NATIONAL CHEMICAL LABORATORY OF INDIA

By DR. BASHIR AHMAD

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IN pursuance of the recognition of the need for the organisation of scientific and technical research on an extensive scale for the larger objective of economic and industrial development of the country, it has been proposed to establish a National Chemical Laboratory in India. A tentative scheme for the Laboratory was drawn up in 1943 and circulated to a large number of scientific organisations and individuals in India and abroad. A final plan has now been formulated after a careful consideration of the suggestions received, the lines along which similar laboratories in other countries have been established, and taking into consideration also the special needs of India. This plan, therefore, incorporates the views and recommendations of a large number of leading men of science and scientific organisations all over the world.

Functions

The Laboratory will be devoted to problems of both fundamental and applied research in different fields of chemistry, and will also concern itself with developing the means for the application of scientific knowledge to practical problems of industry. The Laboratory will bridge the gulf between science and its application to industry and will provide a link between the universities, the State and other scientific institutes on one hand, and industry on the other. The fundamental work undertaken by the Laboratory will be devoted to extending the frontiers of knowledge in directions likely to prove useful to the industrial progress of the country. The applied and developmental work will take the form of improving old processes in the light of newer scientific knowledge, and discovering new processes. This work will be carried to the pilot-plant scale in the Laboratory, after which it will be passed on to industry. The Laboratory will maintain close and continual contact with industry, the difficulties and problems of which may be referred to the Laboratory for solution. In this manner the link between the National Chemical Laboratory and industry will be vital and effective, and so will be its link with the universities and other scientific institutes in the country.

Some of the most important scientific discoveries during the last half a century, which have been of the greatest benefit to mankind, have resulted from large organisations both of workers and of materials, and have involved expenditure beyond the means of an average research laboratory. The National Chemical Laboratory hopes to be in a position to undertake such important and expensive research.

Keeping in view the fact that problems of industry, or in the wider perspective, those of human welfare, require the co-operation of experts in different fields of science, the scope of the National Chemical Laboratory has been kept sufficiently wide. The Laboratory will include not only chemistry, but also physics, mineralogy, engineering and biology in so far as they relate to chemical problems and the chemical utilization of the national resources. The Laboratory will also provide a place for the training of research workers in specialized fields of chemistry and technology, particularly with reference to those

for which there is no provision available in the existing scientific laboratories of India.

The scientific work of the National Chemical Laboratory will be divided into seven main divisions: (1) Inorganic Chemistry, including Analytical Chemistry; (2) Physical Chemistry, including Electrochemistry; (3) Chemistry of High Polymers; (4) Organic Chemistry; (5) Biochemistry, including Biological Evaluation; (6) Chemical Engineering; (7) Survey and Intelligence. In addition to these, two more Divisions are contemplated, one for Fermentation Technology, and another for Cellulose and Related Products.

Location and Staff

Poona, which enjoys a moderate climate all the year round, and is within easy reach of Bombay and its industries, has been selected for the location of the Laboratory. A site of about 470 acres on the Pashan Road on a beautiful, breezy and healthy plateau, in close proximity to educational institutions of the city, has been selected for the Laboratory.

The staff requirements of the Laboratory have been carefully considered. They are summarized below:

1. Scientific staff:		
(a) Director, Assistant Directors, Senior Scientific Officers, Junior Scientific Officers	.. .. .	51
(b) Research Assistants	.. .. .	64
2. Administration staff	.. .. .	42
3. Technical staff for workshop and various services	.. .. .	35
4. Stores, Laboratory Assistants and Attendants	.. .. .	86
5. Other staff	.. .. .	42
Total	.. .. .	320

Buildings and Finances

The floor-space requirements of buildings to house the different activities of the Laboratory have also been carefully worked out. These are as follows:

1. Main building, housing various divisions	.. .. .	150,000 sq. ft.
2. Ten auxiliary buildings	.. .. .	30,000 "
Total	.. .. .	180,000 "

The establishment of the Laboratory will involve a capital expenditure of 3.5 million rupees and an annual budget of 1.16 million rupees when the Laboratory is working at full strength.

NATIONAL METALLURGICAL LABORATORY OF INDIA

By DR. G. P. CONTRACTOR

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THAT India possesses great natural advantages for the production of iron and steel there is no doubt. She has rich and vast deposits of iron ore, exceeding both in quality and quantity the ores found in many States of Europe and America. These ores are reckoned to be more than sufficient for the requirements of India herself for nearly a thousand years. In spite of this, India's yearly pro-

duction of steel ingots and castings in 1939 was only one million tons. The United States are producing $\frac{1}{2}$ ton of steel per man, the United Kingdom about $\frac{1}{3}$ and Japan $\frac{1}{4}$ ton per man. In India, if the target is kept as low as $\frac{1}{8}$ ton per man, she will have to produce about eight million tons of steel a year. This comparison indicates beyond a shadow of doubt that India's iron and steel industry is in an extremely backward state. Only the systematic and thorough development of the iron and steel industry, which is a basic and key industry as well as a defence industry, can facilitate the transition of India from the agricultural to the industrial stage by stimulating the growth of a number of associate or allied industries.

In order to ensure the progress and expansion of India's metallurgical industries, it was decided by the Council of Scientific and Industrial Research in 1942 that a National Metallurgical Laboratory should be established in India. Accordingly, a Laboratory Planning Committee, under the chairmanship of Sir J. J. Ghandy, director of the Tata Industries, Ltd., was constituted to formulate a scheme. A tentative scheme was prepared and circulated to technical experts, industrialists, and others in 1945. This scheme was later altered on the basis of the suggestions and comments received, and principally on the basis of the funds available. The final scheme recently prepared was approved on September 17, 1946, by the governing body of the Council of Scientific and Industrial Research.

Location

The Laboratory will be situated at Jamshedpur, which is the centre of the modern metallurgical industries in India. The Tata Industries, Ltd., have generously placed at the disposal of the Council a very suitable site for the construction of the Laboratory. Services, such as electricity, water, gas, sewage and effluent disposals are available close to the site.

Functions

The Laboratory when completed will cover all aspects of metallurgical research, both fundamental and applied, and will carry out research on ores, minerals and refractories as applied to metallurgy. The preparation of minerals and ores and the smelting of the latter are so definitely a part of the develop-

ment of the country's metallurgical industries that facilities for minerals research have been provided at the Laboratory, complete with pilot-plant equipment for semi-commercial development.

As the metallurgical industry is one of the biggest consumers of refractories, research on this subject has also been included with that on metallurgy; work on metallurgical furnace design will also be undertaken. Work on refractories will be greatly facilitated by the presence of the ore-dressing and minerals research section, with its specialized laboratory and pilot-plant assemblies.

Plans

Provision has been made in the final plans of the National Metallurgical Laboratory for administration, including statistics, library, museum, lecture theatre, etc.; chemical analysis; physical chemistry; physics as it affects metallurgical problems; the examination, preparation and smelting of metallic ores; the melting, heat treatment and working of metals and alloys; research into the structure and physical properties of metals and alloys; the electro-deposition and surface treatment of metals; and research on refractories. Facilities will be provided for the application of research results to commercial operating conditions, and for the study of such conditions as they affect the quality of the products, and the efficiency and economy of commercial production. The National Metallurgical Laboratory will work in close collaboration with the other Laboratories of the Council, particularly on long-term research of a fundamental nature.

The Laboratory is meant to function as an up-to-date research centre where knowledge of the fundamental sciences of physics, physical and inorganic chemistry, metallography, engineering, etc., will be utilized to solve the problems which confront the ferrous and non-ferrous metal industries to-day, and are expected to confront them even more in future, when competition from foreign countries will have to be met. The Laboratory is also meant to function as a clearing-house for information. It will give facilities for the training of a number of students in the application of scientific methods to the metallurgical industries, so as to enable them to take charge of technological duties in the works. To help and encourage industrialists in the solution of

ARCHITECT'S DRAWING OF THE NATIONAL METALLURGICAL LABORATORY, INDIA

their problems, facilities will be provided at the Laboratory through a system of industrial fellowships.

Buildings

The Laboratory when completed will consist of a main building containing administrative offices, research laboratories, museum, lecture theatre, etc., and a separate technological block comprising large workshop-type laboratories with associated control rooms for practical semi-commercial scale operations. The main building will have three floors, the height of each floor being about 12 ft. clear underside of slab. Efficiency and convenience of operation coupled with the required degree of flexibility and adaptation to future needs were borne in mind in designing the Laboratory. The sizes of rooms were carefully planned with regard to the requirements for benches and aisles, especially for the chemical laboratories, and for natural illumination. Chemical laboratories and other rooms on the north were planned to be 32 ft. wide, this being considered the maximum depth which could be illuminated from windows on the outside wall and from the clerestory above the fume hoods on the corridor wall.

The location of the laboratories for different types of work has been carefully considered. Fume-producing laboratories have been kept to the east of the main building, while the physical and metallurgical sections, housing complicated and delicate instruments, have been placed to the west. The laboratories have been arranged, however, so as not to interfere with the convenience of working. The position of individual laboratories has also been given considerable thought. For example, laboratories where heavy objects are tested, such as the macro-room and radiography laboratory, have been placed on the ground floor. Similarly, X-ray laboratories have been planned to be located in the corner of the main building, with a lighting area on one side. The location of the museum and the lecture theatre is such that direct access can be had through the entrance without disturbing the work being carried on in the other parts of the building. The administrative section is centrally located on the second floor. In this section, facilities for statistical investigation, not only for compiling metallurgical trade figures but also for the use of statistics as a research tool in investigations on practical production and operational problems, will be provided. The library has been planned to run through two floors, with adequate provision for book-stacks and working space for book-binding, copying, etc., on the ground floor. The actual working floor area on the first floor is approximately 26,000 sq. ft., with an equivalent space on the ground floor, and about 8,600 sq. ft. on the second floor. The laboratories and the administrative section in the main building will be air-conditioned by a refrigeration system.

The technological block, providing a working floor area of about 28,000 sq. ft., has been situated to the south of the main building and connected to it by corridors in the form of covered ways. The block consists of four main workshops or bays which are situated two on each side of the electrical power distribution station, which is in the centre. This arrangement permits the installation of generators, controls, etc., for a furnace bay on the left, and motors, etc., for a mechanical treatment bay on the right. Furthermore, this arrangement ensures the central power distribution station against dirt, dust,

fumes, etc. The north end of the technological block is occupied by a mezzanine floor forming upper and lower suites of rooms for offices of the operating staff, for inspection and control laboratories, for drawing offices and for specialized apparatus in connexion with pilot-plant work.

Staff and Finance

The initial basic staff of the Laboratory is summarized as follows:

1. Scientific staff:				
(a) Director, Assistant Directors and Research Officers	..	..	..	27
(b) Research Assistants	..	..	..	26
2. Technical staff (mechanics, etc.)	..	..	..	25
3. Laboratory assistants	..	..	..	24
4. Administration	..	..	..	18
5. Laboratory 'Bearers'	..	..	..	33
Total				153

The total cost of construction and equipment of the Laboratory is estimated at Rs. 4,280,000 (£325,000). Buildings, services, air-conditioning, heavy electric plant, etc., are estimated to cost Rs. 25,00,000 (£190,000), and for equipment, provision has been made for Rs. 17,80,000 (£135,000). The recurring expenses in the initial stages are estimated at Rs. 6,00,000 (£45,000).

The foundation stone of the National Metallurgical Laboratory was laid by the Hon. Mr. C. Rajagopalachari, Minister for Education and Arts in the Interim National Government, on November 21, 1946.

CRITERIA OF HYBRIDITY

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THE importance of the study of natural hybridization is obvious in view of the large part it plays in the process of evolution. There have been considerable differences of opinion, first as to the possibility of recognizing natural hybrids and, secondly, as to the status of the parents once the possibility of hybridization has been established. We are not concerned here with the second controversy, for it must be recognized, now, that the existence of hybrids both within and between species is well substantiated. Although hybrids are one of the bane of the taxonomist, their frequent occurrence in Nature makes it important that they should be recognizable without doubt. Further, when such recognition is possible they cease to be a bane.

Decline of Experiment

In 1895, Kerner¹ performed a very useful service by exposing many of the spurious criteria upheld by some of the unscientific horticulturists of his day, and he performed many crosses for himself in support of his belief that hybridization was the basis of the origin of new species. Although his pioneer technique led him to draw several conclusions which we know, to-day, to be generally incorrect, such as the true-breeding nature of hybrids (pp. 580-1), he was insistent that while some of the characters of hybrids were