

THE NATIONAL PHYSICAL LABORATORY OF INDIA, DELHI*

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THE GENESIS

[I]N the year 1941, the Director of Scientific and Industrial Research represented to the then Commerce Member, Sir Ramaswamy Mudaliar, who was also the founder of the Council of Scientific and Industrial Research, that the prime essential for India's industrial development was a Central Research Laboratory, separating as it developed into a National Chemical and a National Physical Laboratory. Already the Government had provided us with a laboratory at the Government Test House in Calcutta to make a beginning in the matter of organising scientific and industrial research in the country to meet national and defence needs necessitated by the war. I proposed in a note both an expansion of the Government Test House and the creation of new laboratories in Calcutta, Delhi or other places climatically more suited. These proposals were still under examination when the entry of Japan into the war changed the situation completely and it became clear that any expansion of activity at Calcutta was out of the question, since Calcutta was obviously vulnerable to air attack. So, it was decided to remove the laboratories of the Director of Scientific and Industrial Research to Delhi and continue the work of the Board at the headquarters of the Government.

The idea of establishing a twin-set of laboratories, the National Physical Laboratory and the National Chemical Laboratory, was accepted in the beginning of 1943 by the then formed Council of Scientific and Industrial Research. Soon after, the idea was widened in scope and the Council approached the Government of India for the grant of a crore of rupees for the post-war establishment of five National Laboratories, the three additional ones being, a National Metallurgical Laboratory, a Central Glass and Ceramic Research Institute and a Fuel Research Institute. Planning Committees consisting of some of the best available scientific and technical talent in the country were set up to prepare broad plans for the work, functions and organisation of each of these laboratories.

It is necessary to stress here the nature of the National Laboratories. These laboratories do not intend to supplant but to supplement the work of individual or collective industrial concerns in respect of research. They undertake work of the kind that does not come ordinarily under the scope of industries. Since they are able to command resources wider than the industries can, the laboratories can employ more talent and try alternative approaches to problems simultaneously. Problems which bear wider social aspects than an industry could be

concerned which become subjects of state scientific research. Moreover, the advice that state research can give will be non-partisan. Industry can hardly undertake work of a purely exploratory nature. So the function of these laboratories is both complementary and independent.

THE PLANNING COMMITTEE

The Planning Committee for the National Physical Laboratory consisted of Sir Ghulam Mohammad as Chairman and as members, Prof. M. N. Saha, Dr. Nazir Ahmad, Sir K. S. Krishnan, Principal G. R. Paranjpe, Dr. H. J. Bhabha, Dr. Wali Mohammad, Dr. D. M. Bose, Dr. Rafi Mohammad Chaudhry and Mr. N. N. Sen Gupta and myself. Besides these members, the Council obtained the services of Dr. K. N. Mathur from the University of Lucknow as Assistant Director for planning and as Secretary to the Committee. Following the usual procedure of the Council's Planning Committee Reports, the National Physical Laboratory Report was first drawn up in a tentative form and was widely circulated, to invite comments and suggestions, both in India and abroad. The response the Committee received could, perhaps, be taken as an index of the general interest in the Laboratory. Besides a volume of comments and suggestions from individual scientists, scientific institutions and Government Departments in India, we had the benefit of the advice of the President of the California Institute of Technology, Prof. Robert A. Millikan, the Director of the National Bureau of Standards, Dr. Lyman Briggs and the Director of the National Physical Laboratory (of England), Sir Charles Darwin. In England, the National Physical Laboratory, situated in the picturesque surroundings of the Bushy Park has established an envied reputation for itself. Its tests and certificates are taken as the hall-mark of the highest precision and accuracy which scientific knowledge and human ingenuity can attain. As members of the Scientific Mission which visited U.K. and U.S.A. in 1945 some of us had the privilege of a free discussion with Sir Charles Darwin and members of his staff on the tentative proposals for the National Physical Laboratory. This discussion and the suggestions received, enabled the Planning Committee to finalise their report which was published early this year and was accepted by the Governing Body of the Council.

ORGANISATION AND FUNCTION OF THE NATIONAL PHYSICAL LABORATORY

In the main, the Laboratory's foremost function will be the maintenance of fundamental and derived standards, and the undertaking of research with a view to achieve greater and greater accuracy in the measurement of those standards. At present there is no well-equipped laboratory in India which can undertake standards work. One or two laboratories in

* Edited extracts from the Address delivered by Sir S. S. Bhatnagar, Kt., O.B.E., D.Sc., F.R.S., on the occasion of the Foundation Stone Laying Ceremony of the National Physical Laboratory during the first week of January 1947.

India possess yard and metre bars which were at one time standardised by the National Physical Laboratory at Teddington. The Mint at Bombay have in their possession certain standard weights certified by the National Physical Laboratory of England. But in neither case any systematic organisation exists to undertake regularly inter-comparisons between their standards and those of the other countries, which is the accepted method of all standards laboratories. Besides the fundamental standards of length, mass and time, there is a large number of derived standards like volume which comes in so much in chemical glassware, and in gallon measures of liquids; the various electrical units against which all the electrical measuring work of the scientists, the electrical industry and the electric supply companies is standardized; density measurements, which are of use not only to the scientists but also to the layman. The Lactometer interests the housewife as a handy weapon in her constant travail against the quantity of water in domestic milk supply. Perhaps, one of the biggest contributions which the National Physical Laboratory in England made under the able direction of Sir Charles Darwin was their organisation for testing gauges for the industry during the war time. We are on the threshold of a great industrial development in the country in which the development of engineering industry is expected to play a very great part. No precision work in engineering can be done without an adequate supply of calibrated gauges, and some organised laboratory where these gauges could be checked and rechecked periodically since gauges wear off with use. This point may be better appreciated if I were to say that in the fittings of high grade automobiles and aero-engines an accuracy better than one part in ten thousand is usually required in individual parts. At the National Physical Laboratory at Teddington, gauges are tested to an accuracy of better than one part in a million. In the calibration of the standard weights they have reached an accuracy of one part in ten million through the use of a special type of balance and accurate control of outer conditions.

NINE DIVISIONS

The work of the laboratory in India will be carried on through the following nine Divisions:—

- (1) Weights and Measures.
- (2) Applied Mechanics and Materials.
- (3) Heat and Power.
- (4) Optics.
- (5) Electricity.
- (6) Electronics and Sound.
- (7) Building and Housing Research.
- (8) Hydraulic Research.
- (9) Analytical Chemistry.

Each of these divisions will be under an Assistant Director, who will have under him scientific assistants besides other laboratory staff.

LIAISON WITH INDUSTRY

Apart from the work of standardisation the laboratory will be called upon to undertake considerable amount of research work which is expected to go a long way towards developing

Industry in this country. Physical science is taking long and fast strides. New discoveries in the fundamental sciences are opening up vast possibilities of industrial application both by way of improving old processes and by introducing new ones. The National Physical Laboratory will be concerned with maintaining constant research work to fulfil this purpose. For the same reason they will maintain a close liaison with Industry. Investigation of raw materials of the country with a view to adopt them to the requirements of the industry will be a correlative work which the laboratory will undertake.

INDUSTRIAL STANDARDISATION

A very important aspect to which sufficient attention has not been given in this country is that of industrial standardisation. It may be recalled that the Government of India recently set up a body known as Indian Standards Institution, which will undertake industrial standardization in India on somewhat the same lines as the British Standards Institution does in the U.K. The work of the B.S.I. is carried on mainly through the active assistance of scientific laboratories. The National Physical Laboratory in England has contributed not a little towards the success of industrial standardisation there in all branches which lie within the scope of their work. The Council of Scientific and Industrial Research have been associated intimately with the formation of the Indian Standards Institution and Dr. Mathur recently represented them at the British Commonwealth Standards Conference and the International Conference on Standardisation, held in London in October last. At both these conferences, measures for a better co-ordination of industrial standardisation were discussed. If India is to play her role as a great nation she has to take an active part in scientific and technological work of an international character quite as much as in the international political sphere. Speaking from experience, I can say without hesitation that the amount of unanimity which the scientists are able to achieve is quite unimaginable amongst politicians. The National Physical Laboratory Planning Committee has rightly laid great stress on the point that the Laboratory shall in all possible ways assist Industrial Standardisation.

FUNDAMENTAL vs. APPLIED RESEARCH

The subject of fundamental *versus* applied research has been recently heard in many quarters. In the minds of those qualified to speak research can hardly be divided into water-tight compartments and such division is a scholastic distinction which ignores how scientific research develops. What is fundamental to-day, may become very much of applied research in a very short while. The electrical dynamo was as much the result of fundamental work on the nature of electricity as the development of atomic energy the result of abstract calculations of the nuclear physicists. Both the theoretical and practical aspects of science have thus progressed by their intimate interplay. An artificial separation is neither theoretically sound nor practically workable and if enforced renders theory arid and practice a petrified routine. It is by the inter-pollination

of thought and work that the most fruitful result emerges. I am glad to state the Council of Scientific and Industrial Research has been keenly alive to this and has given as much encouragement to research of a purely academic type as to applied or utilitarian work. As instances, the Council's grant to Tata Institute of Fundamental Research, the Palit Research Laboratory of Calcutta, the Bose Research Laboratory, and the several research schemes in operation under the auspices of the Council bearing on fundamental aspects of sciences may be mentioned. The Planning Committee of the National Physical Laboratory have also stressed the importance of encouragement to both these aspects of research.

FUNDAMENTAL RESEARCH TO-DAY—AN ORGANISED INDUSTRY

One aspect of fundamental research work which can hardly be neglected in India is that which requires specialised large-scale laboratories. During recent years, and particularly during the last world war, organisation of scientific work has undergone vast changes. Not only does some of the present type of work require large-scale specialised organisations well outside the scope of university work but also expenditure of money running into millions which could only be justified if diversified, co-ordinated and regulated application and professional continuity of work are guaranteed. This is not usually possible in the universities where teaching and research necessarily go hand in hand and are essentially preparatory. Research work there, is bound to be scrappy, discontinuous, and unco-ordinated. I may be permitted to quote here from a recent article by Dr. Lee A. Dubridge who is now President of the California Institute of Technology and who during the war was Director of the Radiation Laboratory at the Massachusetts Institute of Technology which had such a lot to do with the conduct of atomic energy development in the U.S.A. Discussing the importance of large research laboratories, Dr. Dubridge says "... it should be clear that independent laboratories will have as their major facilities only those very large installations which, as far as can be foreseen, are beyond what a single university could contemplate operating—or which, because of shortage of material or funds, not more than one or two universities in any area could have. So,

I, for one, look forward with keen interest to a great new experiment in physical research. Those who long for the old days with lone worker in the basement room with his wax and string and glass-blowing torch can have them. I believe that the essential spirit of the old days—freedom of enquiry, time for thought—can be obtained even in the pressure of great new physical and organizational techniques." In short, fundamental research is soon becoming a huge organised industry in itself.

LOCATION OF THE LABORATORY

The question of location of the National Physical Laboratory was thrashed out threadbare and the Committee made out an overwhelming case in favour of locating the Laboratory at the headquarters of the Central Government. In any new constitution the importance of contact between science and state will even be greater. Delhi, besides being the seat of a young and hence very virile university, is in addition the headquarters of a number of scientific departments of the Government of India like the Meteorological Department, the Agricultural Department, the Medical Department, the Royal Indian Air Force, the Scientific Section of the G.H.Q., the All-India Radio, the Railway Board and others. We are particularly fortunate in the present site as we are close neighbours of an Institution which has played no inconsiderable part in India's agricultural development—I mean the Agricultural Research Institute right opposite us. The Institute has one of the best libraries on the biological sciences, and between the National Physical Laboratory and the Institute, we shall have the most complete scientific library in India which we hope will form the nucleus of a Central Information Service for all the scientific workers in India.

These are days of decision for India and if she is to take, as she must, her rightful and honoured place among the nations of the world she must grow strong and great industrially. In this great and exacting venture the role of the national laboratories will be vital and the people of our country, whose mind and face are already turned towards science in industry and society, will, I am sure, take great interest in the work of the laboratories and extend their unflinching help in their development.

APPLIED ENTOMOLOGY, ITS PAST AND FUTURE IN INDIA*

DR. BHALERAO has been recognized as one of the authorities on Indian Helminthology, and as one who has devoted himself to the subject for the past twenty years, he is in the best position to correlate all our accumulated knowledge of Helminth parasites. He has himself contributed to the elucidation of the life-histories of a number of helminths, either directly or indirectly affecting man and has, in the address, listed all the parasites that have been reported from time to time in this country. Working in one of the premier Research Institutes of India (Imperial Institute of Veterinary Research), it is natural that the parasites of domestic animals get their full attention in his address and a long and comprehensive list is presented of trematodes, cestodes and nematodes occurring in animals that

are associated with man's life in India. In a necessarily brief address such as this, it is naturally impossible to expect comprehensive accounts of the life-history of each species. In fact, in quite a number of cases, the life-history is unknown. That is where Dr. Bhale-
rao's address is a help, in drawing attention to the vast amount of work that is still to be done, and the large number of gaps in our knowledge still to be bridged. Brief references are made in the case of each parasite, to its host, to the disease it causes, and also in such cases where the life-history is fully known, to the remedies.

* Summary of Dr. G. D. Bhale-
rao's Presidential Address to the Section of Zoology and Entomology, Indian Science Congress, Delhi, 1947.