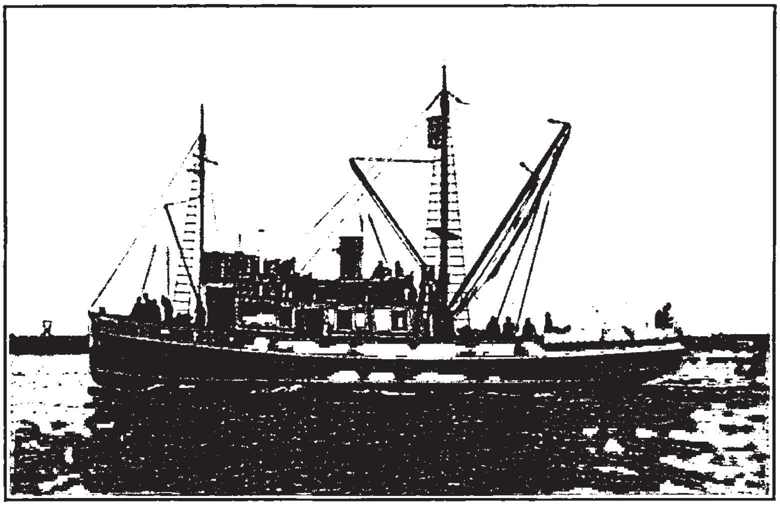
FISHERIES RESEARCH IN AUSTRALIA

BY SIR DAVID RIVETT, K.C.M.G.

SINCE the ill-fated trawler *Endeavour*, under Dr. Dannevig, was lost at sea in 1914, fisheries exploration has rather languished in Australia. This is scarcely pardonable in a country with 12,000 miles of coastline, a relatively poor fish supply, especially in the inland areas, and a definite need for quantities of fish meal on its stock farms. During the past two years, a vigorous effort has been made to improve matters under the Council for Scientific and Industrial Research working in co-operation with universities (particularly that of Sydney) and State Departments.



M.S. *Warreen.*

Dr. H. Thompson, formerly of the Newfoundland Fisheries Services, has been appointed officer-in-charge of investigations, and under his guidance the Station illustrated in the accompanying photograph is nearing completion. The site, made available by the New South Wales Government, is that of Dannevig's hatchery at Cronulla, the southernmost Sydney watering-place, on the Port Hacking estuarial group of salt-water inlets. It is admittedly a very beautiful spot for a marine biological station, with deep and shallow water frontages of rocky and sandy foreshores. Museum and library facilities are easily accessible in Sydney; and the fish market there will be useful in the collection of biological material and statistics from the trawling and seine-netting fleet.

MARINE BIOLOGICAL RESEARCH STATION, CRONULLA.
The aquarium and offices are in the left foreground and the main laboratory building in the right. Behind are the concrete tanks. On the shores are the pond and boat sheds.

The pre-existing hatchery appointments have been converted for experimental work. Salt water is pumped to a 25,000 gallon concrete tank and fed by gravity to an aquarium where the temperature is under control. A large tidal concrete pond (100 ft. × 42 ft.) has been reconditioned for the retention of fish for observation or experiment. New additions include a workshop, net- and fish-cleaning shed, and a main building containing offices, stores, biological, chemical and bacteriological laboratories, dark-room, charting and drawing room, and a large library. Refrigerating cabinets and a small canning plant are provided.

A 16-ft. motor skiff has been built for local sampling work and a 2-ton truck has been equipped as a mobile laboratory.

For exploratory work, mainly on pelagic, or surface-swimming, fish, M.S. *Warreen* (a native name for the sea) was built in Melbourne and has been in commission for about fifteen months. She is 82 ft. long, of 108 tons displacement, and is fitted with a 215 h.p. main engine of Atlas Polar Diesel construction, with Ruston auxiliaries. She carries radio equipment for transmitting and receiving, and an echometer for automatic recording of depth. A small laboratory permits limited work at sea. A large purse-seine net is carried on a turn-table in the stern.

Over so great an extent of sea, one small vessel capable of a speed of only 9 knots can do but little: hence very full use is being made of reconnaissance from the air. Aircraft and personnel are made available to the Council by the Royal Australian Air Force; and particularly in the 'spotting' of shoals of tuna and so-called salmon (*Arripis trutta*), air observation has been conspicuously successful. Already possibilities have been demonstrated which are attracting the attention of commercial men; but a great amount of scientific investigation will be necessary before a sound basis for fisheries development is secured.

STRUCTURE OF THE RAYON FIBRE

By PROF. H. MARK

REFERENCE has frequently been made in these columns[1] to the progress of our knowledge concerning the structure of natural and artificial fibres during the last few years. The accompanying illustration (p. 314) gives a résumé of the present state of knowledge as represented by the cellulose fibre, which is very well known and at the same time of great economic importance.

The illustration was made up under the assumption that we have at our disposal a microscope allowing us magnifications of unlimited amounts in such a way that we can always increase its resolving power by the factor of 10 by switching in another imaginary objective. Looking at a rayon thread through such a microscope, we should obtain such a series of pictures, and it seems desirable to discuss them one after the other and to point out what kind of information they give and to what extent the particular qualities of the fibre are shown by them.

(*a*) We start with the highest magnification, about 1 to 50,000,000, and observe the *fundamental chemical unit* of cellulose, namely, the *glucose residue* composed of 6 carbon atoms, 10 hydrogen atoms and 5 oxygen atoms[2]. These glucose units have a ring structure and are linked together by main valence bonds. They stand for the chemical behaviour of the material, for example, for the fact that cellulose is easily wetted and swells in water, but does not take up organic substances such as petrol, benzene or oil. They are also responsible for the fact that one can produce certain derivatives of cellulose, namely, cellulose nitrate (celluloid), cellulose acetate (cellon), etc. Finally their presence is responsible for the fact that by hydrolysis cellulose can be converted into a sugar.

(*b*) We pass now to the next magnification, 1 to 5,000,000, and get an insight into the *crystallographic unit* of the fibre. What we see is the *elementary cell* of the cellulose lattice revealed by X-ray investigations[3]. We see that the different glucose residues are united to long chains lying parallel to each other and running through the fibre along its axis. The presence of these long and highly orientated chains explains the double refraction of the material, its high mechanical tenacity, the anisotropy in swelling and the behaviour towards substantive dye-stuffs.

(*c*) When we switch in a magnification of 1 to 500,000 we get the next picture. Here each single chain of diagram *b* is represented by a thin line. We learn that these chains are partly bundled together with a considerable degree of order forming a *micellar structure*, and partly they represent a complicated framework of entangled fringes. We get the impression that the whole fibre consists of parts with comparatively high crystallographic orientation and of other parts which can be called amorphous. This peculiar structure accounts for the fact that rayon fibres at the same time show a considerable strength and a high elasticity. It is responsible for the amount of swelling, the dyeability, and the resistance to creasing. Every process that aims at producing rayon has to take account of this fact.

(*d*) The next step, leading to a magnification of 1 to 50,000, gives a more general view of this *fringe and net structure* of cellulose. In *d* the parallel strokes represent the crystallized areas while the small irregular circles are the amorphous regions. We see that the fibre may be regarded as an