

the inhibition of the growth of *Serratia marcescens* and *Staphylococcus aureus* cultures after 5-6 hr. in a strong inhomogeneous magnetic field. The shape of the growth-curve supports the view that after 6 hr. exposure to the magnetic field only a magnetically resistant strain of the population multiplies further. I. L. Mulay (Cincinnati) reported on body deformations found on first and second generations of *Drosophila melanogaster* grown in magnetic fields, suggestive of genetic changes. Sarcoma 37 ascites tumour cells, grown in hanging-drop cultures, showed after 18 hr. exposure complete cell degeneration. The last two papers of this session, by F. A. Brown and F. H. Barnwell (North-western University, Evanston), were devoted to effects of very weak magnetic fields on the orientation of snails, planarians and fruit flies.

On the next day D. C. Butler and D. W. Dean (Butler Research Foundation, Phoenix, Arizona) reported on inhibitory effects observed in the generation of K.B. cells. Leo Gross (Waldemar Medical Research Foundation, Port Washington, New York) discussed his results on the inhibition of transplanted tumours in animals treated prior to implantation in magnetic fields. He attributes this effect to the lymphocytosis ensuing magnetic treatment (*Nature*, 177, 577, 1956). In his experiments on wound healing in magnetic fields he found as much as 20 per cent delay in the reparative process. He discussed also his present investigations on an antibody titre method, as well as his theory that the effect of magnetic fields is due to the influence of the

enzyme substrate intermediates, which are, during their short existence, in the form of free radicals. The last paper, by M. W. Freeman and J. H. Watson (Detroit), described means of introducing iron into the vascular system with the help of sublingual application of iron crystals.

The sessions were concluded by very lively general discussions in which new avenues of approaches and new interpretation possibilities were proposed. On the first day the participants visited the biomagnetic laboratory of the College of Pharmacy, University of Illinois, where a Varian 4-in. electromagnet is available with special pole caps and thermostat facilities to examine the effects of very strong homogeneous and inhomogeneous magnetic fields on bacterial cultures, tissue cultures, oxygen consumption of plants and animals and localized treatment of spontaneous tumours in mice. On the second afternoon the group visited first the laboratory of F. A. Brown at North-western University, where orientation of snails, *Planaria*, etc., are investigated in very weak fields. Thereafter, they visited the laboratory of J. M. and M. F. Barnothy at the Biomagnetic Research Foundation in Evanston. Here, ten large permanent magnets are installed in which 30 mice can be treated at the same time for prolonged periods and where many of the so far established biomagnetic effects were discovered (effect on leucocyte count, retardation of development of embryos and young animals, postponement of ageing and of the onset of spontaneous cancers, compensation of radiation syndromes, etc.).

M. F. BARNOTHY

BRITAIN'S WATER PROBLEM

AN indication of the welcome increase of interest in the growing water problems of Britain (to which *Nature* has frequently made reference during the past decade¹) has recently been demonstrated by the rapid sale of the final survey of the Sub-Committee on the Growing Demand for Water. This latest report² of the Central Advisory Water Committee was sold out on publication and is now being reprinted.

The report may prove to be one of the most significant that has yet come from the Central Advisory Water Committee as it proposes a major reorganization of Britain's water resources along the lines of the memorandum which was circulated by the Minister of Housing and Local Government in the spring of 1961 (ref. 3). The Sub-Committee recognizes that numerous interests are at present engaged in activities which affect the quantity and quality of water available. The authorities range from the Minister of Housing and Local Government to the Minister of Agriculture, Fisheries and Food, and from the River Boards, Internal Drainage Boards, statutory water undertakers, navigation and public health authorities, to agricultural, industrial and riparian interests. There is at present little or no co-ordination between many of these bodies and some indeed work against each other. No single authority is responsible locally for determining the proper use and development of the water resources, and there is no machinery for planning and executing positive conservation measures, either locally or nationally. The Sub-Committee thinks that the time has now come when a major reorganization must be attempted to meet the increasing demands on Britain's

water resources. As the river basin is the natural hydrological unit the recommendation is made that new authorities should be set up to administer river basins and that these should be co-ordinated by a central authority accountable to the Minister.

The proposed new bodies are termed "River Authorities" in the report and it is envisaged that they would be charged with the positive duty of water conservation. This is defined as "the preservation, control and development of water resources (both surface and ground) by storage and other means, and the prevention of pollution, to ensure that the largest possible amount of water is made available for all purposes in the most suitable and economical way whilst safeguarding legitimate interests". The River Authorities would be required to assess the water resources of their areas, and where appropriate develop those resources. On the position of the existing statutory water undertakers the report recommends that "The question whether storage for public water supply should be provided by, or jointly with, the river authorities, or by statutory water undertakers alone, will be a matter for agreement. Once this has been determined and the quantity, point and method of abstraction, including the building of reservoirs, have been settled, the impounding, abstraction, treatment and distribution of the water for the public supply should remain entirely the responsibility of the statutory water undertakers".

As part of the policy of water conservation it is envisaged that River Authorities would construct and operate river regulating and other reservoirs according to need, and where appropriate transfer water from one basin to another. The Sub-Committee

rejects the idea of any form of national water grid as impracticable, but agrees that regional arrangements might well prove useful and desirable. The hydrologists who have consistently stressed the importance of the river basin as the natural administrative unit will welcome the recognition at long last of this fundamental starting point for reorganization. Strangely, however, this view was not taken by all the water authorities and organizations which submitted evidence.

While the Sub-Committee was united in the view that a major reorganization of the control of Britain's water resources along the lines indicated is desirable, it divided as to the means whereby this could be achieved. The majority report proposed the creation of completely new River Authorities limited to small, compact and working groups of 10-15. These new Authorities would be responsible for conservation and also assume the functions of, and supersede, the existing River Boards. There is a minority report, however, of six out of the sixteen members in favour of reconstituting the existing River Boards as integrated River Authorities. The majority of the Sub-Committee think that this method would create very large and unwieldy bodies as membership might rise to more than 40. The existence of the River Boards (at present charged with land drainage and flood control) is clearly a very vital factor in the situation.

The Sub-Committee also emphatically recommends the creation of a central authority, accountable to the Minister of Housing and Local Government, to promote an active policy for the conservation and proper use of water resources, and to ensure that the River Authorities carry it out efficiently. A national view of the developing situation is now increasingly being demanded as the growing conurbations seek their water ever farther afield, and more often than not in areas designated as National Parks. Water conservation and national parks are not irreconcilable, but the public needs reassurance that the right decisions are being made as to the proper allocations between competing land users. Only a central authority can collate and co-ordinate data and under-

take research that will provide from year to year a national appraisal of water requirements and the best ways of meeting those needs.

The need for a comprehensive and integrated land drainage, water conservation and flood control management policy was amply demonstrated during the period in which the Sub-Committee was sitting. The summer of 1959 was the driest for nearly 250 years and many water undertakers were unable to meet the demand, some industries were forced to close down and there was considerable inconvenience in the north and west of Britain, where reliance is placed more on surface waters than on underground storage. The fall in river-levels affected navigation, stopped fishing, reduced irrigation and increased pollution. By contrast 1960 was the third wettest year for 250 years and the rainfall during the late summer and autumn was the heaviest on record for England and Wales. Widespread flooding resulted in the absence of regulating reservoirs. These events coming in such close juxtaposition had a significant impact on the public and there was a widespread realization that Britain ought to be able to manage her affairs better. The final report of the Sub-Committee on the Growing Demand for Water now directs the way to better management. Without this reorganization the continued economic development of Britain will be imperilled and further Tryweryn and Ullswater battles may be expected to occur with increasing frequency. It is to be hoped that the Minister and the Government will find time to introduce the necessary legislation without delay and not wait until the next drought or flood crisis is on the country. The setting up of the River Authorities and the emergence of a national appraisal will take some years even if the task is regarded as urgent. Meanwhile, the insurance against drought diminishes yearly as both the population and the standard of living rises.

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¹ *Nature* 172, 263, 823 (1953); 176, 1133 (1955); 184, B.A., 18 (1959).

² Central Advisory Water Committee. Sub-Committee on the Growing Demand for Water—Final Report. Pp. iii+43. (London: H.M.S.O., 1962.) 3s. 6d. net.

³ *Nature*, 191, 421 (1961).

PLANKTON INDICATOR SPECIES AND THEIR STATISTICAL ANALYSIS

THE study of plankton indicator organisms in relation to water masses and the fisheries usually involves much subjective reasoning and assumption. Typically, only the presence or absence of certain forms is considered, or the percentage composition of the arrow-worm population (*Sagitta* species). There has always been great difficulty in using exact analyses, in part because of the poor sampling qualities of conventional nets, but also because in the study of small areas the result is a purely temporal distribution, much more awkward to assimilate than the simple contoured maps of a spatial distribution.

The work described in a recent series of papers* represents the start of more objective methods in

the study of samples from a small area. Some errors of conventional sampling have been removed by the use of high-speed samplers, in this case modifications of the small 'Hardy indicator' capable of being used from any vessel in the herring fleet. Further errors between day and night samples as a result of diurnal migration and evasion of nets have been minimized by omitting day samples. The results are presented as the average abundance per sample at night in summer for each of the ten years 1949-59.

Dr. M. H. Williamson has taken the figures of average abundance, and by using ranking methods (Spearman's coefficient is preferred) has derived primary and secondary correlation matrices showing the degree of relationship between years and between species. With one or two exceptions the organisms fall into four groups. Two of them (*B* and *M*) are regarded as not being geographical assemblages, but the others are recognized as neritic (*A*) and oceanic (*Z*—"a centre of distribution towards the edge of the continental shelf"). In the appendix, the matrices of

* *Bulletins of Marine Ecology*, formerly *Hull Bulletins of Marine Ecology*, Nos. 47 and 48, Vol. 5: An Ecological Survey of a Scottish Herring Fishery. Part 3: Geographical and Ecological Groups in the Plankton. By R. S. Glover, G. A. Cooper and D. C. T. Forsyth. Part 4: Changes in the Plankton during the period 1949 to 1959. By Dr. M. H. Williamson. Appendix: A Method for Studying the Relation of Plankton Variations to Hydrography. By Dr. M. H. Williamson. Pp. 195-229. (Edinburgh: The Scottish Marine Biological Association), 9s.