resins containing chelating groups, and a study of factors determining the semi-permeability of poly (vinyl alcohol) films in non-aqueous systems has shown that membranes of low permeability can be used to determine the molecular weights of simple compounds of known structure; work on the development of membranes for use in aqueous systems has commenced.

Besides the work already noted, the Microbiology Group continued its fundamental studies of sulphate-reducing bacteria, particularly their metabolism, and the continuous process for bacterial sulphate reduction, and started some studies of the bacterial oxidation of aromatic compounds, particularly the microbiological breakdown of phthalate, a process of industrial importance in the disposal of effluents.

THE ICE AGES AND PAST VARIATIONS OF THE EARTH'S CLIMATE

DURING the past sixteen years, Dr. E. J. Öpik has written extensively on climatic changes in a number of publications, and in Contribution No. 9 of Armagh Observatory, entitled "A Climatological and Astronomical Interpretation of the Ice Ages and of the Past Variations of Terrestrial Climate"*, he has written a paper which largely embodies the main points in his studies.

As might be expected, Dr. Öpik rejects the old astronomical theories of the fluctuations of climate—the changes in the obliquity of the ecliptic and the eccentricity of the earth's orbit. About half a century ago these were shown to be utterly inadequate to account for glaciations and warm interglacial climates, but from time to time they have been revived. Simpson's theory of the ice ages, which was advocated a quarter of a century ago—that they are caused primarily by an increase in solar radiation which in turn leads to a rise of the mean global temperature and an increase of the absolute moisture content of the atmosphere, followed by more precipitation in the form of snow in the polar regions and an advance of glaciers—is dismissed with very little criticism. It is pointed out that there is an absurdity in the theory which postulates the melting of the glaciers and the retreat of the ice when the greater heat takes control, because both the advance and the retreat of the glaciers are explained by the same cause. In addition, climatological and other evidence points to the conclusion that the glaciers of Greenland retreated during the past century, in close response to the increased global temperature.

Dr. Öpik maintains that an interpretation of climatic changes cannot be made without a clear quantitative understanding of the heat balance of the earth, and he develops a method of quantitative analysis of the climatic heat balance, based on the equation $Q = I + E$. In this, Q, I and E represent respectively the net radiation to space, the net insolation or the absorbed solar radiation, and the heat supplied by other sources; the last-named includes convective interchanges with other parts of the earth's surface, such as atmospheric and oceanic currents, or released from that stored in the soil, the water or the atmosphere. On this basis and with certain further assumptions, standard mean radiation curves, in dependence on the mean surface temperature, are calculated for summer and winter as well as for clear and cloudy sky, and the results are given in the paper. Two sections, comprising twenty pages, are devoted to "Variations of Solar Luminosity" and "The Mechanism of Solar Long-Term Variability" and contain references to Öpik's work on these problems during the past fifteen years or more. Regarding the latter section, it appears that a temporary increase of the energy production near the sun's centre will lead to a decrease of solar radiation and to an ice age if the decrease is deep enough. A qualitative picture is sketched of the way in which repeated disturbances in the interior of a dwarf star like the sun can be produced, and it is just possible that here may be an explanation of the mechanism by which major ice ages were recurrent phenomena of a periodicity of about 240 million years. Of course, there is necessarily a considerable amount of speculation in all this, and it is very difficult to make many definite deductions in such matters.

Towards the end of the paper, under "The Problems of Pre-Tertiary Climate", Dr. Öpik confirms his views expressed in 1938 that, although Wegner's theory of continental drift, postulating a corresponding displacement in latitude, cannot explain the last ice age, nevertheless there can be little doubt about the reality of large-scale horizontal displacements (Alpine foldings) in the earth's crust. The opinion is expressed that even if the strange phenomena of Carbo-Permian glaciation can be partly explained by continental drift (and this glaciation is an inducement to regard Wegner's theory favourably), this explanation completely fails for the earlier Cambrian glaciation.

* Contributions from the Armagh Observatory, No. 9: A Climatological and Astronomical Interpretation of the Ice Ages and of the Past Variations of Terrestrial Climate. By E. J. Öpik. Pp. 79 (distributed by Blackwell Scientific Publications, Ltd., Oxford, 1953). 10*s*. 6*d*. net.

WINCHESTER COLLEGE NATURAL HISTORY SOCIETY

IT is regrettable that the reports of the Winchester College Natural History Society can be published only once every three years owing to increased costs of printing, etc., for the report before us (1950–53) is well produced and makes very encouraging reading. However, duplicated summaries of observations on birds, insects and plants are issued every year.

The Society itself is very active, and the report reveals a variety of interests from general field observations to more specialized studies. Three specialized sections of the Society have now been formed—birds, insects and plants—and others may follow.

The report opens with an account by the warden, J. A. L. Myres, of the Viscount Grey Nature Reserve, "Fallodon", which is a part of Watermeads, a piece of land belonging to the College. It is quite clear that enthusiastic boys of the College have done much to render this nature reserve a really valuable asset since the War, during which its upkeep proved impossible.

P. J. Chadder gives an excellent account of the birds' nests (fifteen nests of seven different species) he examined in Fallodon during 1953. This is followed by a numerical analysis of the seasonal changes in birds in that reserve by D. E. D. Campbell.

He concluded that the number of birds were the same in summer as in winter, but that there were considerable decreases during early spring and autumn. The population also varied from week to week during the winter, but was constant during the summer. H. E. Norton publishes a commendable study of the territorial life of the blackbird—a long paper accompanied by six maps. He also presents the bird records for September 1949–July 1953. The bird-ringing report is made by J. A. L. Myres. Interest in birds is also enhanced in this report by a short account of the birds of Australia by J. E. Mollison.

A record of butterflies and moths around Winchester during 1950–53 is given by P. O'B. Harris. W. H. Dowdeswell describes the numerous visits made to Fisher's Pond, a pond which is proving ideal for the study of freshwater life. Molluscs, arthropods and birds were the main subjects of investigation. Another long paper is contributed by R. G. Borneman, writing on the movements and changes in a freshwater plankton community. This is accompanied by two figures and a table of results. Botanical activities are recorded by J. B. Poynton.

During the season reported about forty lectures and film exhibitions were arranged.

This report is one of several which reveal the active interest shown in some schools in field natural history where young students are able to make first-hand studies in ecology, taxonomy, behaviour, etc. Winchester College, with some of our more enthusiastic schools, is leading the way in a fuller appreciation of the true import and value of biological studies.

FORESTRY IN NEW ZEALAND

THE critical position of the indigenous forests of New Zealand has been known for some years and discussed in the annual reports of the Director of Forestry, New Zealand Forest Service. The annual report for the year April 1952–March 1953 (pp. 80. Wellington: New Zealand Forest Service, 1953) deals at some length in its opening pages with this question in its relation to the large area of exotic softwood coniferous forests now existing in the Islands. The position appears to be whether to sanction cutting out in a comparatively few years the remaining existing indigenous forest to maintain the saw-mill industry and industries dependent on indigenous timber and other vested interests, or to reduce the cut so as to maintain a portion at least of the natural forest of the Islands. The Forest Service correctly advocates the latter policy; but there appears to be a considerable body of public opinion against it.

New Zealand is not the only country in the world faced with this question in varying aspects, not excluding Great Britain. The time would appear to be approaching, if indeed it has not been already reached, when the world as a whole will have to make up its mind so far as forestry is concerned (which, in fact, is Nature herself) whether the forest soils of any country capable of maintaining its indigenous forest and species of trees should not rigidly be confined to this purpose; fast-growing exotics showing quick financial returns would then only be used when obviously useful or to fill a temporary gap in supplies, due to past mismanagement by man of the natural forests.

In New Zealand, as the report says, "The exotic forests were established to conserve the indigenous forests; therefore it is putting the cart before the horse to suggest that the Forest Service is seeking a ready sale for exotics by curtailing the cutting of native timber. It would be more correct to say that the production of exotics has been expanded in order to make it possible to reduce the sale of indigenous timber. . . . Experience has shown in foreign countries . . . that exotic species have definite limitations and for this reason the national policy must envisage the management of the indigenous forest to secure their maximum favourable production of timber". To this might have been added their management by the Forest Service in perpetuity, since there can be no question that this is the correct forest and economic policy for the indigenous forests.

E. P. STEBBING

NEW OBSERVATIONS ON THE CHEMISTRY OF N-CARBOXY-ALPHA-AMINO-ACID ANHYDRIDES

By D. G. H. BALLARD, DR. C. H. BAMFORD
AND
DR. F. J. WEYMOUTH
Research Laboratory, Courtaulds, Ltd., Maidenhead, Berks.

THE polymerization of N-carboxy-α-amino-acid anhydrides initiated by primary and secondary bases has been studied in some detail, and the main features of the chemistry of the reactions occurring are fairly well understood[1]. In these cases the main products are linear polypeptides. When primary or secondary base initiation has not been used, other products have occasionally been observed, including cyclic peptides and substituted derivatives of hydantoin 3-acetic acid[2,3]. The exact experimental conditions favouring the formation of these substances are not established in the literature, and no detailed mechanism of the reactions has been put forward. We have recently investigated the behaviour of a number of N-carboxy-α-amino-acid anhydrides in highly polar organic media, and have observed some interesting phenomena which lead to a clearer understanding of the general chemistry of these compounds. Our main observations, on the effects produced by the addition of inorganic salts and tertiary bases, are summarized here.

Catalysis by Inorganic Salts

Many N-carboxy-α-amino-acid anhydrides are stable, or react only slowly when dissolved in highly polar organic liquids such as NN-dimethylformamide or NN-dimethylacetamide. Addition of a soluble anhydrous inorganic salt, however, has been found to produce a rapid reaction. Fig. 1 shows typical results with glycine, C-phenyl glycine and DL-phenylalanine N-carbonic anhydrides in NN-dimethylformamide. In the case of C-phenyl glycine N-carbonic anhydride there was no detectable reaction before the addition of lithium chloride; after addition, rapid evolution of carbon dioxide occurred. Glycine and DL-phenylalanine N-carbonic anhydrides gave