUDIES OVERSEAS

ARRANGEMENTS, it is understood, are now complete for sending students overseas for advanced studies. In addition to the provision made for stipendary students, the Government of India are also making arrangements for assisting in placing in foreign institutions of those students who desire to proceed overseas for advanced studies at their own expense.

The Government of India, in addition to the students sponsored by Provincial Governments, will send overseas a number of students who will receive adequate stipends for further education and training in various branches of Technology, Applied Science and Agricultural subjects. Government servants will also be eligible for stipends, and they may also be sent overseas at their own expense.

Applications are being invited to reach the Selection Board (Overseas Students) set up by Education, Health and Lands Department by April 15, 1945, on a special form which has been included in a booklet *Information for Students Desiring to Proceed Overseas for Advanced Studies* (1945), being issued by the Manager of Publications.