efficient a basis in the various college research centres. A very small proportion of the money thus saved could be distributed as small annual grants to those undertaking problems in science colleges.

7. Invite recognized research bodies like :
   (*a*) The Imperial Council for Agricultural Research,
   (*b*) The Zoological and Botanical Surveys of India,
   (*c*) The Imperial Forest College,
   (*b*) The Indian Central Cotton Committee,
   (*e*) The Indian Science Congress,
   (*f*) The Indian Medical Council,
   (*g*) The Imperial and Provincial Agricultural Research Institutions, and other scientific bodies to co-operate by giving such help (financial or otherwise) as would enable the Central Government to formulate a scheme of work as would effectively cope with the present needs of the country.

Such a co-ordinated effort for carrying on an intensive research from an economic point of view will mean not only less money spent on research work but also added interest to so many trained men whose energy, training and time have hitherto not been utilized. This scheme would be within the strictest bounds of economy and would produce results of immense importance to the economic development of India.

A Marine Biological Station for India.*

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THERE is no doubt whatever that Marine Biological Stations in India are essential for advancement of Science and its successor, the economic exploitation of the sea. At the present time, there are facilities for marine research in the University of Madras and in the Madras Fisheries Department. As there are already places on the East Coast for research as such, one on the West Coast will be a great asset. As regards the centre, it may be said that Bombay is one of the suitable places, although in 1926, Col. Sewell initiated a five-year plan for the Zoological Survey of India, in which a Marine Biological Station was to be established in Karachi, but which was temporarily suspended due to financial reasons.

Among the problems that a station such as this will take up, will be the whole question of suitable methods of obtaining the maximum catch with the minimum cost of money and energy as it is not safe to assume that the appliances used in the West will be equally successful in Indian Waters. Thus, there is every possibility that great improvements will be made in the methods employed by our fishermen to-day. One has to look at Japan to know what great scope there is to develop the marine resources on Western lines to suit local conditions.

The value of the fisheries will depend not only on the quantity of fish caught but also on the quantity sold fresh or preserved for food and on the by-products such as oil, fishmeal for manure, etc. Hence *pari passu* with the improvement of fishing methods, marketing facilities, etc., must be developed, on the lines similar to those of the Madras Fisheries Department.

There is one important suggestion worth considering and that is the economic research must have a pure scientific basis. This will be best achieved if both the scientific and economic sides of the question are studied by *different* officers in the same biological station, thus ensuring a healthy co-operation and free exchange of ideas. The importance of this is borne out by the fact that fishery work has been carried on in Madras for about twenty-five years, but little research as such has been accomplished, as the time of its officers has been absorbed by administrative duties : in spite of this handicap the department has collected some valuable data and obtained good results.

The importance of knowing the bionomics of the animals is emphasized by Dr. Setna himself who states, " Our fishermen—and even we people with scientific training—know practically next to nothing of the migratory instincts of the fishes, etc." Here, one should not forget that data will be needed not only on the study of fishes with reference to the breeding season, rate of growth, food supply, and other factors but also on the questions of salinity, temperature, chemical composition, and movements of the water mass that wash the Indian Coast *at all seasons of the year*.

Further in a marine station, facilities will exist to work out in detail the morphology of the common animals to provide the necessary books for teaching. It is this want of text-books, dealing with Indian types, that is mainly responsible for the deplorable state of affairs as stated by Dr. Setna regarding specimens from Europe. Here one may refer to the fact that the essence of teaching science is not to cram the student with a mass of facts but to develop the powers of observation and logical deduction and text-books are to serve as mere guides to the student. Thus as the text-books used in various colleges are those dealing with European species, the institutions had to resort to importing specimens for the class-rooms. This number will die a natural death when a few more custom appear of the series entitled "The Indian Zoological Memoirs" which was initiated and is edited by Prof. Bahl.

As Dr. Setna suggests " the income of the station will be derived from (1) admission charges to the aquarium, (2) supply of marine specimens to places inland, (3) rental of tables "; it is submitted that the last item should be kept as low as possible for individual workers and especially the under-graduate, as it is not advisable to increase the cost of training ; whereas

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* *Cur. Sc.*, 1, 108, 1932

institutions may be approached to contribute annually towards the upkeep of any particular table.

In conclusion, the importance of the establishment of a Marine Biological Station in Bombay cannot be over-emphasized and special attention is to be paid to scientific research as a basis for economic exploitation of the Indian Waters.

The British Association—York Meeting, 1932.

THE Presidential Address of Sir Alfred Ewing at the York Meeting of the British Association is a very human document. Full of years and honour, Sir Alfred has known the Association almost from its very inception and gives a graphic account of the early days and the state of science then, contrasting it with the present conditions and outlook. He shows how a proud sense of scientific certainty has given place to a more humble, questioning spirit which recognizes that we are yet groping very much in the dark and that "to understand is to draw one incomprehensible from another incomprehensible" as Einstein put it. This humility has brought science nearer to the layman who shares in the desire for truth; the social and economic problems of the day make him look wistfully to science for a satisfactory solution. The British Association has helped the advance of science by providing a common meeting ground for experts in different branches of science and Sir Ewing gives a famous instance of this in the fruitful association it brought about between Joule and Thomson. He also shows how the British Association was the first to try and give a sound scientific basis to British Engineering practice, mostly empirical before. The standardization of electrical units is another of its services.

After mentioning the most recent advances in our knowledge of nuclear structure due to the work of Chadwick and Cockcroft and Walton, Sir Alfred Ewing passes in review the many wonderful inventions whose birth he has witnessed, such as the dynamo, the motor, the internal combustion engine, the aeroplane and airship, the turbine, the gramophone and wireless. He emphasizes that modern invention has had such rapid progress because it built upon sure scientific knowledge and not on accidental discovery. This rapid increase of inventions has brought many amenities to the lives of men, but the consequent change in the methods of production and distribution has also upset the balance of human relations so that unemployment, competition and war have become a standing menace. Sir Ewing rightly concludes by a note of warning against allowing such a condition to develop; as he says, we can only hope that man will not encompass his own destruction by wrong application of his God-given understanding, but that science will help him to enjoy the luxuries which science creates, in a manner leading to the elevation of his soul.

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The Presidential Address to the Section of Mathematical and Physical Sciences deals with the application of physics to a problem of economic and national importance, namely, the discovery of valuable deposits such as minerals or oil, without actual digging or boring. It is a subject which, for its development, requires the co-operation of physics and geology, involves team-work in the field and is costly to pursue. Yet judicial application of the methods developed by workers in this field often leads to a considerable decrease in relative costs, and further improvements may in future lead to greater reliability and cheapness. Being an infant science which cannot attract public attention through sensational discoveries such as are being made in atomic physics, it is likely to languish for want of support: Prof. Rankine justly emphasizes the need for Government help at such a critical stage of its life. Leaving aside such appliances as the divining rod, whose action, even if real, is not based on known scientific principles, the methods at present available are four, *viz.*, gravitational, seismic, magnetic and electrical. In the first method, the extremely sensitive torsion balance invented by Baron von Eötvös, is used to study the variations in gravity due to variations of the density when layers of different minerals are present in any locality. The instrument though costly, is very reliable, and its indications will lead to valuable results, unless topographical irregularities are so large as to mask the effect of mineral deposits. The seismic method is particularly suitable when there is a horizontal separating layer between two extensive deposits in the lower of which the seismic wave travels faster than in the upper. In such a case the disturbance due to an explosion travels to the separating layer and being refracted or diffracted along this, reaches the surface at a large distance earlier than the direct pulse travelling along the upper deposit. Hence a delicate portable seismograph will be able to record it so that it is not masked by the larger perturbations due to the direct wave. When iron-bearing deposits are concerned, the magnetic method, which depends on measuring the variations of the horizontal and vertical components of the Earth's magnetic field by means of a portable magnetometer, is most suited and is least costly. The method will be even more useful when the magnetometer is improved as suggested by Prof. Rankine by utilizing the torsion principle used in the Eötvös balance and thus making it more sensitive and at the same time less liable to disturbances due to daily and temperature variations of the magnetic field. The possibilities of the electric method, in which the variations in the electrical conductivity of different layers are measured, have not yet been fully explored. In fact, the method was shrouded in mystery before the publication of the Report of the Imperial Geophysical Experimental Survey. But in future, when other nations besides the Germans, who have so far been almost the sole cultivators of this science, devote their attention to the problems of Geophysics, the electric and other methods may confidently be expected to be enormously improved and the science firmly established among other branches of applied physics.

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