THE NATIONAL CHEMICAL LABORATORY

Its Scope and Functions*

By SIR S. S. BHATNAGAR, O.B.E., D.SC., F.R.S.

(Director of Scientific and Industrial Research)

THE NATIONAL CHEMICAL LABORATORY is the fifth in the chain of a series of National Laboratories which the Council of Scientific and Industrial Research has sponsored. On previous functions I dealt at great length on the nature of the National Laboratories. These Laboratories as I have said before are not intended to supplant but to supplement the work of individual or collective industrial concerns in respect of research. They will undertake work of the kind that does not come ordinarily under the purview of the existing industries or universities. One of the main functions of the National Chemical Laboratory will be to bridge the gulf between scientific research and its application to problems of human welfare. The National Chemical Laboratory will undoubtedly take up long-range problems of fundamental research in chemistry —problems which are usually not tackled in the universities for want of funds or lack of facilities for organised co-operative research. Such problems are not sponsored by ordinary industrial organisations as their solution does not hold out prospects of bringing immediate monetary advantages to the industries concerned inasmuch as they must be preceded by pilot plant investigations. That this country is capable of first class scientific work, is well established by the many important contributions made by the Indians in the theoretical field. The road from a scientific discovery or an invention, to its successful industrial application is generally long and tedious and it is this stage which the Indian scientist seldom reaches. His published work is immediately made use of by countries better equipped to traverse the difficult route of application. The Indian businessman very often has neither the staff nor the equipment nor even the insight to appreciate the discovery of his colleagues and so the utilisation of discoveries made in India takes place in some other countries and even the credit of the newness of an Indian idea is snatched away from the real author. I could quote many illustrations. When I was in America in 1944, some notable Indians in America brought several instances to our notice. Such instances are not uncommon even in Britain. The most important recent example is that of the discovery of penicillin which was due to two British scientists, Fleming and Florey, but as England was unable to develop the large-scale or semi-large-scale production of this material during the war, America had to take it up; and the credit due to the British scientists had to be fought for and revived by the British people. Very often the developmental stages involved, require work of high quality and originality and the expenditure generally is much higher than that involved in the discovery of the fundamental principle. India must realise that this developmental work deserves to be recognised as well as the discovery of a principle. Perhaps the most attractive and useful feature of the National Chemical Laboratory will be that it will be equipped and organised to meet the needs for such developmental work for which hardly any laboratory in India is at present equipped. Such work has been almost completely neglected so far by the universities in India.

I cannot do better than quote a few sentences from a booklet issued by the National Chemical Laboratory Planning Committee in which these aims and objects of the proposed laboratory have been described in great detail. According to this book, "The developmental work in the National Chemical Laboratory may take the form of improving old processes in the light of new scientific knowledge or of discovering new processes. The development of new processes will be carried out to the pilot plant stage in the laboratory. When a successful process has been passed on to industry, the National Chemical Laboratory will remain in touch, and any difficulties or problems that may arise in the large-scale manufacture of the product will be brought back to the laboratory for solution. In addition to the processes developed in the National Chemical Laboratory, other problems of industry which fall within the scope of investigations of the National Chemical Laboratory may be taken up. The men at the National Chemical Laboratory even on their own initiative may undertake to investigate technical processes of Indian industry and make improvements in them.

"In this manner the link between the National Chemical Laboratory and the industry will be living and vital, and so will be its link with universities and other scientific institutes in the country where fundamental scientific research work is being pursued. These institutions may be invited to pass on their discoveries and inventions to the National Chemical Laboratory for developing the means to their successful industrial application.

"Some of the most important scientific discoveries during the last half century, which have been of the greatest benefit to mankind, have nearly always resulted from large organisations both of workers and of materials, and have involved expenditure, which falls outside the capacity of the average scientific laboratory. In the same manner technical processes developed in the western countries which have revolutionised industrial development and modern civilization itself, have required huge expenditure of funds and materials. The utilisation of coal tar, fixation of

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* Extract of speech delivered by Sir S. S. Bhatnagar on the occasion of Laying the Foundation Stone of the National Chemical Laboratory, at Poona, on the 6th April 1947.

atmospheric nitrogen, the development of plastics and artificial rubber, of artificial textiles and fabrics, the hydrogenation of coal, and the development of the entire petroleum industry are a few important examples out of a large list. The National Chemical Laboratory hopes to be in a position to undertake such difficult, important and expensive research.

"It must be mentioned here that the major problems of industry, or speaking of the wider aspect, those of human welfare are never such as fall within a narrow grove represented by a particular branch of chemistry. More often than not, for the successful solution of a problem, the co-operation of experts from different fields of science is necessary. The National Chemical Laboratory will, therefore, embrace not only chemistry, but also physics, mineralogy, engineering and biology in so far as they relate to chemical problems and the chemical utilisation of national resources. Without the provision of such a wide scope the laboratory may become sterile. The institutes of industrial research in other countries fully recognise this need. The Mellon Institute, which is peprhaps one of the best industrial research institutes in the world dealing with chemistry, has highly developed sections representing biology. The famous Massachusetts Institute of Technology has a department of Biological Engineering which comprises of such subjects as biophysics, food technology, sanitation, nutrition and industrial biology. The National Chemical Laboratory recognising the same principle will have sections of Chemical Engineering and Biological Chemistry and Evaluation.

"It may also be stated that in modern applied research concerted teamwork is becoming more and more essential. The day of the individual research worker is nearly passing away. The solution of problems which arise to-day require the specialized knowledge of a number of experts. It is, therefore, essential that the National Chemical Laboratory while embracing a large number of subjects and experts in different fields should be able to work as a team.

"Last of all, the functions of the National Chemical Laboratory will include the training of research workers in specialised fields of chemistry and technology with particular reference to those for which no provision has been made in the existing scientific laboratories of the country."

The subject of chemistry occupies a unique position in the field of industrial development. There is hardly any finalised industrial product, raw material or process in which chemistry does not play a part. It is obvious that no single laboratory could hope to accomplish everything needed for industrial research in this field and specific problems will have to be solved and fundamental work carried out in numerous other laboratories in the provinces and the universities and in the laboratories of private industries. At the present stage of our country's development, we do, however, need an outstanding laboratory in India which will offer facilities for research work in the more important fields of chemistry. It has therefore, been proposed by the Planning Committee that the National Chemical Laboratory will have the following seven main divisions:—

1. Inorganic and Applied Chemistry.
2. Physical Chemistry including Electrochemistry.
3. Organic Chemistry.
4. Chemistry of High Polymers.
5. Biochemistry and Biological Evaluation.
6. Chemical Engineering.
7. Survey and Intelligence.

It must not be forgotten that chemistry is an expanding subject and some of the divisions may have to become independent laboratories. For example, Electro-chemistry is fast becoming an important branch of chemistry capable of independent existence and the Council is already exploring the possibility of developing it in a separate laboratory of its own.

It will be noticed that the divisions of Inorganic, Organic or Physical Chemistry and Chemical Engineering cover a wide variety of chemical industries. For example, the division of Inorganic Chemistry and Physical Chemistry jointly will deal with the chemistry and industry of radio-active substances, industrial gases and mineral resources of India and many other industries such as glass, ceramics and clay. Physical Chemistry finds many applications in industry. Industrial catalysis, high and low pressure technique, colloidal solutions, pastes, paints, emulsions and foams, phase-rule separation, electro-metallurgy, electro-chemistry and corrosion constitute some of the types of systems and problems wherein physical chemistry has played an important part in the past and will continue to play an even more significant role. The fascinating research work in Organic Chemistry has contributed greatly to the present chemical age. Civilisation would have been very different and prosaic but for such chemical industries as coal and coal tar products, organic solvents, dyestuffs and intermediate chemicals, drugs, vitamins and hormones, alkaloids and other active principles of plants, essential oils, perfumes and cosmetics, oils, fats, waxes, tannin materials, carbohydrates, detergents, wetting agents and petroleum industries, etc., etc. In fact there is hardly any industry in which Physical and Organic Chemistry have not found direct access and even warm welcome. The section of chemical engineering will enable workers to carry out pilot plant work and help in engineers and chemists being trained to take up the designing and working of large-scale chemical plants. The division of High Polymers will deal with the fascinating field of plastics, paints, rubber and synthetic rubbers. The division of Biochemistry will be helpful in dealing with problems pertaining to life processes and will assist in establishing pharmaceutical industries and health organisations in the country. This is a very live branch of chemistry and India is fast developing an active school of workers in this field. The division of Survey and Intelligence will form an important part and it will deal with survey of raw materials and also provide research, technical information, and library and translation services. It will also carry out the duties

of scientific *liaison* and will provide museum, publication and publicity facilities.

There are hardly any new lands which India can hope to exploit. Science may discover new sources of wealth in the lands we hold and grow new raw materials in them. The only new lands on which we may have our eyes must lie in the domain of the mind and have to be created in the research laboratory. It is on these sources which will emerge from the national laboratories that we have to depend now and in the future for the means to maintain and raise our standard of living and to keep abreast amongst the best nations of the world.

SIR K. S. KRISHNAN

THE announcement recently made by the Hon'ble C. Rajagopalachariar, Member for Industries and Supplies, that Sir K. S. Krishnan, D.SC., F.R.S., has accepted the Directorship of the National Physical Laboratory will be warmly welcomed by readers of *Current Science*.

Professor Krishnan has had a remarkably brilliant career. After completing his University education, Krishnan joined the staff of the Madras Christian College. But his thirst for higher studies and research did not keep him long there. In 1923 he joined the band of research students working under the inspiring guidance of Professor Raman at Calcutta. Placed in the proper environment, Krishnan soon shone as an enthusiastic and brilliant investigator and was foremost among Professor Raman's collaborators. In 1928, he was appointed as Reader in Physics at the Dacca University. This post he occupied only for five years, for, when Prof. Raman left Calcutta in 1933, he unhesitatingly chose Dr. Krishnan to occupy the newly created Mahendralal Sircar Professorship of Physics at the Indian Association for the Cultivation of Science. With characteristic ability, Prof. Krishnan successfully kept up the great traditions acquired during the leadership of Prof. Raman by the Indian Association for Research in Physics. In 1942, the Allahabad University invited him to occupy the Chair of Physics which he accepted. He now relinquishes this post to take up his new appointment.

The research activities of Prof. Krishnan and his associates extend over diverse branches of physics. During the years 1923-1928 he carried out a series of important investigations both theoretical and experimental on the scattering of light, molecular optics and Raman effect in collaboration with Prof. Raman. While at Dacca and later at the Indian Association, Prof. Krishnan initiated and conducted with conspicuous success numerous investigations on the magnetic properties of crystals the results of which were published in the *Transactions of the Royal Society* as Memoirs. Outstanding investigations on the optical properties of crystals and X-ray crystallography have also been carried out by Krishnan and his collaborators. In recognition of his distinguished researches in optics and especially for his study of the influence of magnetism on crystals, the Royal Society of London elected Prof. Krishnan to its Fellowship in 1940. He thus became the sixth Indian and first pupil of Sir Raman to achieve this unique distinction. At Allahabad Prof. Krishnan has built up an active school of research carrying out investigations on the thermal and electrical properties of metals and alloys.

No sketch of Prof. Krishnan's career would be complete without a reference to his extensive travels abroad, which gave him many an opportunity to visit important centres of research in Europe and America and to cultivate personal relations with eminent men of Science. He first visited Europe when he was invited to take part in the International Conference on Photoluminescence held at Warsaw in 1936. He widely toured throughout Europe and delivered a series of lectures at various important centres including the Royal Institution in London and the Cavendish Laboratory at Cambridge and in many of the Continental Universities. The Liege University honoured him with the award of the University Medal. He again visited Europe in 1939 to attend the International Conference on Magnetism held at Strasbourg under the auspices of the International Institute for Intellectual Co-operation and of the Service Central de Recherche Scientifique de France. In the summer of 1946 he went to England as one of the Indian delegates to the Empire Scientific Conference organised by the Royal Society. He also took part in the third annual conference on the X-ray analysis group of the Institute of Physics held in July 1946. At the request of the Government of India he visited Europe and America to survey the modern trends of research in the prominent physical laboratories.

Besides being a Fellow of the Royal Society, Prof. Krishnan is a member of many Scientific Societies in India and abroad. He was the President of the Physics Section at the Madras Session of the Indian Science Congress. He has served in a number of Committees sponsored by the Government of India for the scientific and technical development of the country. In recognition of his services to the cause of Indian science he was knighted in 1946.

It is a matter of national pride that Prof. Krishnan who has had his entire research training in India should have been chosen to be the first Director of the National Physical Laboratory. Simple and unostentatious as he is, Prof. Krishnan is a gifted lecturer, noted for the profundity of his ideas and clarity of expression. With a man of his eminence and experience at the helm, the National Physical Laboratory can be expected with confidence to fulfil the tasks that it is intended to do.

R. S. KRISHNAN.