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The Royal Veterinary College.

IT would indeed be a national calamity if the Royal Veterinary College, London, the premier veterinary college of the British Empire, had to close its doors. The precarious condition of the College was emphasised by the Earl of Harewood recently in the House of Lords when he asked what steps the Government is prepared to take to maintain it. Reference to Lord Harewood's speech and to the discussion which followed was made in our issue of Aug. 9, p. 212.

Less than a year ago there was issued as a White Paper the report of the Departmental Committee on the Royal Veterinary College appointed by the Minister of Agriculture and Fisheries in 1928. The report stated that "the condition of the Royal Veterinary College is a national disgrace, it needs rebuilding and re-equipping". After a very thorough investigation the Committee stated clearly that "the deplorable condition to which the College has been reduced both as regards buildings and finance has not been due to any lack of enthusiasm on the part of those few members of the Governing Body who for many years past have been sufficiently public-spirited to devote attention to the affairs of the College, or to the small staff who, despite their meagre salaries and wholly inadequate facilities, continued loyally at their work. It is nothing less than extraordinary that the College has been able, in spite of the most depressing circumstances, to turn out year by year a regular flow of qualified students." The necessities of an Institution have never, we venture to state, been more strongly emphasised by a Government departmental committee, and it should have been unnecessary for the question to have been raised again in either House of Parliament.

The response of the Government to the appeals which have been made is frankly disappointing, and one wonders if the responsible ministers have really taken the trouble to read the report or to weigh up its import. The committee recommended a grant of £280,000 for building and equipment, and a guaranteed annual income of not less than £21,000. The Government offer, as stated by the Earl de la Warr, of pound for pound up to £100,000, is totally inadequate in view of the circumstances. The governors have collected £30,000 as the result of four or five years' urgent endeavour and urgent appeal, and it is believed to be absolutely impossible substantially to increase that amount, so that the offer is practically abortive. Lord Ernle pointed out in the debate in the House of Lords

that in Berlin the *annual* sum paid for veterinary science is £280,000, and yet in London a single capital grant of that same amount is refused.

Earl de la Warr suggested that Lord Harewood and his friends should confer with the Ministry of Agriculture before coming to a decision as to the future of the College. While agreeing that the Ministry of Agriculture is the chief ministry concerned with veterinary science, we agree with the suggestion recently made by Major-General Sir John Moore that other ministries are also vitally concerned and that a conference of responsible heads of those ministries might be held to consider the necessities of the case, with the view of obtaining a proportionate grant from each of them. The Lovat Committee appointed by the Colonial Office emphasised the importance of a good supply of fully trained veterinary officers for the Colonies; the Ministry of Health requires veterinary officers for its administration, particularly in regard to milk supply and meat inspection as well as in respect of animal diseases communicable to man; the Ministry for War still requires a fully competent Army Veterinary Corps, and will continue to do so in spite of mechanisation; and the Ministry for Education must certainly be concerned with the technical education of a College affiliated with the University of London and training candidates for science degrees of the University. Thus no fewer than five ministries are more or less seriously concerned, and a conference as suggested of the Ministries of Agriculture, the Colonies, Health, War, and Education might yield some satisfactory results.

The progress of veterinary science has, moreover, introduced a new factor. The governing body of the profession—the Royal College of Veterinary Surgeons—has extended the course of training from four years to five years, and the change is expected to take place next year. This extension alone will increase the need for more accommodation and a larger staff at the Royal Veterinary College. If it is difficult to carry on the work under present conditions, it will become impossible under the new curriculum.

An International Veterinary Congress has just been held in London and upwards of two thousand delegates attended from all over the world. Most of them visited the Royal Veterinary College and must have wondered at the depressing and humiliating spectacle which is presented by this dilapidated structure, the premier veterinary college of the British Empire. It is to be hoped that the Government will realise its responsibilities in this matter, and take early steps to place the College on a sound basis both as regards buildings and finance.

Popular Science under Discussion.

(1) *The Pastures of Wonder: the Realm of Mathematics and the Realm of Science.* By Prof. Cassius Jackson Keyser. Pp. xii+208. (New York: Columbia University Press; London: Oxford University Press, 1929.) 14*s.* net.

(2) *Modern Science: a General Introduction.* By Prof. J. Arthur Thomson. Pp. xi+210+6 plates. (London: Methuen and Co., Ltd., 1929.) 3*s.* 6*d.*

(3) *The Rhythms of Life, and other Essays in Science.* By Dr. D. F. Fraser-Harris. (Science for You Series.) Pp. vii+185. (London: George Routledge and Sons, Ltd., 1929.) 5*s.* net.

(4) *Short Stories in Science.* By J. G. Crowther. (Science for You Series.) Pp. viii+213. (London: George Routledge and Sons, Ltd., 1929.) 5*s.* net.

(5) *Science and the New Civilisation.* By Robert A. Millikan. Pp. vi+194. (New York and London: Charles Scribner's Sons, 1930.) 7*s.* 6*d.* net.

(6) *Popular Research Narratives.* Vol. 3: *Fifty Brief Stories of Research, Invention or Discovery, directly from the 'Men who did it'.* Pp. viii+174+5 plates. (London: Baillière, Tindall and Cox, 1929.) 4*s.* 6*d.* net.

(7) *Men Who Found Out: Stories of Great Scientific Discoverers.* By Amabel Williams-Ellis. Pp. 224+15 plates. (London: Gerald Howe, Ltd., 1929.) 5*s.* net.

(8) *This Bondage: a Study of the 'Migration' of Birds, Insects and Aircraft, with some Reflections on 'Evolution' and Relativity.* By Cmdr. Bernard Acworth. Pp. xxiv+229. (London: John Murray, 1929.) 7*s.* 6*d.* net.

A. WHAT have you there?

B. The eight books on popular science that I asked you, as an educated man disclaiming any special knowledge of science, to read and to discuss with me. They were written especially for people like you.

A. Have you read them too?

B. Well, I have to review them for NATURE; and I am reasonably conscientious. A discussion with you might give me some useful ideas for the review.

A. I am honoured. But how shall we begin? The books do not fall into any special order.

B. Shall we take them as they come? Here is Keyser's "The Pastures of Wonder", which explains the philosophy of mathematics, and bases on that a philosophy of science. I suspect you found it heavy going.

A. I must confess I did. I struggled along to page 36, where I met my Waterloo: "If a pro-

position P is such that to assert it is equivalent to asserting that a proposition q is logically deducible from a proposition p, or—what is tantamount—that p implies q, then P is a hypothetical proposition ; in the contrary case P is a categorical proposition ".

B. I sympathise with you. In no sense of the word can logic or the theory of mathematics be made popular. But I strongly recommend Section 2 of the book, in which Keyser deals with the realm of science. You will follow most of it in spite of your disaster with page 36, and enjoy, I hope, the courageous examination of the veiled antipathy between the scientist and the philosopher—a conflict due, of course, to differences in temperament, not in ideals.

A. You encourage me. I like the feel of the book—its binding, paper, and the excellent print. But isn't it somewhat dear at 14*s*. ?

B. American books are always expensive.

A. Ah ! that's due to protection.

B. You forget. I am reviewing for NATURE, not for the *Spectator*. Here is the next book : " Modern Science ", by J. Arthur Thomson. There was no difficulty here, I imagine ?

A. None at all. Thomson's books—I've read most of them—never give me the impression that he is writing down to my level, and yet, of course, he is.

B. Few people have that happy gift, and Thomson is one of them. But I must be critical if possible. What did you think of the diagrams ?

A. I don't remember them particularly, except, of course, those illustrating some definite point, such as the development of a coral.

B. Exactly. I cannot feel that the complex relations between organism and environment, for example, are much illuminated by a few concentric circles with arrows of different lengths scattered over them. But I mustn't be dogmatic ; they may serve as mnemonics. Now for the next book : " Rhythms of Life ", by Fraser-Harris.

A. That ranges over almost as wide a field as Thomson's book. I like the manner in which all kinds of out-of-the-way information has been welded into a coherent whole. The chapters on " Suspended Animation " and " How many tastes have we ? " show that particularly well.

B. " Rhythms of Life " deals mainly with biological subjects. It is, I see, in the same series as J. G. Crowther's " Short Stories in Science ", which is largely concerned with physics and chemistry. I shall be most interested in your views on Crowther's book.

A. Why that one more than the others ?

B. Well, Crowther implies in the preface that he is a layman in science. That brings up the question whether science for the general public is presented better by laymen or by professional scientific workers. In other words, should the author be a man who knows his subject or one who knows his audience ?

A. I don't quite follow you. Surely every author should know his subject ?

B. Obviously. But among men of science, ' knowing the subject ' implies the initiation and control of original research work. So I will put my question in this form : Is the discoverer the best man to explain his own discoveries, and those of others, to the educated public ?

A. An awkward question. I am not competent to answer it. But I thoroughly enjoyed Crowther's book.

B. Frankly, so did I. If every layman-author understood as much of science and wrote as well as he does my question would be answered. Incidentally, Crowther devotes his last chapter to this very question. He argues that the majority of men of science should avoid non-technical exposition, and bluntly says : " a scientist who chases both literary and scientific images is endangering his scientific career ". The argument is cogent and merits the careful attention of all scientific workers who hanker after the fleshpots of journalism. But we cannot spend more time on that point now ; we have still four books to deal with. I suggest we take Millikan's " Science and the New Civilisation " next.

A. That will be most appropriate, for I can see it is an exception to Crowther's general argument. Although the book is a collection of various addresses, and therefore discursive in parts, there is an unmistakable air of authority about it ; Millikan knows what he is talking about.

B. Yes, and knows how to say it, too. In fact, I wish he had not used italics so freely in places, for his literary style does not need such artificial aid. Take, for example, his address on the relation of science to industry given to the hard-headed business men of the New York Chamber of Commerce. That speech must have been a triumph ; yet in its printed form it contains scarcely any italicised words. Well, the next book also hails from the United States : " Popular Research Narratives ", vol. 3, with the comprehensive sub-title, " Fifty Brief Stories of Research, Invention or Discovery, directly from the ' Men who did it ' ".

A. That left me with rather a dizzy feeling. From "Distances of the Stars" to "Cast Iron Pipe" and thence to "Wealth from Cornstalks"—to mention three typical examples—is rather a big jump; and an average of only three pages for each account gives the book a hurried, breathless atmosphere.

B. It was written for the American public, which has an insatiable appetite for concentrated information, and has no time to waste on literary trimmings. This book undoubtedly meets that demand; and it has given me, with my sneaking admiration for the crude vivacity of American phraseology, another addition to my collection. It is the opening of the article on moulding rubber with electricity: "Man has long used rubber to keep electricity where it belongs". I could quote some others, but I know you detest them. So let us pass to "The Men Who Found Out", by Mrs. Williams-Ellis.

A. I had no opportunity of reading that; my children discovered it and stuck to it firmly.

B. I don't think we could find any higher tribute than that, but I would like to add one thing. These stories were first given as broadcast lessons to young children. A mere transcription of such lessons into book form would make a poor book, for the technique of broadcasting to children, and of writing for them, are two very different things. Mrs. Williams-Ellis evidently appreciated this point, and she has produced a most enjoyable book. Her descriptions of Harvey, Faraday, Pasteur, and other scientific pioneers will set many youngsters on the path of hero-worship.

Now we come to the last book: "This Bondage", by Commander Bernard Acworth. Well?

A. Well?

B. From which illuminating remark I judge that the Commander has not had an enormous success. What was the trouble?

A. I had the uncomfortable feeling that the author had a few axes to grind. He has no use for airships, aeroplanes, scientists, Dean Inge, and the Bishop of Birmingham; and all this is based on his demonstration that the track of a bird or insect in flight is inevitably affected by air currents.

B. We can dismiss the axe-grinding with the cynical remark that it would have been better had he collaborated with one of the despised scientists. With regard to the effect of wind velocity on the flight of birds, which is ostensibly the main purpose of the book, I feel unkind enough to say that the author has discovered—somewhat belatedly—the parallelogram of velocities and is anxious to tell the world about it. He should have confined himself to that, for, as he justly points out, some naturalists talk a lot of nonsense on the subject.

Now, having completed our discussion of these books, I propose not to write a formal review, but to give instead the gist of our conversation.

B. A. KEEN.

Life and Physics.

Beyond Physics, or the Idealisation of Mechanism: being a Survey and Attempted Extension of Modern Physics in a Philosophical and Psychical Direction. By Sir Oliver Lodge. Pp. 172. (London: George Allen and Unwin, Ltd., 1930.) 5*s*. net.

SIR OLIVER LODGE could not write a dull or uninteresting book if he tried. In this book he puts forward his own views so modestly and discusses the view of others so lucidly and fairly that it is an ungrateful task to criticise him. At the same time he states the problems so fully and candidly that he provides all the material needed for criticism. His main object is to find a place for life and mind in the world of physics, or rather behind the world of physics as a primordial ingredient of the universe. In the reviewer's opinion he is looking in the wrong direction for the solution of the problem, and if his theory were true the problem would be of its very nature insoluble. Of course the problem may be insoluble.

The nature of the argument can perhaps be made clear by an analogy. It is said that a tourist once got into a cab at Cambridge Station and asked to be driven to the University. The cabman after much thought and with some hesitation stopped midway between the Senate House and Great St. Mary's and said that that was the best he could do. He realised that the University is not, as the tourist imagined, a physical object. Neither is it a set or class of physical objects. The class of all members of the University plus all inanimate objects such as buildings, books, and so on that belong to it, is not in itself the University. The University is rather a system of relations among members of this class and many other physical objects too numerous to mention, but including the King, his Parliament and all his subjects, in accordance with whose laws the University continues to exist. What constitutes the University and why we give it a single name is that there is a unifying principle among these relations. In a word, the University is an organism, or a system of organisation among a group of physical objects, which are in a more or less intimate way its organs. The

Vice-Chancellor is one such organ, but so also to a less degree is the cheque for five guineas sent to an external examiner. From the ordinary point of view of physics, which is not unlike that of the tourist, the University is a pure nonentity.

The University in its relations to physical objects is taken as being analogous to the life or the mind of a man in its relations to his body and physical environment. There is nothing novel in this statement; the matter has come to the fore recently in the writings of several well-known philosophers, and it is all excellently discussed by Sir Oliver Lodge. But he is not content to say simply that the life of an organism *is* the unity or principle of its organisation; he looks for something physical or quasi-physical to be its basis. His answer is (to put it crudely) as though the cabman had said to the tourist: "All these buildings and people you see round you being physical objects are ultimately only sets of group waves having relatively slow velocities, of the order u. Their constituent waves in the ether, which have higher velocities v such that $uv = c^2$ where c is the velocity of light, *are* the University. These constituent waves, though they possess no energy, control the direction of propagation of the group waves, which possess all the energy and consequently are what you perceive. But I can assure you that though the constituent waves are not accessible to observation they pervade the whole ether, and the specific University of Cambridge waves are specially concentrated on this spot."

This is meant seriously as a *reductio ad absurdum* argument. As we all admit we know little about life and mind we are ready to believe almost anything about them. It is easier to see the fallacy of a theory if it is applied to a similar type of organisation we do know something about, though there is the risk that the analogy may be misleading. In this case the analogy is of course imperfect, but it is not likely to be seriously misleading, because practically all we know of life from the physical point of view is that it is a process of organisation among material objects.

The fallacy (as I believe it) that Sir Oliver Lodge has fallen into is a common one. Everybody sees that life and mind are not physical objects or things related in any simple way to physical objects, therefore they either say that there are no such things or try to discover something quasi-physical to fill the gap. Most of the traditional theories of life and mind are of this type. The savage and the child cannot believe in an entity which is not a physical object, and the difficulty lurks at the back of the minds of all of us. Even Sir Arthur Eddington inclines in this direction when he would base spontaneity and freedom on the supposed indeterminism of intra-atomic processes, and Sir Oliver Lodge very properly criticises him for it.

Up to the present time physical theory has developed on analytic lines. Where the behaviour of aggregates has proved too complex for study they have been analysed into their components, and it has been assumed that the behaviour of the aggregates can be found by compounding in some simple way the behaviour of the components. The other type of aggregate that has been dealt with is the random aggregate to which the theory of probability can be applied. The great triumphs of physical theory have been in the treatment of random aggregates on one hand and of 'microscopic' transactions on the other. Organised aggregates have until recently been left alone. If the essential character of living things lies in their mode of organisation rather than in the nature of their parts, we can infer from the failure of physics to discern the nature of life among macroscopic objects that it is useless to look for it among molecules and atoms or electrons and protons, still more so in a hypothetical underlying ether. If you cannot see the design of a house in the pile of bricks dumped on the site, still less can you see it in the clay the bricks were made from. It may be mentioned in passing that the biologist has for the most part been confined to using the tools that physics has provided, and this is his excuse for having gone such a little way with such great efforts. The psychologist labours under similar but even greater difficulties.

There is evidence, as indeed Sir Oliver Lodge points out, that the physicist is beginning to consider the problems of organisation. Atoms are evidently organisms of electrons and protons, not aggregates in the simple sense. Again, a crystal is an organism of atoms of a very elementary kind. It is possible that from the study of these simple cases a physics of organisms will develop to supplement the classical physics of mere aggregates; and thereby new and superior tools will be put into the hands of the biologist for the study of higher grade organisms. On the other hand, it is possible that the human intellect will not be able to advance much beyond the classical analytical procedure. However, the problem does not appear to be inherently hopeless.

The suggestion that the nature of life and mind is to be sought in some property or process of the ether refers the problem to something outside the range of ordinary experience or knowledge. Sir

Oliver Lodge admits that no perceptible effect, however small, which can be attributed to the ether, has yet been found. He says (p. 100): "We may not be able as yet to measure motion except with reference to other pieces of matter, but some day I hope it may be measured with reference to the ether; . . ." If the principle of relativity is correct this hope cannot be realised: if it is false the probabilities are still all against it, seeing how hard physicists have tried to realise it and failed. As things stand at present we can assert anything we like about the ether, but nothing we assert will enable us to infer anything definite about any perceived or perceptible event. It was pointed out long ago by Leonardo da Vinci that valid scientific knowledge must begin with what is experienced and in the end point to something that can be experienced.

In the whole material universe life appears as something accidental and trivial. It needs very special and inherently unlikely combinations of circumstances for its development. So far as we know, it emerges only for a little while on one obscure planet. To say that the ultimate basis of life is something inherent in the constitution of the physical world makes the problem more difficult. If the seeds of life occupy all space and time, why are their flowers so few and brief?

To us as living and conscious beings the most important aspects of life and mind, the aspects that interest us, are not to be described in terms known to contemporary physics. So far as they can be described at all, it must be in terms of value, of praise and blame, of desire and aversion. It is conceivable that a system of knowledge might be built up from the general and abstract basis of physics to give an adequate account of life and mind, but it will need to include many elements not originally given in that basis. It is scarcely conceivable that a theory that uses only the most abstract and general physical terms can answer the questions about life and mind we are most concerned to ask.

A. D. RITCHIE.

Savage Life and Thought.

Orokaiva Society. By F. E. Williams. Pp. xxiii + 355 + 37 plates. (London: Oxford University Press, 1930.) 25*s.* net.

MR. F. E. WILLIAMS, the Government Anthropologist of the Territory of Papua, has given us in "Orokaiva Society", a book that will be of great value to ethnologists, to psychologists, and to those interested in administration. His excellent previous book "Orokaiva Magic" (1928) should be read in conjunction with the new one, as together they afford an illuminating study of savage life and thought. It is not too much to say that this combined work is one of the best that has been written about a particular group of peoples, for it not only gives detailed and well-illustrated accounts of the multifarious aspects of native life and the things that are made, but, what is of special value, the conclusions of a thoughtful investigator who has had, and made full use of, exceptional opportunities.

The useful, though obscure, name of Orokaiva is given to the group of tribes who inhabit the northern division of Papua from the lower Eia River (8° S. lat.) to Oro Bay, north of Hydrographers' range and inland for a distance of thirty miles or more. They are Papuan-speaking peoples with a fairly uniform culture which, on the whole, resembles that of many parts of New Guinea, but there is a notable difference between the northern and southern groups. The former includes the Aiga, Binandele, and Tain-Daware, and is characterised by numerous and remarkable dramas (at which very small drums are employed) which seem to replace the use of the bullroarer and ritual flutes in the initiation ceremonies of the southern tribes and in those of other tribes to the north and north-west.

All the tribes perform certain ceremonies, which are virtually *rites de passage* to convert the candidate, usually about the age of puberty, into a 'new child'. As among the Marind-anim of the extreme south-west of New Guinea, both sexes are initiated together. Those of the southern group are interned in a specially built house where they are introduced to the spirits of the dead, who are supposed to emit the noises caused by the bullroarers and flutes, and they are subjected to ill-treatment and terrifying experiences. The novices are completely covered with hoods of barkcloth, and the fathers and mothers entreat the spirits not to devour their children. Then follows a long period of seclusion in the special house, the avowed object of which is to make the children grow big and well-conditioned. They are taught to be honest, obliging, and diligent, and how to play the flutes. The end of this period is marked by a spectacular display; each novice is invested with a feather headdress which had been worn by a man who impersonated a spirit, and some of them, but not all, are adorned with a valuable ornament, the possession of which involves certain ethical obligations, and formerly in some cases it constituted the

distinctive badge of a homicide. Then follows promiscuous intercourse (on this occasion only), but not by the novices. A small rite releases the taboo on the mother's cooking, and a mixed stew is brewed and, after the novices are fumigated in its steam, they partake of it and may then resume full diet; this last rite is to prevent bodily deformities. It may be pointed out that there is a remarkable general similarity between these customs and those which obtain among the peoples north of Huon Gulf, and to a somewhat less extent to those of certain tribes about the Fly and farther west, all of which point back to an ancient cult of a monster or ancestral spirit who devours the novices.

A curious example of native psychology is found in what is termed *meh*, a feeling of shame, humiliation, and contrition. An Orokaiva who has been wronged is not only sorry for himself but he also wants others to be sorry for him, and particularly the man who has wronged him. Such a man will destroy his own property, run away from home, deliver himself up to an enemy tribe, or even hang himself on a tree, for the Orokaiva is very prone when his feelings are hurt to punish himself instead of the man who has hurt him, or rather by punishing himself to take revenge upon the other party or in order to make him feel *meh*. The state of anger and self pity endured by the wronged man has a definite name, *sisira*, and by his action the culprit is put to *meh*, and very unpleasant he finds it, as apart from his own sense of shame he is the object of public reprobation.

The foregoing will suffice to indicate the interest and value of this careful piece of work.

A. C. HADDON.

Aviation and Meteorology.

(1) *Exploring about the North Pole of the Winds*. By Prof. William Herbert Hobbs. Pp. viii + 376 (24 plates). (New York and London: G. P. Putnam's Sons, 1930.) 5 dollars.

(2) *La navigation aérienne transatlantique*. Par Capt. G. Voitoux. Pp. 144. (Paris: Société d'Éditions Géographiques, Maritimes et Coloniales, 1930.) 28 francs.

(1) PROF. HOBBS'S book is a well-illustrated and entertainingly written account of three expeditions under his leadership between 1926 and 1929 to the south-west coast of Greenland. The expeditions were organised as a University of Michigan enterprise, and were for the purpose of studying the wind system controlled by the Greenland ice-sheet. An aerological station was established on Mt. Evans at a little above 1000 feet, some distance inland from Holstenborg in about latitude 67° N., and functioned uninterruptedly for two years. The staff of the observatory had to be changed at intervals, and though the latter has now been closed, everything has been left in readiness for a resumption of activity in the future. A large number of balloon ascents were made from here and at encampments elsewhere in this part of Greenland in addition to the usual ground observations, and several sledge journeys were conducted to the inland ice-sheet.

The observations appear to confirm the prevalent theory that the winds blow outwards from the ice-dome and inwards at higher levels. Prof. Hobbs, of course, has always been a champion of the Glacial anticyclone, and it is satisfactory to find his views substantiated in the chapter on the "Winds from the 'Great Ice'", wherein he shows that the entire circulation over the ice-cap is similar to the outline of an hour-glass. What serious meteorologists will miss, however, is something like a complete log of the actual daily observations which would give them an idea of the extent of the variations from these standard conditions. The southern part of Greenland has a heavy snowfall, which certainly points to temporary influence by the Icelandic depressions. The expedition appears to have met with an abnormally mild winter on the south-west coast in 1927–28, when föhn winds, raising the temperature at times above 40° F., would cause a complete clearance of the scanty snowfall. Storm winds are recorded of the order of 120 miles an hour, rendering navigation difficult and perilous in the long winding fjords. One is struck with the frequent reference to rain instead of snow in the summer months along this part of the Arctic circle, and wonders whether this is usual. The reader will, in fact, wish for a little more discussion of the weather events experienced in relation to general climatic conditions in Greenland.

Prof. Hobbs considers that Mt. Evans has unique advantages for a flying base on a proposed northern air route across southern Greenland between America and Europe. Along the route from Mt. Evans eastwards to Angmagssalik the ice plateau has a maximum altitude between eight and nine thousand feet, and it should be possible for the aviator to navigate safely by the use of his altimeter above the smooth snow surface.

On the human side the book is pleasant reading, and there are naturally some exciting adventures to record.

(2) Capt. Voitoux's book, if somewhat close reading, affords nevertheless a very intelligible account of North Atlantic weather in relation to aerial navigation. It is based fundamentally on a full year's observations from vessels at sea, and in order that the reader may have, so to speak, all the author's cards on the table, these observations are reproduced in the form of a log covering 366 daily observations over the period May 1, 1927–April 30, 1928. This shows the positions of the centres of high and low pressure (produced also on a handsome map of the North Atlantic), the direction and force of the wind, and the state of the weather. After a general explanatory account of the regimen of North Atlantic wind and weather, a number of weather situations that occurred during the period are carefully analysed with the aid of the weather charts of the French Meteorological Office, and opinion expressed as to what, in the particular conditions, should be an airman's route across the ocean, having regard first to safety and then to speed.

Wind according to its relative angle can be helpful to aircraft, but is more usually prejudicial even if not actually dangerous, whilst storms and all atmospheric conditions that the author comprises under the term 'intempéries' are always inimical. That the North Atlantic is a stormy ocean is brought out in a way that cannot fail to impress the reader. It appears that a ship crossing the ocean must practically always reckon on encountering storm winds on some part or other of the voyage even in summer, and that in sixteen years a Commandant de Transatlantique only once enjoyed fine weather the whole way. The mean wind velocity is about 40 kilometres per hour, a figure based upon a great number of observations from all parts of the North Atlantic, including calms and tempests. Out of 5782 ships' observations, calm is noted only for 111 positions on 86 different days, but on these 86 days winds of varying strength were experienced on other parts of the course.

A contrast is drawn between the conditions of the seaman and the airman over the ocean. The seaman has his navigation charts to rely on, and whilst the marine currents can only deflect him from his course by relatively small known amounts, the effect of the air currents on the drift of his vessel is insignificant. The airman's case is very different. For him the most advantageous route to follow is constantly changing from day to day, or even from hour to hour; the air currents may help or hinder him in a way he does not immediately appreciate, and may deflect him from his course by an amount ten, twenty, fifty times greater than is the case with the seaman.

The aviator's chart cannot, unfortunately, indicate the mobile dangers of the atmosphere as the mariner's chart does the fixed dangers of the sea. It is nevertheless essential that the airman should study the behaviour of cyclones and anticyclones, and learn to take the favourable side of these systems, for on this procedure depends success or failure, safety or death. Reference is made, further, to the vast lonely tracts of ocean even in the frequented liner routes, giving poor chance of succour to an airship or aeroplane in distress.

Capt. Voitoux writes throughout with a strong note of caution, and deprecates reckless adventures of the kind that inevitably spell disaster. He quotes expert opinion to the effect that in the present state of the science of aviation the flight across the North Atlantic from west to east is almost impossible in the higher stormier latitudes. Whilst fully endorsing all the caution that the author enjoins, we must yet ask whether there is really much justification for supposing that the *present* state of the science in question will obtain much longer. With all that has already been achieved, it seems to us disproportionate to think that the time will be long before the flight across the Atlantic becomes a commonplace in either direction. We must also remember that all mechanical progress has been purchased at the cost of a toll of human life.

Our Bookshelf.

Shells of the Tropical Seas. By Ida Colthurst. Pp. iii + 13 + 6 + 6 plates. (Calcutta and Simla: Thacker, Spink and Co., 1930.) 4.8 rupees.

THE author has a pleasant way of writing about what is usually made dull. She might quite well expand her pamphlet into a short volume to reawaken interest in shells. A little story is told us about most conspicuous families, their varieties of shells and their beauty and interest being brought out with subtlety. The author should visit Tuticorin, Ceylon, or the Andamans, and collect her molluscs on the reef flats, if she wants to make the attractive picture of the living animals that the present generation requires. We want to know much more about the *cilia-moving forms* and the mode of feeding of bivalves. We wonder whether pressure is of any importance in the distribution, and surely diminution of light is only indirectly so as inhibiting the growth of the plants on which they feed. There is no laminarian zone round southern India, being replaced by the coralline zone, which extends to about 30 fm., where it is stated that it commences. Nor is any evidence given that the pearly nautilus or any other existing animal lived

in palæozoic times. To say nothing about the squids is extraordinary.

It is foolish to-day even for a "Diocesan Press" to talk about "the book of creation" and "the power which makes the planets go"; the religion which prints such worn cliches can only be laughed at by educated Indians; it is best to take advice from S. Athanasius, who is quite clear on this subject. Why drag in a Laccadive sea of no particular interest and certainly not a "sea"? An author must handle oysters and mussels before they can be written about, and why not say how the starfishes of tropical seas kill oysters? Most shelled Buddhas are in freshwater mussels—and Bideford bridge is not at the junction of the Taw and Torridge. The illustrations are well chosen and badly reproduced, but clearly the book is not intended to sell, for 23 pages of letterpress with 6 half-tone plates will never find a wide market at 6*s*. 9*d*., taking the rupee at 1*s*. 6*d*. Perhaps some member of the staff of the Calcutta Museum might supply the facts for a book and Miss Colthurst the indispensable vivacity; it would do both good.

British Museum (*Natural History*). *British Antarctic* (Terra Nova) *Expedition, 1910. Natural History Report. Zoology*, Vol. 5, No. 5: *Coelenterata*. Part 5: *Hydroida*. By A. Knyvett Totton. Pp. 131-252 + 3 plates. (London: British Museum (Natural History), 1930). 15*s*.

EIGHTY species of hydroids were obtained by the *Terra Nova* expedition, of which four only belong to the Athecata, a discrepancy which is not explained. Their geographical distribution is not considered, but judging from the list of stations there would seem to be about the same number of species on suitable bottoms from the surface to 300 fm. The present treatment of a group of beautiful little animals is in a hard systematic strain. The author restrains his soul, for there is scarcely a reference to, and not a single drawing of, any polyp. We wonder whether the classification almost solely on the external skeleton is sound and how far it is going to lead us. The British Museum alone of institutions in Great Britain has the material necessary to answer this question. Like all its publications, the work is well reproduced. We would, however, ask the director to consider the advisability of enforcing standard magnifications in all figures, one genus showing no less than thirteen different magnifications in the plates.

The Colloid Chemistry of Rubber. By Dr. Paul Stamberger. Pp. vii + 80. (London: Oxford University Press, 1929.) 6*s*. net.

THE Oxford University Press has already published under the title "The Colloid Chemistry of the Rubber Industry" a small volume (of 56 pages) by Dr. E. A. Hauser, professor of colloid chemistry at the Massachusetts Institute of Technology, as a report of lectures of a series instituted by Mr. Patrick Gow. The present volume contains the subject-matter of lectures of the same series, given at University College, London, in November 1928, under the title "Colloid Chemistry and its Relation to the Rubber Industry". The first chapter is a general introduction to the study of colloid chemistry and colloids, the second chapter—on the colloidal properties of rubber—deals with rubber latex and its industrial applications, the third chapter—on lyophile colloids—deals with crude rubber and its solvation, whilst the two remaining chapters deal mainly with the 'compounding' of rubber with 'fillers' of various types, and with its vulcanisation, but also include a section on the synthesis of rubber, and an account of current views on the structure of rubber. The book will appeal most strongly to those who are concerned with the manufacture and use of rubber, but is written on such broad lines that it may be read with interest by other students of colloid science. The volume is presented in a very attractive form and at a reasonable price, and it should have a wide circulation.

Medicinal Herbs: and How to Identify Them. By Richard Morse. (The "How to Identify" Series, No. 21.) Pp. 64. (London: The Epworth Press, 1930.). 1*s*. 6*d*. net.

IN this little book of 64 pages, descriptions are given of twenty-seven commonly found wild plants that either are or have been used for medicinal purposes. An illustration is given of each plant described, and the descriptive matter includes a description of the plant in popular language, particulars as to where the plant is to be found, and an account of its medicinal properties and uses. The author does not claim that his work is exhaustive in any direction, his object in writing the book being to provide a pocket guide which would enable people on country rambles to learn something about some of the plants they pass.

The Trauma of Birth. By Otto Rank. (International Library of Psychology, Philosophy and Scientific Method.) Pp. xv + 224. (London: Kegan Paul and Co., Ltd.; New York: Harcourt, Brace and Co., 1929.) 10*s*. 6*d*. net.

LIKE so very many examples of psycho-analytic writing, this work is almost purely speculative and the author allows himself to be carried away by theorising, seeing and believing what he wishes to see and believe. His main theory is that the trauma of birth is the most deeply repressed portion of the mind. Anxiety and other symptoms are attributed to this birth trauma. From a therapeutic point of view, experience with schizophrenics leads one to be very sceptical of analysis as a procedure of any value.

The Truth about Mind Cure. By Dr. William S. Sadler. Pp. viii + 206. (London: George Allen and Unwin, Ltd., 1929.) 5*s*. net.

"THE Truth about Mind Cure" is a simple and straightforward account of elementary psychotherapy by an American physician. He deals with his subject in a popular way and certainly presents a very readable account for the lay reader. The advice is sound and may do good to many lay people who are interested enough to read it.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Spontaneous and Induced Magnetisation in Ferromagnetic Bodies.

ACCORDING to Weiss's well-known theory, a ferromagnetic body in the absence of an external magnetic field must be spontaneously magnetised in such a way that the direction of magnetisation varies in an irregular manner in different portions of the body. It was originally assumed by Weiss that these portions coincide with the minute crystals of which the body is built up. That this is not so is clear from the fact that spontaneous magnetisation (as revealed by the existence of a Curie temperature) is present also in single crystals. We are thus forced to assume that a moderate-sized single crystal of a ferromagnetic body consists of a number of 'elementary magnets' the resultant magnetic moment of which vanishes. This spontaneous subdivision of a ferromagnetic body into elementary magnets can be interpreted both qualitatively and quantitatively in the following manner.

In the absence of Weiss's 'quasi-magnetic' forces (forming the molecular field and depending, according to Heisenberg,[1] on the quantum exchange effect) the individual magnets (electrons) would tend to orient themselves in such a way as to insure the disappearance of the resulting magnetic moment in every unit cell of the crystal-lattice—just as in the case of a crystal built up of electric dipoles.[2] The usual conception that such dipoles—whether electric or magnetic—tend to orient themselves in the same direction is wholly wrong, the minimum value of their mutual potential energy corresponding to a state of electric or magnetic neutralisation, that is, to the disappearance of the resulting polarisation in the least possible volume.

In the case of a ferromagnetic body, there are, on the other hand, the quasi-magnetic forces, which at small distances are much more powerful than the Coulomb ones and tend to orient the individual magnets in exactly the same direction. This struggle between magnetic and quasi-magnetic forces results in a compromise, the individual magnets uniting in elementary 'bunches', which owing to Coulomb forces acting between them are oriented in a way similar to those in which the individual magnets would be oriented in the absence of quasi-magnetic forces. This spontaneous magnetic splitting can be compared with the splitting up of a large mass of a liquid into single drops, under the condition that the surface energy of the latter should be compensated by some sort of mutual potential energy quite different from the energy of the ordinary cohesive forces.

In our case, the work done against the quasi-magnetic forces in the process of splitting up of a uniformly magnetised body into single 'drops', which magnetically neutralise each other, is equivalent to a surface energy of the amount $\frac{1}{2}AI^2s\delta$ per drop, where I is the original magnetisation of the body (equal to the magnetic moment of each drop M, divided by its volume v), A is the constant of Weiss's molecular field, s is the surface of a drop, and δ the thickness of its surface layer, that is, the range of the quasi-magnetic forces; δ is obviously of the order of magnitude of one atomic distance. The Coulomb potential energy per 'drop', corresponding to the work done by the magnetic forces in the process of 'disorientation', is equal to $-\frac{\alpha M^2}{l^3} = -\frac{\alpha I^2 v^2}{l^3} \cong -\alpha I^2 v$, where l is the distance between the centres of the neighbouring drops (since it is of the same order of magnitude as its linear dimensions, $l^3 \cong v$) and α a numerical coefficient; in Born's theory of a dipole lattice (*loc. cit.*) $\alpha \cong 1{\cdot}5$. We thus see that the increase of quasi-magnetic energy due to splitting is just compensated by the decrease of magnetic energy when $\frac{1}{2}AI^2s\delta = \alpha I^2 v$, that is, when the linear dimensions of the 'drops' $\frac{v}{s} = l$ reach the minimum value $l_0 = \frac{A}{2\alpha}\cdot\delta$. Since Weiss's constant A is of the order of magnitude of 20,000 (for iron), we have approximately $l_0 \cong 10{,}000\ .\ \delta \cong 10^{-4}$ cm. This shows that *the elementary regions of spontaneous magnetisation must contain at least* $(l_0/\delta)^3 = 10^{12}$ *atoms.*

To find the average size of these regions or 'magnetic drops', we must consider the minimum value of the quasi-magnetic and magnetic energy of a body consisting of a given number of atoms as a function of the linear dimensions of the drops l. Denoting the volume of the body by V, we get for the total quasi-magnetic surface energy $U_1 = \frac{1}{2}AI^2s\ .\ \delta\frac{V}{v} = \frac{1}{2}AI^2\frac{\delta}{l}\ .\ V$ (it may be remarked that this energy can be regarded as the quasi-demagnetisation energy of the 'interspaces', connecting the uniformly magnetised elementary regions of the body). As to the total magnetic (Coulomb) energy, we must add to the volume part of it $U_2 = -\alpha V^2 v\ .\ \frac{V}{v} = -\alpha I^2 V$, which does not depend upon the size of the drops (if the volume of the interspaces is neglected with respect to V), the surface energy of the whole body, due to the incomplete 'screening' of the surface drops. For this surface energy we get in the same way as for the surface energy of an electric dipole substance the expression $U_3 = \alpha' I^2 l\ .\ S$, S being the surface of the body and α' a numerical coefficient of the same order of magnitude as α ($\alpha \cong \alpha' \cong 1$). The minimum value of $U = U_1 + U_2 + U_3$ is determined by the equation $\frac{dU}{dl} = 0$, which gives $\alpha' I^2 S = \frac{A}{2} I^2 \frac{\delta V}{l^2}$, or $l^2 = \frac{A}{2\alpha'}\delta\ .\ \frac{V}{S} = l_0\ .\ L$, where l_0 is the above defined minimum value of l and $L = V/S$, the linear dimensions of the whole body. For a body of moderate size we thus get $l \cong 10^{-2}$ cm. (It must be, of course, supposed that $L >> l_0$.)

The fact that the mean size of the 'magnetic drops' depends upon the size of the whole crystal seems at first sight somewhat bewildering. It should be mentioned, however, that a similar fact is met with in various other problems; thus, for example, in the Debye theory of specific heats of solid bodies, the wave-length of the elastic waves extends on the long wave-length side up to the linear dimensions of the body, and the total number of normal vibrations within a given frequency interval is proportional to the body's volume.

It is probable that actually there are to be found in a ferromagnetic body 'magnetic drops' of various size—from the smallest one (l_0) and up to 10^{-3} cm. or even more. Experiments on the Barkhausen effect by Bozorth in fact give evidence of drops of such large dimensions. An important corollary from the above considerations which should be emphasised here is the fact that very small (colloidal) particles,

the linear dimensions of which do not exceed $l_0 = 10^{-5}$ cm., can never split into drops, and must therefore be permanently magnetised.

Another important consequence is the absence of remanent magnetisation in ferromagnetic single crystals of an ordinary size and, more generally, the absence of hysteresis in such crystals as this was actually shown by Gerlach. It should be remembered that hysteresis is a direct consequence of the Langevin-Weiss theory when applied (as is usually done) to the individual magnets. Actually, an external magnetic field acts on each drop as a whole, the magnetic moment of the drop being determined practically by Weiss's molecular field only, and thus being a function of the temperature alone. We have not yet been able to derive the exact formula giving the dependence of the observed induced magnetisation I' upon the field strength H and the temperature T. According to Weiss's empirical formula, one has, for large values of H, $I' = I(T)(1 - a/H)$, where $I(T)$ is the saturation magnetisation for a given T, and a is a constant independent of the temperature. Our 'drop' picture of a ferromagnetic body leads to an expression of the type $I' = I(T) \cdot f(H)$, where $f(H)$ is a function of H only, different, however, from Weiss's $(1 - a/H)$. It may be observed that the process of orientation of the 'drops' by the magnetic field must be accompanied by their gradual fusion, the whole body becoming a single large drop when saturation is reached.

The phenomena of retentivity and hysteresis which are observed in ordinary ferromagnetic bodies (not single crystals), appear to be connected with the inner stresses characteristic of their structure. It is possible that they are due to the formation of strongly prolate drops arranged in chains (a disposition which is not consistent with the principle of minimum energy within a single crystal). We hope to consider these questions at a greater length in a future communication.

J. FRENKEL.
J. DORFMAN.

Physico-technical Institute,
Leningrad.

[1] See also J. Frenkel, *Z. f. Phys.*, **49**, 34; 1928.
[2] Cf. M. Born u. Kornfeld, *Phys. Zs.*, **24**, 121; 1923.

Space and Matter.

"SOMEWHERE in the absolute elsewhere."—*Punch*, July 9.

"My interest in Nature
Is rather based, I feel,
On freaks of nomenclature
Than scientific zeal."

Reading these lines, I feel that not a little truth is expressed in poetry, particularly when published from Bouverie Street (July 16). It is true

"I sometimes like to ponder
Upon the proper mien
For coping with a condor
Couched on the nineteenth green:
Or else a capercaillie
Conversing in Old Bailey
About the works of Paley
With our tremendous Dean."

Or talk to Ol'ver Lodgey
About his great big body,

especially when he tells us (July 5) that "Matter is inert; space is energetic. Matter *does* nothing". Like another Bellman,

"He has bought a large map representing the sea
Without the least vestige of land."

Perhaps history will be repeated:

"This was charming, no doubt: but they shortly found out
That the Captain they trusted so well
Had only one notion for crossing the ocean
And that was to tingle *his* bell.

"He was thoughtful and grave, but the orders he gave
Were enough to bewilder a crew."

Apparently, matter is mere window-dressing. Is not perhaps Sir Oliver a window-dresser? *Are* his doings, his writings, *nothing*? They seem to sell. Do they just come out of space? He more than fills a stall and definitely fills space when he jazzes. Would there be no difference between his body and a sculptured likeness in stone from the 'point of view' of space? Is there really no hope for us bits-o'-chemists—is our occupation of structure-hunting gone? He would put matter 'on the dole'. Will he tell us: if not energetic, how does it smoke cigarettes, or is this a function of space? It seems now to be the universal habit: space, we suppose, must have its bad as well as its good habits.

I do venture to question my old friend's modern freaks of nomenclature—his contortions of our vulgar tongue. I have just received a company circular in which the chairman replies to a shareholder's question—"What do the complicated Resolutions really mean in plain and unmistakable language?" I should like to ask, what does Sir Oliver mean in terms of plain English? Is he merely breaking a lance on behalf of his beloved steel-hard ether or is he 'getting at us', in order to air his more than nebulous notion of a future life in space, whatever that may be?

'Science' is something that we are endeavouring (perhaps I ought to say, should endeavour) to pass on to the masses. It were time, therefore, that some protest were made against the language used by our would-be leaders:

"They have wholly forgot (and it vexes me much)
That English is what we speak."

The public is being played upon and utterly misled by the dreamery of the rival mathematical astronomers and physicists—not to mention the clerics—who are touring to-day and raising the game of notoriety to a fine art. In rivalry to religious mysticism, a scientific pornography is being developed which attracts the more because it is mysterious—apparently the professors are seeking to outrival Mrs. Eddy. They have no regard for consequences. These may well be serious, as is shown by the way in which nonsense about the energy in a drop of water is being repeated everywhere—by law lords thinking of the world in 2030, as well as presidents of societies bordering on the learned, discoursing either of water or of the future of chemical industry—as if it were possible to make such energy available, a contingency which honest men know to be more than remote.

'Science' to-day is prostituted by over-speculation in public; no proper use is made of it to moral ends. Machinery is being made omnipotent: in fact, we need a new word: we no longer *manu*facture; not space but the machine does the work. Man certainly is not energetic. Whilst human beings are fast increasing in number, every attempt is being made to 'rationalise' them out of usefulness. We are even told that agriculture is soon to be handed over to a new synthetic agency—the craze to escape from Nature is upon us. Living matter will soon have nothing to do but lapse into space—we shall al

seek our fortunes 'somewhere in the absolute elsewhere'; in fact, be

"A pack of pure porbeagles,
For hunting of the Snark."

Is it that our make-up is such that we cannot be scientific—that we are perforce only religious?

HENRY E. ARMSTRONG.

Stability in Soap Films.

IN his letter to NATURE of June 28, p. 970, Mr. Lawrence has not, in my view, made the sandwich structure for soap films appear more likely, but has only discussed some necessary limitations to the layered arrangement that I suggested. One or two definite points may therefore be acceptable.

1. Surface layers are almost universal for solutions, but only soap solutions give stable mobile films. If their mobility and permanence is to be ascribed solely to the surface layers, these must be of surprisingly unique cohesiveness.

2. Such surfaces admittedly take time to form, especially in dilute solutions. The process of a slowly growing bubble may be sufficiently deliberate, but the 'throwing' of a film—described by Dewar as workable certainly up to a diameter of 19 cm.—takes only a very small fraction of a second. It would therefore seem that to persist, a film must be formed of material capable of being drawn into some initial structure; the nature of this is, I think, suggested in the definite boundaries which frequently appear, either in long-lived bubbles in the absence of convective disturbance, or in plane films during steadily maintained vortical motion, and in other gradations exhibited in films in a permanently liquid form (see Clerk Maxwell: "Scientific Papers", II. 397. Dewar: "Papers", II. 1341). This is very different from the abnormal solid stratifications depicted in the frontispiece to "Soap Films". The described crystallisation extruded into the original film and provided by solute from the surrounding Gibbs ring can, of course, only occur in tiny films and not over large areas; some of Perrin and Wells's films may be similar, but Perrin says of those last described (*Koll. Zeit.*, April 1930) that they are certainly liquid, and describes the means he took to satisfy himself about this.

3. It is obvious that a five per cent solution can only provide in any film a limited number of layers if these are to be close packed solute; the possible lamination of colloid threads or flakes would certainly be even more limited; and if instead of five per cent we consider a solution of 0·1 per cent (which Dewar found to give perfectly stable films) a statistical estimate such as that suggested would give only a fifth of a molecular layer in a 1000 $\mu\mu$ film. If we then assumed that the equivalent of two close packed layers is present as surface film on either side of this vestige, the disproportion of concentration between soluble surface and enclosed solution becomes miraculous, and how to maintain the supply for the reserve layer an embarrassment, even in such a thick film; reduce the thickness and therefore the available material to one-tenth to get to the order of a silvery film, and I think it may be agreed that we shall need to enlarge our conceptions beyond what close packed solute can provide. Hydration—or may I say 'hydrosolation'—may provide one clue: be it noted that the 'anchoring' of carboxyl groups, etc., to water must be by molecules or molecular groups, and not into an indefinite statistical 'surface' as is sometimes implied.

4. Soap films maintained in vortical motion by steady air jets continuously exhibit sharply defined colour tracks (Dewar: "Papers", II. Front.). Not only is there in such circumstances a main stream in rapid motion—at about one metre a second (*ib.*, 1376)—but the successive adjacent tracks move at different rates, so that the whole film is in continuous relative motion of distinct thicknesses. A similar discontinuous appearance is revealed by almost any horizontal film under microscopic examination (with a vertical illuminator). It is therefore evident that the soap film does not need to be a smooth sandwich.

5. The interfacial attractions that I suggest between self-cohesive layers would be successively equilibrated throughout the film, whereas an ordinary film of liquid without some structural cohesiveness must and does collapse under 'surface' tension despite the universally present adsorbed layer, admittedly because the inwards forces at the surfaces are not equilibrated. The word 'powerful' applied to the interfacial attractions may be misleading; but I see no reason why such layers (see Rideal: "Surface Chemistry", 1926, 91) though yielding to lateral displacements, should not be successively shed or aggregated in the relentless separation of the black. After Lyons's recent work on the variations with *p*H value of the submersion of oleic acid lenses (*Jour. Chem. Soc.*, April 1930) we may expect the *p*H value of a soap solution to influence or even control the intensity of aggregation by varying the interfacial or intramolecular attractions within the film. It is certainly to be hoped that the *p*H value will now be regarded as an essential part of the description of experimental soap solutions.

6. The 'black' area is the only portion of a soap film giving evidence of a close packed structure, because it is non-extensible (Dewar: II. 1197, also Clerk Maxwell: *ib.*, 398) except possibly in very dilute solutions which give misty greys rather than blacks (Dewar: *ib.*, 1345). The observed mechanism of the appearance of the black is by the separation of clots emerging (at greatly varying intensities) from the initial thick film (*ib.*, 1335). Fig. 1 shows (what has never before been illustrated) that even this sometimes occurs in stages. The distinct character of the coloured area was early evident in the account of one of Dewar's 56 cm. black films (II. 1209). Wandering coloured clots on approaching the periphery are not absorbed into the 'Gibbs channel', as they would be with avidity if they were enclosed between elastic surface layers, but on the contrary divide and circulate in both directions, obviously because they are at the foot of the curved slope of the liquid ring of contact, and actually on the black film surface.

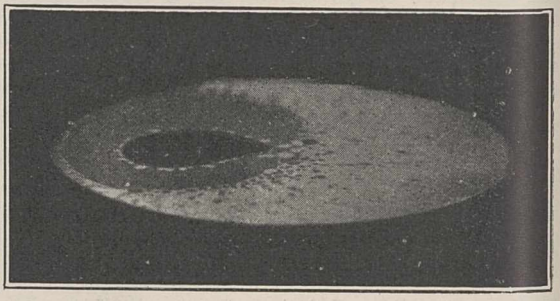

FIG. 1.—Development of horizontal soap film: slow aggregation of one 'black' layer on another, film still two-thirds coloured.

Such observations show that an examination of a directly accumulated mass of black film is very desirable. It should be possible by passing a clean glass rod through masses of black film as collected by Dewar in a 200-litre globe (*ib.*, 1210); or accumulating

a succession of films (drained by cellulose threads to blackness) in a McBain apparatus. Even more valuable would be a trial of the forces at the black boundary by the Langmuir-Adams method, using quite a small trough or film-frame in a moteless Dewar enclosure.

After years of observation I find it difficult therefore to accept that one oriented layer and one irregular reserve layer below this on either face, and nothing but chaos between, can explain the appearances presented by soap films, or maintain their tenacity under such conditions as have been described.

W. J. GREEN.

Royal Institution,
Albemarle Street, W.1,
June 25.

Daily Variations of Temperature.

IN the discussion on the "Irregular Variations of Temperature in London" (NATURE, **126**, 61) the case of periods of several days was in question, and smoothed averages were taken. Some years ago I was attracted by the daily irregularities observed at Greenwich, in averages of fifty years, and compared them with those of other available records, Falmouth, Kew, Valentia, and Aberdeen. I wished to have included Buitenzorg, but the volume of records was missing from the Royal Society library.

The results are in the diagram (Fig. 1). The maxima will represent the true solar effect, as we do not know of any other cause of heat; all below the maxima must be due to some cause of deficiency. It will be seen that at the vertical lines (marked with the day-number in the year) each of the records shows a minimum; such a deficiency cannot therefore be due to a local cause. The only obvious cause would be the interposition of streams of minute asteroids in regular orbits. To study this farther would need the comparison of records from a large number of positions, over short terms of years, as orbits may shift by precession. The zodiacal light seems only explicable as due to a large diffusion of matter between the earth and sun, certainly extending as far as the earth's orbit.

FLINDERS PETRIE.

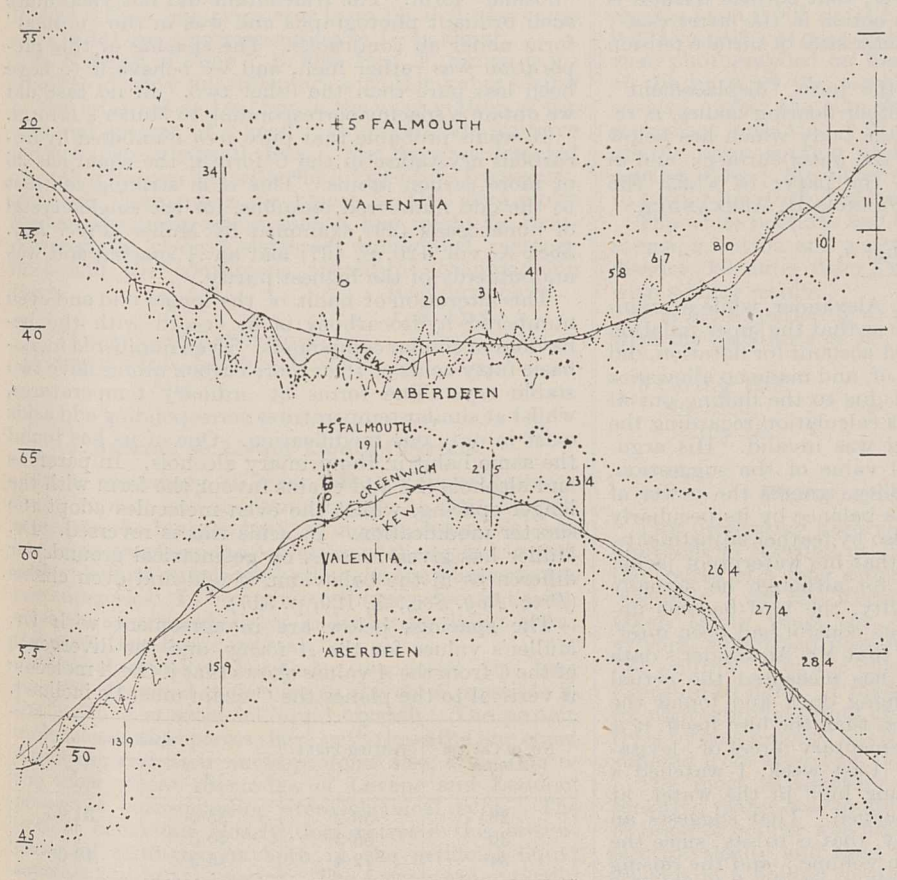

FIG. 1.—Daily temperatures, average of 50 years. Full wavy line, Greenwich; full smooth line, the nearest sine curves for Greenwich maxima. Vertical lines are numbered with day of year, and these are placed where a minimum occurs in all the records.

SIR FLINDERS PETRIE'S suggestion that regular periods of low temperature may be caused through partial cutting off of the sun's rays by cosmic dust is an old one, but is not supported by any real evidence. In Britain temperature is governed far more by wind direction and cloud amount than by solar radiation, especially in winter, when it is practically independent of latitude. The only real test of the cosmical hypothesis would be the examination of averages over a number of years of the daily measurements of solar radiation made by the Smithsonian Astrophysical Observatory. I do not think this test has yet been made; probably the number of observations is still insufficient. The occasional agreements between minima at different stations, shown on Sir Flinders Petrie's curves, may be due to the frequent occurrence of extensive systems of northerly winds on those days, or may be merely accidental coincidences.

C. E. P. BROOKS.

Bird Flotation.

IN commenting on a paper of mine in NATURE of June 14, p. 902, it is suggested that the ability of a bird to extend its feathers further from the skin may enable it to displace a greater volume of water when afloat than the volume measurable to the same surface level when ashore.

Undoubtedly this ability does exist, but, in comment upon the suggestion, I would like to point out that, if the displaced volume were materially increased in this manner the bird could not maintain an upright position but would overturn. This instability is due to the lowering of the metacentre, so that it would be brought well below the centre of gravity of the bird. The facts can be ascertained by calculation and experiment. A duck was provided with a waterproof jacket fitting closely against the underbody feathers; when put afloat, the freeboard of this bird was about one-eighth of an inch less than without the

jacket, but the bird was unable to remain upright. It lolled over about 15° to port, or to starboard, as set; and, from such data, the position of the centre of gravity could be obtained with reasonable accuracy.

As regards the suggestion that a check might be employed to measure the actual water displaced, this is not so simple a matter as it may appear. It seems necessary to define the word 'displacement' as applied to flotation.

A waxed needle can be made to float by the aid of surface tension, and, when doing so, actually displaces a volume of water more than seven times its own volume, however absurd this may seem. In a similar sense, a bird weighing 5 lb. on land may, and must, displace a volume of water weighing 5 lb. In the case of the needle, the weight of water below the line of contact of needle and water surface is only about one fourteenth of the weight of the needle; in the case of the bird, I contend that the weight of water displaced below the line of contact between bird and water surface is only about one-third of the weight of the bird. Possibly surface tension accounts for $\frac{13}{14}$ of the weight of the needle, and for $\frac{2}{3}$ of the weight of the bird. Are we sure, however, that surface tension is the supplementary force in action in the latter case? The usually observed characteristics of surface tension do not seem to be apparent.

The usual meaning of the term 'displacement', when applied to ships or other floating bodies, is restricted to the volume of the body which lies below the line of its contact with the water-surface; and in this sense it was used in the paper to which the comments referred.

FRANCIS H. ALEXANDER.

Armstrong College,
Newcastle-on-Tyne, Aug. 5.

IN his original paper, Mr. Alexander, while examining curious suggestions such as that the super-inflation of the internal air-sacs might account for flotation, did not mention the possibility of, and made no allowance for, increased displacement due to the fluffing out of the feathers. Therefore his calculation regarding the amount of water displaced was invalid. His argument against the practical value of the suggestion, that it would cause instability, ignores the power of the living bird to control its balance by its peculiarly adapted feet and perhaps also by feather adjustments. Yet this is the one power that his waterproof jacket experiment demonstrated, for although he actually lowered the centre of gravity, the bird became unstable—obviously because its control had been interfered with. We still think that Mr. Alexander's data are insufficient; until he has measured the actual displacement of the swimming duck and found the water displaced to weigh less than the bird itself, it is futile to argue about supplementary forces of 'levitation' or any other force. Last week, I watched a grebe at one time swimming high in the water, at another time almost submerged. That suggests an alteration in specific gravity, that is to say, since the bird's weight is constant, in volume; and the raising or adpressing of the feathers, with a corresponding increase or decrease in the air-jacket, seems a possible and natural explanation of the change.

THE WRITER OF THE NOTE.

Crystal Structure of Normal Paraffins.

DR. MÜLLER has recently (*Proc. Roy. Soc.*, A, vol. 127, p. 417) made a detailed study of the effect of temperature on the crystal structure of the normal paraffins. He found two modifications, a 'normal' structure *A*, and a second form *B*, the *A* form having a 001 spacing 2 A. longer than the *B* form. Paraffins having more than 22 carbon atoms were found only in the 'normal' *A* form, whilst those of carbon content from 11 to 22 could assume both modifications. The 'normal' form of these was only stable at temperatures near the melting points.

We have recently examined specimens of hexacosane (26), triacontane (30), and tetratriacontane (34). They were supplied by Prof. Garner, and had been prepared by electrolysis of the pure acids, purified by distillation and crystallisation from alcohol, and finally digested with concentrated sulphuric acid at a temperature of about 130° C. Final crystallisation was from alcohol or benzene. Hexacosane and tetratriacontane showed two *stable* forms at room temperature. One had the normal *A* spacing, whilst the other spacing, about 4 A. shorter, was obviously not the *B* 'second form'. In hexacosane this *C* form occurred alone in the crystals from benzene and from alcohol, whilst a melted layer showed both *A* and *C* spacings, the former being the stronger. Crystals of tetratriacontane from benzene gave only *C* spacings, a layer evaporated rapidly from benzene had equally intense *A* and *C* lines, whilst melted specimens showed only the *A* or 'normal' form. The triacontane did not yield quite such brilliant photographs and was in the 'normal' form under all conditions. The spacing of this preparation was rather high, and we believe it to have been less pure than the other two. In no case did we obtain a spacing corresponding to Müller's *B* form.

It seems probable that pure *even* numbered hydrocarbons crystallise in the *C* form if the chain has 26 or more carbon atoms. This is in striking contrast to the odd numbered paraffins, for the single crystal of nonacosane (29) examined by Müller (*Proc. Roy. Soc.*, A, vol. 120, p. 437) had an *A* spacing and was undoubtedly of the highest purity.

This alteration of habit of the longer odd and even numbered hydrocarbons is in accord with the behaviour of similar compounds. Even numbered monobasic fatty acids of 16 or more carbon atoms have two stable crystalline forms at ordinary temperatures, whilst at similar temperatures corresponding odd acids exist in only one modification. One of us has found the same habit in the primary alcohols. In paraffins and alcohols the odd chains favour the form with the longer spacing, whilst the even molecules adopt the shorter modification. In acids this is reversed. Dr. Müller has given reasons on geometrical grounds for differences in the behaviour of odd and even chains (*Proc. Roy. Soc.*, A, 129, p. 317).

The spacings below are in agreement with Dr. Müller's values for the *A* forms, and the divergence of the *C* from the *A* values shows that if the *A* molecule is vertical to the planes the *C* chain must be inclined.

No. of Carbon Atoms.	Setting Point °C.	Spacings.	
		A	*C*
26	56·2	35·0	31·05
30	65·3	40·5	..
34	72·4	45·3	40·00

An important feature of the *C* spacings is their approximation to the *A* values of other paraffins. Tetracosane has an *A* spacing of 31 A. compared with 31·05 for the *C* form of hexacosane, whilst the *A* spacing of triacontane corresponds to the *C* of tetratriacontane. We have only found the *C* spacings in the best specimens we have examined, and believe their appearance to be a very good criterion of purity.

S. H. PIPER.
T. MALKIN.

H. H. Wills Physical Laboratory,
University of Bristol.

Raman Spectrum of Diamond.

In the course of an examination of the infra-red and ultra-violet regions of the spectrum of a large number of diamonds, we have come across one which, unlike the others, is transparent both at about 8μ, and also in the ultra-violet so far out as λ2300. This diamond was consequently well suited for determining the Raman effect throughout a much more extended region of the spectrum in which exciting mercury lines are available.

With this diamond we have in fact identified no less than 17 Raman lines originating from mercury lines within the range of spectrum from λ4358 to λ2378. The mean value of all differences is 1333 cm.$^{-1}$, a value lower than we reported in NATURE of May 10, p. 704, but agreeing with that of Ramaswamy in the same issue, and of Bhagavantam on Aug. 2, p. 168. This still corresponds to 7·5μ, which is removed from the centre of the infra-red band at 8 μ found by us in most diamonds.

With a quartz spectrograph the diffuse band found faintly by Ramaswamy and by Bhagavantam is fairly strong, with its centre about λ4156 as they report. If this diffuse line originates from λ4046·6, the value of $\Delta\nu$ is 651 cm.$^{-1}$ corresponding to 15·4μ about.

In NATURE of June 7, p. 855, Prof. F. Simon is inclined to identify this difference with Reinkober's band in the infra-red at 14μ, but in the examination of the infra-red spectra of a good many diamonds we have failed to detect a band there. Nor have we detected any other Raman line with this difference of frequency, although there are some places in the ultra-violet Raman spectrum where such a line might be overpowered by strong scattered unmodified mercury lines and the continuous spectrum accompanying them.

R. ROBERTSON.
J. J. FOX.

Government Laboratory,
Clement's Inn, London, W.C.1,
Aug. 7.

Sperms as Living Liquid Crystals.

It is customary to draw the boundary between living organic and inorganic matter so that crystals represent the highest form of inorganic material and low organisms form the beginning of the organic world, with a definite and deep physiological gap between the two categories. In my opinion, this gap does not exist, since the sperms, which are undoubtedly living, are at the same time liquid crystals.

Stereochemically, Vorländer recognises the long straight stretched molecules as the chief principle in the building of artificial liquid crystals. The protein molecules of the sperms share with these the fine chain structure, and their nucleoproteins also, according to the most recent researches of Levene and London, possess a corresponding stereochemical type. The optical behaviour clearly demonstrates this stereochemical arrangement both in the artificial liquid crystals and in the sperms. The former are optically uniaxial and show positive or negative double refraction. The sperms have also long been recognised as optically anisotropic, and W. J. Schmidt has definitely proved that in the living seedthreads of *Sepia officinalis* L. the chromatin portion of the head exhibits double refraction of the type of an optically uniaxial crystal ($\omega = 1{\cdot}544$; $\epsilon = 1{\cdot}501$; hence $\omega - \epsilon = 0{\cdot}043$). In addition, it is important to note that the double refraction phenomena are the same both in the living sperms and in specimens which have been preserved in alcohol. Debye-Scherrer diagrams show, as well as the alcohol ring, an interference due to the sperms, which surrounds closely the spot of the primary beam, in agreement with the nature of liquid crystals. With regard to the morphological conditions, the moulding forces of surface tension together with the fine structure give rise to many corresponding forms.

F. RINNE.

University, Freiburg i/Br.

Mushrooms—Mineral Content.

SPECTROGRAPHIC analysis of mushrooms by the method described in NATURE of April 20, 1929, p. 601, has revealed a remarkable composition. A button mushroom from the Cromer district was divided into skin, white portion, gills, and stem and the parts were dried in a water oven at 100° C. The analyses prove that each part has a high potassium and a low calcium content; the skin contains lithium and it contains most iron. Phosphorus in the dried material varies from about one to three per cent, the gills containing most. The chief interest lies in the presence of silver and copper; all parts contain these, the stem containing least. The spectra of four standards, containing from 0·001 to 0·01 per cent of silver and from 0·002 to 0·02 per cent of copper, and other elements, were photographed on the same plate as the spectra of the parts of the mushroom. Comparison of the spectra proves that the skin, white, and gills contain somewhat more than 0·02 per cent of copper and that all the parts contain decidedly more than 0·01 per cent of silver; the silver content of the gills appears to be not less than 0·05 per cent.

The white portions and the gills of two other mushrooms, a button and a flat variety, from the Loddon district, 30 miles from Cromer, have been analysed with similar results.

The investigation is to be continued and extended with the assistance of Mr. H. J. Howard.

HUGH RAMAGE.

5 Carrow Hill,
Norwich,
July 26.

Photography on Copper.

The interesting observation recorded by Dr. C. J. Smithells in NATURE of July 26 is not new. During the course of a long series of experiments on 'metal colouring' at the Birmingham Technical College about thirty years ago, it was found that copper articles, which had been coloured by immersion in a hot solution of cupric chloride, blackened rapidly on exposure to light. I made a number of attempts to fix photographic prints obtained from ordinary negatives by this process, but in every case the image itself suffered from attack by the reagents used.

The most satisfactory method of preparing the sensitive plates was found to be as follows. A sheet of brass or copper was first coated thinly with copper electrolytically and then it was immersed for a few seconds in a boiling solution of cupric chloride, or in a copper sulphate solution containing a little common salt. If the surface after this treatment was not perfectly uniform in appearance, the sheet was scratch-brushed and immersed again in the hot solution. It can then be washed and dried with a cloth. The coating is salmon-pink in colour, is perfectly adherent, and shows none of the white film mentioned by Dr. Smithells.

T. J. BAKER.

King Edward's School,
New Street,
Birmingham.

Distribution of some Oceanic Birds in the Waters East of New Zealand.

By Dr. P. JESPERSEN, Copenhagen.

THE Danish Research Ship *Dana*, sent out for a two years' expedition around the world by the Carlsberg Foundation in Copenhagen, under the leadership of Prof. Johs. Schmidt, director of the Carlsberg Laboratory, spent the months of December 1928 and January 1929 in New Zealand waters. From Jan. 2 to Jan. 13 investigations were carried out in the waters east of New Zealand on a cruise, going out from Auckland in a southerly direction to a position situated about 49° S. Lat. and 177° E. Long., from there going west to about 172° E. Long. and farther north along the east coast of the South Island to Wellington.

On the whole circumnavigating expedition of the *Dana*, observations of the bird-life were made on the high sea, but as we on the above-mentioned cruise in New Zealand waters had the New Zealand zoologist, Mr. R. A. Falla, a keen and clever ornithologist, on board the *Dana* as guest, the ornithological observations on this cruise were made with a higher degree of accuracy than in ordinary circumstances. In very few areas of the world are the birds belonging to the order Tubinares represented by so many different species as in the New Zealand waters, and as Mr. Falla has especially studied these birds, it is first of all due to Mr. Falla's knowledge about these oceanic birds that the ornithological observations were so extensive on this particular cruise.

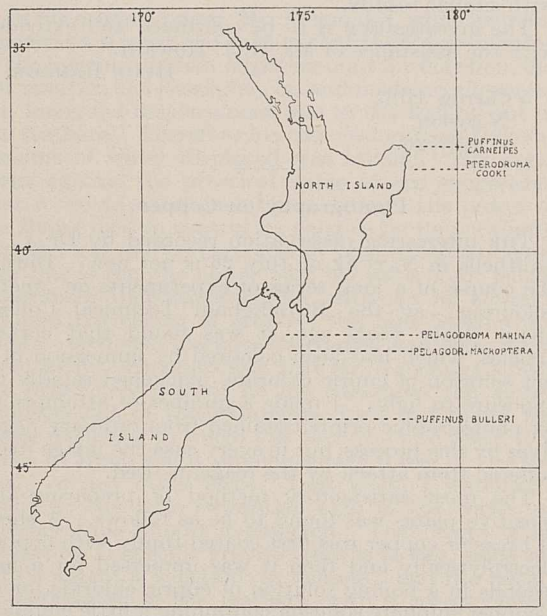

FIG. 1.—Map showing the southern limit for northern breeding species of birds.

Our most important task was to determine, so far as possible, the limits for the distribution of the various species of birds in the open sea, and in the following a brief account of the result of our investigations will be given, especially in regard to the distribution of the various species from north to south. It must, however, be remembered that the results apply only to the month of January,

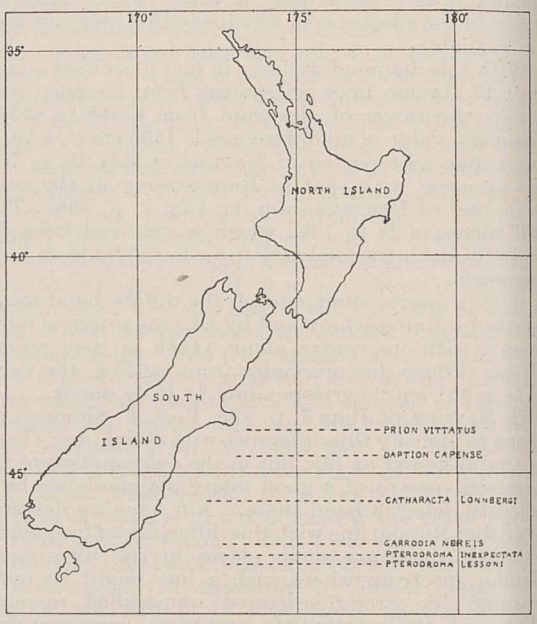

FIG. 2.—Map showing the northern limit for southern breeding species of birds.

which is the height of the breeding season, and that the position of suitable breeding islands must have some influence on distribution at this time.

The observed species will be divided into two groups, namely, the northern breeding species and the southern breeding species. To the first-named group belong birds breeding on the north island of New Zealand and the small islets lying north of this, and the last-named group comprises species breeding on the south island of New Zealand or on islands in more southern latitudes.

We will first consider the distribution of the northern breeding species, and the chart, Fig. 1, shows approximately the southern limit for the occurrence of these birds in the open sea.* North of the lines indicated the different species are seen more or less frequently, while these species are not observed south of the respective lines. It will be seen that the two species, the pale-footed Shearwater (*Puffinus carneipes*) and Cook's Petrel (*Pterodroma cooki*), both of which were observed in large numbers in the waters round the north coast of the north island, already ceased to appear when we passed off the East Cape (about 38° S.). Both species are also only known to breed on islets north of this point. Other northern breeding species extend their distribution more to the south. In Cook Strait we thus found the southern limit

* In regard to the systematic names I refer to "Birds of the Ocean" by W. B. Alexander (G. P. Putnam's Sons, New York and London, 1928), a book which has given me the most valuable assistance in my ornithological observations during this cruise with the *Dana*.

for the appearance of the white-faced Storm-Petrel (*Pelagodroma marina*), but in regard to this species it must be mentioned that its breeding area is not restricted only to the north island of New Zealand, as it is also noted as breeding on Chatham Island and Auckland Island (*cf.* W. B. Alexander, p. 92). The southern limit shown, therefore, apparently only accounts for the New Zealand breeding specimens of this species. A little more to the south (about 42° S.) we find the most southern occurrence of the great-winged Petrel (*Pterodroma macroptera*), and the grey-backed Shearwater (*Puffinus bulleri*) is observed so far south as off Banks Peninsula (about 44° S.). Both the two last-named species are in these regions only found breeding on the north island of New Zealand and surrounding islets.

As we gradually came more to the south we met several species of birds at sea, which we had not observed before, and all these species were breeding on the south island of New Zealand or in more southern latitudes. The northern limit of the southern breeding species in this month of the year was found about 44° S., as will be seen on Fig. 2.

Off Banks Peninsula we thus met the first specimen of the broad-billed Prion (*Prion vittatus*), which is recorded as breeding on Stewart Island and Chatham Island, but elsewhere on islands under more southern latitudes. A little more to the south we fixed the northern limit for the Pintado Petrel or ' Cape Pigeon ' (*Daption capense*), as this species is commonly called by sailors. The nearest known breeding-place for this species is Antarctica, although it probably occurs at the Snares and other sub-antarctic islands. About 45°-46° S. Lat. the first specimen of the dark Skua (*Catharacta lönnbergi*) was observed. This species, which is recorded as breeding on the south island of New Zealand, appeared always singly. In the most southern part of the area investigated —between 46° and 47° S. Lat.—we further noted other species, which are only known breeding on South Island or in the sub-antarctic islands of New Zealand. These were the following: the grey-backed Storm-Petrel (*Garrodia nereis*), Peale's Petrel (*Pterodroma inexpectata*), and the white-headed Petrel (*Pterodroma lessoni*), all of which only appeared as single specimens. In most cases the largest numbers of birds were observed during the morning and the forenoon, and nearly all were flying in an easterly direction, presumably indicating that it was breeding birds making seaward from land.

In connexion with the recorded observations of oceanic birds it is of interest to look at the surface temperatures in the waters east of New Zealand, as found during our trip in the month of January 1929.

It will be seen from the chart (Fig. 3) that the surface temperature is decreasing in a rather high degree from north to south, namely, in the investigated area, from more than 19° to less than 13° C. It is the cold antarctic water, which here advances along the east coast of New Zealand. The isotherms are based on rather few observations and only on this single cruise, but they seem to indicate that the temperature especially is quickly decreasing from 17° to 14° C. This is the case between 42° and 44° south latitude, and it is just in this area that we found in most cases the southern limit for the northern breeding species and the northern limit for the southern breeding species of sea-birds. The marine biological investigations on board the *Dana* along the east coast of New Zealand also demonstrated a very great difference in the composition and kind of plankton on the way from north to south. Thus we found

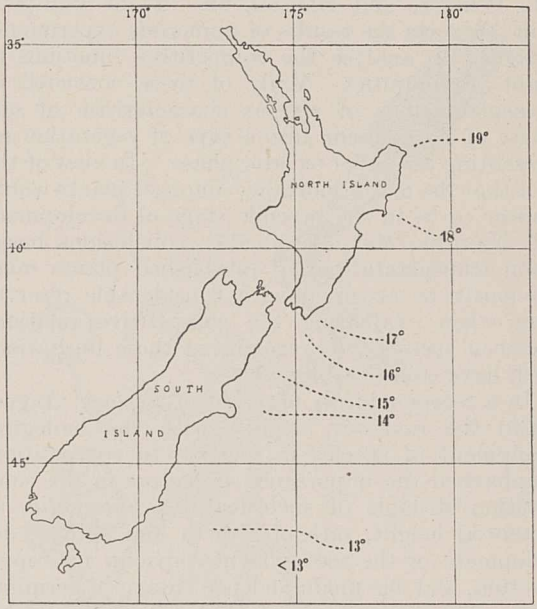

FIG. 3.—Map showing the surface temperatures in the waters east of New Zealand on the cruise of the Danish Research Ship *Dana*, Jan. 2-13, 1929.

the plankton more and more characteristic of the colder water when we were going south, and on the most southerly stations the plankton had in many ways certain resemblances to that in the waters round Iceland and the Faroe Islands in the North Atlantic. Due to the different temperatures in the water the food for the birds living over the high sea thus will be different in the various latitudes, and therefore the surface temperature of the water, in an indirect way anyhow, is a factor of great importance in regard to the distribution of various sea-birds in these waters.

From the above-mentioned observations it will be understood that the composition of the bird-life is quite different in the northern and in the southern parts of the investigated area, but for certain species of sea-birds it has not been possible within this area to determine limits for their distribution. Two species of Albatross (*Diomedea exulans* and *Thalassarche melanophrys*) and the Giant Petrel (*Macronectes giganteus*)—the nearest breeding-places for these are presumably the sub-antarctic islands south of New Zealand—we thus met a little north of New Zealand and within the whole investigated area, and the Fluttering Shearwater (*Puffinus gavia*)

which is found breeding both on North and South Island and on the Snares south of New Zealand was recorded rather near land along the coast of both the north and the south island. Furthermore, it may be mentioned that the Sooty Shearwater (*Puffinus griseus*), which is known to breed on both the New Zealand islands, on the south-going trip was seen about 44° south latitude, but during the following part of the route, as well as in Cook Strait, the species was observed daily and sometimes in large numbers.

To complete the list of more oceanic birds which were observed and determined with certainty during this cruise, it may be mentioned that several specimens of the Fairy Prion (*Pachyptila turtur*) and the Little Penguin (*Eudyptula minor*) were observed during the passage through the Hauraki Gulf as well as in Cook Strait.

Competition between Plants.*

THE recent publication of the work of Clements, Weaver, and Hanson, on "Plant Competition" reports the results of numerous experiments designed to analyse the competitive functions in plant communities. Many of these consisted of transplantations of species characteristic of one phase of a succession into a type of vegetation representing an earlier or later phase. In view of the fact that the major mortality amongst plants would appear to be in the juvenile stage of development (cf. NATURE, May 31, p. 817), conclusions based upon transplantations of established plants must obviously be accepted with considerable reservation when evaluating the competitive relations between species, but recognising these limitations such have considerable value.

In a recent address (*Journal of Ecology*, August 1929) the reviewer, dealing with the biological equipment of species in relation to competition, emphasised the importance as factors in the competition struggle of such features, *inter alia*, as potential height, rate of growth and spread, development of the root system, capacity for reproduction, and the mode and percentage of germination. The experiments of Prof. Clements and his collaborators furnish additional corroboration of these conclusions. They state that practically all the advantages or weapons of species are epitomised in the two words amount and rate. In competition between short and tall grasses the latter were successful under moist conditions, but under dry conditions or when the herbage was grazed the shorter grasses, as might be expected, more than held their own. *Sporobolus asper* was successful in competition with *Andropogon furcatus*, despite its shorter stature, a result attributed to its more efficient root system. *Elymus canadensis* is the victor in the struggle with *Panicum virgatum* owing probably to the earlier and more rapid growth of the former.

The importance of percentage germination was shown by cultures of *Andropogon glaucum* with *Andropogon scoparius*, in which it was found that either species became the dominant when the number of its seedlings had been considerably in excess of those of the other. The advantage of priority of occupation was shown by transplantation experiments, in which it was found that the species already established were almost always victorious over those introduced—a conclusion which supports the contention that mass migration rather than random inoculation is the important factor for successful establishment.

Experiments upon the competition between forest and prairie show the importance of moisture in favouring the arboreal vegetation. The transition zone between the grassland and forest is a broad one of fluctuating extent, and the hypothesis is put forward that the advance or retreat of the forest margin respectively corresponds to the wet and dry climatic phases which coincide with the sunspot cycle.

The observations of Cockayne in New Zealand, and of other experienced field botanists, have emphasised the absence of naturalised species from virgin climax communities in regions where disturbed vegetation has become invaded by an extensive alien flora. Denudation experiments also bear witness to the importance of priority of occupation in the plant world. Cornfields which have passed out of cultivation may still show remains of the weed flora thirty-five years after they have ceased to be arable land, whilst wood-anemones and other members of the shade-flora will persist long after a woodland area has been converted into pasture. Such persistence is indicative of the comparative stability of plant communities and shows that the pressure of competition may operate over a considerable period before its effects are manifest. For this reason the drastic changes involved in many competition experiments, such as those here considered, which operate within a brief period of but a few years at most, are probably not directly comparable to the competitive processes of Nature, which if sure in their outcome are often extremely slow in their manifestation. Nevertheless, the amount of experimental work bearing on the phenomenon of competition is so meagre that we welcome the publication of any such studies whilst recognising the caution necessary in applying conclusions based on these artificial conditions to the explanation of competition phenomena as they occur in Nature.

The work is more of a very detailed account of the experiments than, as might be inferred from the title, a general résumé of the subject, and indeed one is conscious of a sense of inadequacy due, in part, to a lack of coherence in the method of presentation and, in part, to the omission of data necessary to the proper appreciation by the reader of the real significance of these experiments.

E. J. SALISBURY.

* Plant Competition: An Analysis of Community Functions, by F. E. Clements, J. E. Weaver, and H. C. Hanson. Pp. xvi+340, with 32 Plates, 30 Figs., and 133 Tables. (Washington, D.C.: Carnegie Institution, 1929.)

Some Scientific Instrument Makers of the 18th Century.*

By ROBERT S. WHIPPLE.

ADAMS appears to have given a great deal of consideration to the method of measuring magnification of microscopes, and illustrates in detail in the "Micrographia Illustrata" (Plate 14), fourth edition, various micrometers for this purpose, amongst others the micrometer he made in 1761 for the silver microscope of George III. This instrument originally formed part of the King's collection and is now in the Lewis Evans collection. It has been described by Messrs. Clay and Court at some length.[1] Although the details of workmanship in this instrument are excellent, the instrument as a whole must be regarded as an ornament rather than a serious contribution to microscopy. Such is not the case with the earlier instrument made for the King when Prince of Wales, and known as the "Prince of Wales" microscope (see Fig. 2). It is particularly interesting as embodying the method of mounting a microscope on trunnions; perhaps, as Clay and Court remark, the first microscope so supported. There are three stages, one of which (shown in the bottom of the illustration) is of great interest, having micrometers registering in two directions at right angles. The screws have 100 threads to the inch, and the scales on the heads are divided into 100 parts, so that the micrometers read to 1/10,000 inch. The stage shown in position on the microscope was intended to carry a frog for demonstrations of the circulation of the blood. It is a matter of general knowledge that King George III. was keenly interested in scientific matters, and wished that his family should be instructed in science. Dr. Demainbray commenced to teach the Royal family in 1754, and appears to have used for this purpose the apparatus which formed the major part of what is known as the King George III. collection. The instruments in the collection were catalogued in a manuscript book which is still preserved in the Kew Observatory, and also in a catalogue which is now in the Science Museum at South Kensington. The instruments were housed at the Kew Observatory until 1841, when they were transferred to King's College, London. In 1925 they were removed to the Science Museum at South Kensington, where the majority of them can be studied. The story of the collection was told in some detail in a paper before the Optical Convention of 1926.[2] The majority of the instruments intended for instructional purposes were made by George Adams, although few of them bear his name. Fortunately two books of instructions have been preserved, and it is by means of these that it is possible to state that the majority of the instruments were made by Adams.†

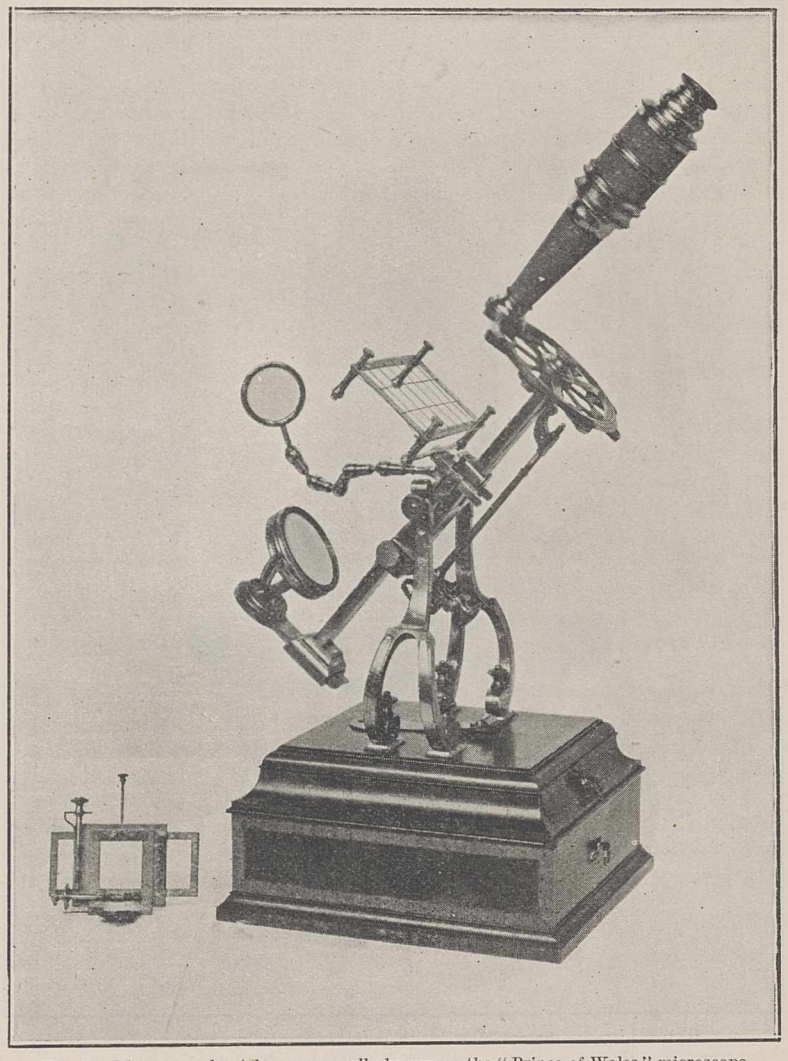

FIG. 2.—Microscope by Adams, generally known as the "Prince of Wales" microscope.

The instructions consist of two manuscript books about 19 in. × 13 in., with two small books about 12 in. × 9 in. The pages of the latter are of blue paper, on which are pasted white sheets on which the illustrations have been drawn. One book is entitled:

* Continued from p. 246.

† It is by the courtesy of the Delegacy of King's College and the Director of the Science Museum that I have been able to examine these books.

" A Description of an Apparatus for explaining the Principles of Mechanicks made for His Majesty King George the Third by George Adams, Mathematical Instrument Maker to His Majesty. In Fleet Street, London, 1762." The second book is entitled: " A Description of the Pneumatic Apparatus made by George Adams in Fleet Street, London, 1761." In the case of the " Mechanicks " the final sheets of drawings were in course of preparation, the outlines having been drawn, but the shading is incomplete and reference figures have not been inserted. It was evidently intended that the sheets of drawings should be bound as a book to accompany the instructions, and probably that the latter should be bound also when the drawings were completed, but these were never finished. In the case of the " Pneumatics ", drawings on plates the same size as the manuscript (19 in. × 13 in.) were in course of preparation, and those that are finished are excellently drawn. In the case of both books it was no doubt intended to have the manuscripts bound—as they are now a series of loose leaves in rough covers—but this was never done. The two books containing the comparatively rough drawings appear to have been the centre around which Adams built up the experimental courses. In the case of the " Mechanicks " a little mathematical work is also included, although the course is essentially experimental and based on Desagulier's translation of the classical work of 's Gravesande, the distinguished professor of mathematics at Leyden.[3]

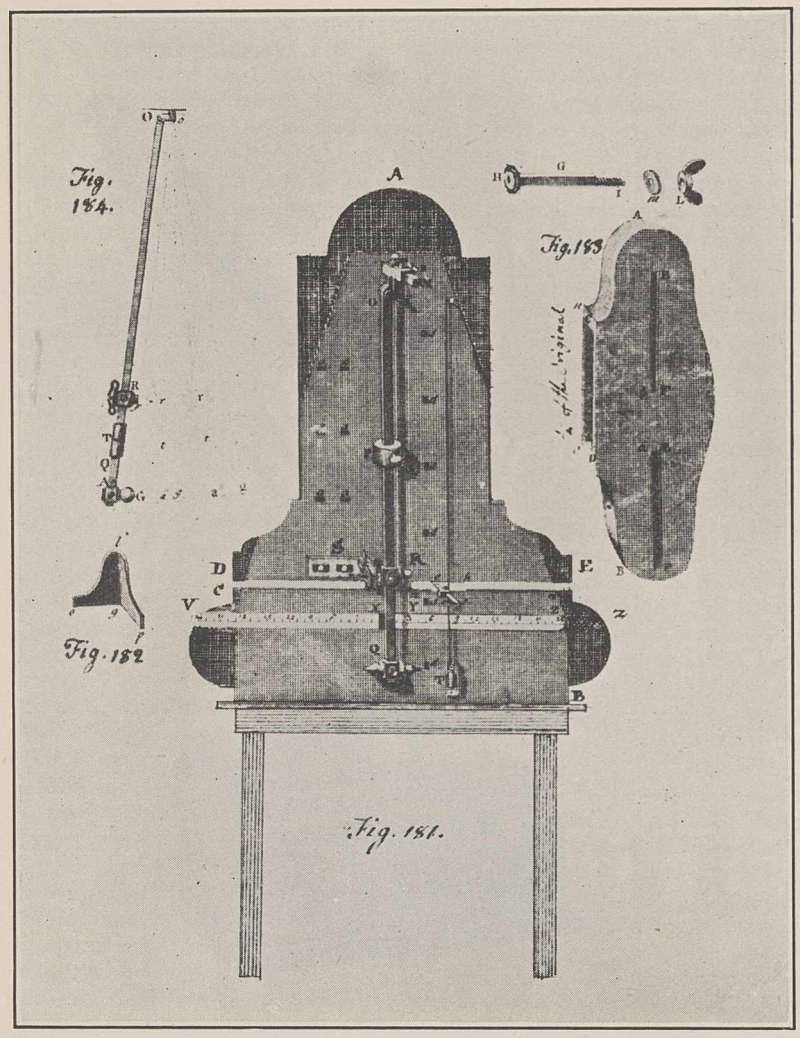

FIG. 3.—'s Gravesande table for pendulum experiments, as modified by Adams.

Adams apparently cut out many of the illustrations from Desaguliers' book, and added pencil or ink modifications to guide the workman. Fig. 3 is an example of a modification of this kind. The apparatus is intended to demonstrate experiments on pendulums and the impact of bodies; it is generally known as " 's Gravesande table ". The central illustration in Plate 25 of Desaguliers' book has been cut out and modified. The additions are shown by the cross hatching, but the parts removed have been carefully cut away before mounting. The finished instrument can be seen at South Kensington, and comparing the original design with that made by Adams, one has to admit that the latter is more graceful than the original. The workmanship of the whole of this piece of apparatus is excellent. Adams evidently considered the cost of making apparatus, because several modifications are introduced with the view of reducing labour. The drawing of a table is shortened in pencil, with the words " Too long " written against it, and there are small pencil sketches at the side showing alterations. A ring is made to take the place of a fairly elaborate handle, and a simple glass basin is used instead of a brass bowl.

There can, I think, be little doubt that, judging from the large number of sketches that are dimensional, they must have formed the actual drawings from which the apparatus was built. Not improbably the workman had made some of the instruments previously for other customers, so that he did not require detailed drawings. The work of making the instruments may have spread over a few years. In the case of one of the pneumatic instruments mention is made of apparatus previously supplied and now " in one of the Cabinets of the Palace at Richmond".

All through both books references are made to various scientific authors; for example, when discussing the Archimedian screw five references are given.

One of the most interesting instruments shown in detail is the rotating speculum suggested by Searson as an artificial horizon. Full details of the construction are given, and a manuscript copy of Emmerson's paper in the *Philosophical Transactions*, vol. 47, p. 352, is included with the manuscript papers of the collection. Adams commences the description of the instrument with a short introduction :

"I received this invention from the late Sir Jacob Ackworth, first Commissioner of his late Majesties Royal Navy ; soon after the inventor Mr. Searson was unfortunately lost on board His Majesties Ship the 'Victory'."

Adams's mechanical ability shows itself in his instructions as to lubrication :—"It is necessary to put a drop of sweet Oil into the concave Steel polished segment of a sphere, for if the speculum be whirled without Oil it does not spin much above ten or twelve minutes, with Oil it will spin generally 36 minutes."

Only two of the illustrations are actually signed by Adams, although there is little doubt that the various notes are in his writing. There is a short four-page manuscript slipped into one of the books, which is a sheet of instructions with regard to some details of an instrument. Adams presumably wrote his notes out in this manner, and they were afterwards transcribed in the elaborate copy-book writing of the instructions.

The fourth edition of the "Micrographia Illustrata" is dated 1771, and Adams died in 1773. He must have lived a full life, as, judging by the large number of instruments that may be found bearing his name, and by the "Catalogue of Mathematical, Philosophical and Optical Instruments" published in the end of the "Micrographia Illustrata", he must have had a large and flourishing business. Adams left it to a son—George (born in 1750)—who added greatly to the prestige of the firm. He was a cultured man, and a favourite at Court. He wrote a large number of books, the majority of which passed through more than one edition. The most famous of his books was his "Essays on the Microscope" published in 1787. In the preface he states frankly that he had intended to confine himself to a republication of his father's work the "Micrographia Illustrata", but that knowledge of the subject had increased so much since his father wrote that he felt the book had to be rewritten. Discussing the natural history side of the subject, he states that he has endeavoured to correct some of the faults in arrangement, etc., "by arranging the subjects in systematic order, and by introducing the microscopic reader to the system of Linnæus, as far as it relates to insects". Chapter i. is an extremely interesting history of the microscope, as observed by one who lived close to many of the inventions. In it he mentions that he invented an improved form of the lucernal microscope in 1774. In Chapter iii. he mentions that "this microscope was originally thought of, and in fact executed by my father ; I have, however, so improved and altered it, both in construction and form, as to render it altogether a different instrument". He also mentions that "the great demand I have had for them, has fully repaid my pains and expences [*sic*] in bringing it to its present state of perfection". The lucernal was a simple compact form of projection microscope which met with general approval as an instrument which could be conveniently demonstrated to a number of people at the same time.

A second and enlarged edition of the "Micrographia Illustrata" appeared in 1798, edited with great care by F. Kanmacher. This editor in a footnote dwells on the fact that Adams had not given full credit to Benjamin Martin for what he had done to develop the microscope. Adams's "Geometrical and Graphical Essays", first published in 1790, was an extremely useful text-book for surveyors, civilian and military. The lectures on "Natural & Experimental Philosophy" first published in 1794, in five volumes, very nearly cover the range of physics as then understood—or in the words of the sub-title "describing in a familiar and easy manner the principal phenomena of nature and shewing that they all co-operate in displaying the goodness, wisdom and power of God". One is much impressed with the immense amount of work involved in the preparation of these books, for they are all full of individuality. The lectures were evidently written under difficulties. In the preface the author mentions: "During the composition of these Lectures I have had to attend to the grateful calls of daily business, and have struggled with much weakness and langour". He passed away on August 14, 1795. We learn from an editorial note to the second edition of the "Essays on the Microscope" that Adams at the time of his death was preparing a new edition and that he had other books in view. After his death his books and instruments were sold by auction, and the stock and copyright of his books were purchased by the brothers W. and S. Jones. William Jones was responsible for the editorial work and the republishing of several editions of Adams's books. The firm also continued to make instruments to the Adams's design for many years.

The manuscripts and plates of Adams the elder were inherited by his widow, who gave them to her younger son Dudley. He edited a thirtieth edition of the treatise on the globes, published in 1810. It is said that he had intended to publish another edition of the "Micrographia Illustrata", but it is not improbable that the revised edition (1798) of his brother's "Essays on the Microscope" rendered this unnecessary. Dudley Adams appears to have continued in the instrument business, as Mr. Court possesses a statement written on the back of a shop print, about 1800, of the wholesale trade terms for telescopes. These were evidently of the short brass draw-tube type which Dudley Adams had developed. The note attached to the price-list states that "the object glasses not being single but achromatic" shows that non-achromatic glasses were sometimes sold.

Time has only allowed me to dwell in detail on

four instrument makers in this century so full of scientific development. Their names are not so well known to the general public as those of Dolland, Herschel, and Ramsden. Nevertheless, the men whose work I have briefly described did an immense amount to popularise science, and to raise the standard of scientific instrument craftsmanship. How world-wide this reputation for good work became is best seen by the number of instruments of English eighteenth century workmanship treasured in the Continental museums.

[1] "Two Microscopes made by G. Adams for King George III." By R. S. Clay and T. H. Court. *Jour. R. Micr. Soc.*, pp. 268-273; 1926; and Supplementary Note, *Jour. R. Micr. Soc.*, p. 255; 1927.

[2] "An Old Catalogue and what it tells us of the scientific instruments and curios collected by Queen Charlotte and King George III." By R. S. Whipple. *Proc. of the Optical Convention*, Part II., 1926.

[3] "Mathematical Elements of Natural Philosophy, confirmed by Experiments: or an Introduction to Sir Isaac Newton's Philosophy." Written in Latin by the late W. James 's Gravesande, LL.D., Professor of Mathematicks at Leyden and F.R.S. Translated into English by the late J. T. Desaguliers, LL.D., F.R.S., and Published by his son J. T. Desaguliers. Sixth Edition 1747.

Obituary.

Mr. A. E. Seaton.

THE death of Mr. Albert Edward Seaton, which occurred at Hemel Hempstead on Aug. 8, robs British shipbuilding and marine engineering circles of one of its oldest and best known representatives. For nearly half a century Seaton's "Manual of Marine Engineering"—now in its twentieth edition—has been familiar to marine engineers, while his "Pocket Book," compiled in collaboration with Mr. H. M. Rounthwaite, is to be found in every drawing office. His "Manual" would alone cause his name to be remembered, but he had an almost lifelong association with the Institution of Naval Architects, and during the course of his long career enjoyed the friendship of many of the most distinguished members of his profession.

Born at Padstow, Cornwall, in 1848, Seaton entered Devonport Dockyard in 1864 as an engineer student with the object of following a naval career, and four years later, as a result of his success in a severe competitive examination, he gained a scholarship to the once well known Royal School of Naval Architecture and Marine Engineering at South Kensington, which had been established by the Admiralty in 1864. During its existence of nine years, the School occupied a unique position in Great Britain, and from it came not only future chief constructors and engineers-in-chief of the Navy, but also men who rose to important positions in private firms. In Seaton's time, Woolley, Merrifield, Cotterill, and Unwin were members of the staff; the occasional lecturers included Airy, Froude, Rankine, and Scott Russell, while among the students were Elgar, White, Watts, Biles, Sennett, Durston, Pratten, Corner, and others, whose important work during the last decades of the nineteenth century and the first of this century were of the greatest value to the country in building up our great naval and mercantile fleets.

Passing out in 1872, Seaton immediately left the public service and became technical secretary to Reed (afterwards Sir Edward Reed), who in 1870 at the age of forty had resigned his position as Chief Constructor at the Admiralty. Through Reed, Seaton became associated with Earle's Shipbuilding and Engineering Co., Hull, and during the next twenty-nine years was responsible for the design and construction of not only the machinery of many vessels but also of the ships themselves.

Leaving Hull in 1901, Seaton set up in Westminster as a consulting engineer, and in 1905 succeeded his former fellow-student and lifelong friend, Alfred Morcom, as chairman of the well-known Birmingham engineering firm, Messrs. Belliss and Morcom. But much of Seaton's best work was done in connexion with the Institution of Naval Architects and other societies. He was elected a member of Council of the Institution in 1888, a vice-president in 1919, and represented it on various important committees. His knowledge of the progress of marine engineering design was probably unique, and for some years he was chairman of the British Marine Engineering Design and Construction Committee. He also took part in public life, served as a County Councillor for Hertfordshire, and was made a Justice of the Peace. His funeral took place on Aug. 12, at St. Marylebone Cemetery, East Finchley.

THE issue of the *Physikalische Zeitschrift* for June 1 contains a short account by Prof. F. A. Schulze of the work of Prof. Wilhelm Feussner, who died in 1928 at the advanced age of eighty-five years. He was born in Hanau in 1843, and studied at Heidelberg under Kirchhoff and at Marburg under Gerling. He took his doctor's degree in 1867 and became lecturer, in 1880 additional professor, and in 1908 honorary professor of theoretical physics at Marburg. He retired in 1918, but still kept in touch with modern research, and contributed to the section on interference in the new "Handbuch der physikalischen Optik".

WE regret to announce the following deaths:

Prof. A. R. Crook, for many years chief of the Illinois State Museum at Springfield, Illinois, known for his work on Cretaceous fossil fishes and geology generally, on May 30, aged sixty-five years.

Dr. J. Walter Fewkes, fellow of the U.S. National Academy of Sciences, who was chief of the Bureau of American Ethnology from 1918 until his retirement in 1928, on May 31, aged seventy-nine years.

Dr. W. S. Franklin, who retired last year from the professorship of physics and electrical engineering at the Massachusetts Institute of Technology, vice-president (Section B) of the American Association for the Advancement of Science in 1902, on June 6, aged sixty-six years.

Capt. J. T. Ainslie Walker, widely known by his work on disinfectants, who was associated with the late Dr. Samuel Rideal in perfecting the Rideal-Walker test for potency, on July 27.

Sir William Walker, C.B.E., late Director of Health and Safety in Mines Department, Board of Trade, and formerly Chief Inspector of Mines at Home Office, on Aug. 17, aged sixty-six years.

News and Views.

THE voyage of the *R100* from Cardington to Montreal and back is a definite popular success. On the technical side, a large amount of invaluable information must have been obtained from both design and operational points of view. The efficacy of the mooring mast in particular is the satisfactory reward of original ideas well worked out. The previous failure of the tail fairing, the stripping of fabric, and the dislodgment of a fuel tank seem trivial in themselves; only those in possession of all the facts can judge whether they are minor mishaps with no serious implication or symptoms of a graver nature. The framework has resisted considerable buffeting, and here again, information should be yielded as to whether the structure has an effective margin of safety or has been stressed to an excessive degree. It is clear that the best meteorological service cannot enable an airship to avoid all stress of weather during the speediest passage across the Atlantic.

ON the more general question of a regular airship service, it can scarcely be held by the most optimistic that much has been added to the stock of knowledge by the recent voyage of *R100*. Referring to the analysis of Zeppelin figures given in NATURE of Oct. 11, 1924, p. 548, it is seen that their expectation of life falls far short of eighteen voyages in eighteen months. It is by no means clear that the great increase in size of *R100* and *R101*, and the further increase now proposed, will diminish these risks, and a cautious experimental programme seems a more reasonable policy than any hasty endeavour to make good the claims of the airship's partisans. The projected flight of the *R101* to India will bring further knowledge, and those who are most critical will join in congratulating the courageous exponents of airship construction on their great technical efforts to overcome the inherent defects of size and fragility.

THE Anglican bishops, recently assembled at Lambeth, have embodied the results of their deliberations in an Encyclical Letter, and in a number of Resolutions. These appear to be inspired predominantly by a rational and enlightened spirit, and students of science will read large portions of them with interest and sympathy. Very noteworthy are the sections which deal with the relations of Christian doctrine with modern scientific and philosophic theories, which are said to provide "a climate more favourable to faith in God than has existed for generations". "New interpretations of the cosmic process are before us which are congruous with Christian Theism. The great scientific movement of the nineteenth century had the appearance, at least, of hostility to religion. But now, from within that movement and under its impulse, views of the universal process are being formed which point to a spiritual interpretation. We are now able, by the help of the various departmental sciences, to trace in outline a continuous process of creative development in which at every stage we can find the Divine presence and power. Thus scientific thinking and discovery seem to be giving us back the sense of reverence and awe before the sublimity of a Creator Who is, not only the cause and ground of the universe, but always and everywhere active within it." The Encyclical goes on to declare that "we must school ourselves to include in our habits of thought about the Creator God as much as we can of the beauty and order of the world, and of everything in life that evokes the awe, the loyalty, and the self-sacrifice of men and women at their best".

IT is all to the good that the bishops should express themselves in this way, but, as everyone knows, it is the rank and file of the clergy whose conversion to a more modern outlook must be achieved if the ideals of the Encyclical are to be fulfilled. The ordinary Christian teacher, who expounds his message Sunday by Sunday from the pulpit, must be encouraged to think out his position afresh, and to impart to others the convictions to which his studies and reflections have led him. When we remember that the average age of the Anglican clergy has been authoritatively stated to be fifty-five years, we shall realise the difficulty of the situation. The hope would appear to lie with the younger clergy. "We especially desire to impress upon the younger clergy that the Church requires the service of men who will devote themselves to the study of theology in all its branches. The Church needs learning, as well as spiritual power and practical ability in its clergy." But it should be remembered that men will not think well unless they are allowed to think with freedom. Will the young theological student enjoy the same latitude as the young scientific student? Do the bishops really mean business? In view of the importance of giving an adequate education to candidates for ordination, it is encouraging to note that the bishops express a strong preference for university training as against that given in the seclusion of a seminary. "It is essential that Christian theology should be studied and taught in universities in contact with philosophy, science, and criticism." If the gap should widen between the Church and those standards of intellectual integrity recognised in universities, it would soon cease to play any effective part in English life.

THE opportunity of the meeting at Cambridge of the fifth International Botanical Congress was utilised for the unveiling of a tablet to the Hookers in the church at Halesworth, Suffolk, on Sunday, Aug. 17, to which reference was made last week (p. 249). The inscription explains the circumstances it was desired to record; it is as follows: "This Tablet records the connection with Halesworth of the botanists, Sir William and Sir Joseph Hooker, father and son, who became in succession directors of the Royal Botanic Gardens, Kew. Sir William lived here 1809–1820, and here Sir Joseph was born 1817. Erected 1930." The tablet (of stone) is the work of the sculptor, Mr. A. H. Gerrard, of the Slade School, and is beautifully executed. The dedication service, arranged by the Bishop of St. Edmundsbury and

Ipswich, and by the Rev. H. C. Newbery, rector of Halesworth, was fully choral. The actual unveiling was performed by Sir David Prain, a successor to the Hookers at Kew, and the bishop delivered an address.

A LARGE party came over from Cambridge, and together with other botanists and naturalists from East Anglia, about a hundred visitors were entertained to tea after the ceremony at Halesworth Church. Two members of the Hooker family were present, Mr. Reginald Hooker and Mr. Richard Hooker; the old home of the Hookers (the Brewery House) was shown by the courtesy of Miss Parry, the present owner. The visitors, who came from many countries, were delighted with the charm of Halesworth and its welcome, and with the beauty and admirable rendering of a well-designed service. It was generally felt that the tribute paid to these former citizens of Halesworth, in which so many participated, was entirely fitting. The arrangements for the execution and erection of the tablet were made by a small committee under the chairmanship of Viscount Ullswater, whilst the funds required were contributed partly by individual botanists and others contemporary with Sir Joseph Hooker, and by representative institutions, including the Royal Society, the Linnean Society, the Norfolk and Norwich Naturalists' Society, the Royal Horticultural Society, the Court of the University of Glasgow, the *Annals of Botany*, the staff of the Royal Botanic Gardens, Kew, and of the Department of Botany, British Museum, and the Ipswich Naturalists' Field Club.

AMERICA dallies with the thought of its own antiquity. While the Boston Society of Natural History has celebrated its centenary by the publication of impressive "Milestones", reviewed by Prof. Stanley Gardiner in our issue of Aug. 9, p. 195, the Philosophical Society of Washington commemorated more modestly its thousandth meeting on Jan. 18 last. The foundation of the Society was due in some measure to the Civil War, for it was the recurrence of normal times, after a disturbance which had disorganised the meetings of scientific men in the capital, that led to the setting up of a formal organisation at the regular meetings of which all the sciences, save those of speculative thought, might play a part. Previous to the foundation of the Philosophical Society on Mar. 13, 1871, the capital had been served from 1810 onwards by a series of agricultural, medical, and botanical societies, and finally by the National Institute, which was disbanded near the beginning of the Civil War. The Philosophical Society has seen many changes, from the time in 1874 when it was minuted that its members should appear in the records under no title other than plain "Mr.", and when formality of debate, associated with full evening dress, was the rule, but it has throughout been supported by a noble band of 'intellectual giants' and has made many contributions to the progress of science, reaching far beyond the confines of its meeting room. Since 1911 its *Bulletin* has ceased publication, and it has supported and published in the *Journal of the Washington Academy of Sciences*.

IN the Italian National Park of Gran Paradiso the numbers of wild goats and of chamois have increased beyond reasonable limit, the former being reckoned to number 2800-2900, the latter 1600-1800. Accordingly the Royal Commission which controls the Park has decided that during the coming autumn permits will be granted to hunters, for a consideration, to shoot these animals. The licence is stated by the Italian sporting journal, *La Caccia e la Pesca* of June 15, to cost 10,000 lire for each goat the sportsman desires to shoot, and 600 lire for each chamois, and accredited hunters will be accompanied by a warden. In order to ensure the continuance of healthy stock upon the mountains, a breeding enclosure for goats is to be constructed in the Valsavaranche, whence young goats will be distributed, and Bardonecchia deer and mouflon from Sardinia are to be transported to suitable localities so that, so far as possible, the typical fauna of the Park may be restored.

THAT considerable progress has been made at the Rubber Research Institute of Malaya is evident from the annual report for 1929, increased co-operation between the Institute and other cognate institutions in Malaya, Great Britain, and elsewhere being worthy of special mention. Advisory work on behalf of the estates continues to increase, and in consequence the research programmes have of necessity been curtailed. It is anticipated, however, that much valuable information will accrue from such work, much of which may be regarded as applied research. With regard to soil investigations, special attention is being paid to the development of more rapid methods of analysis, and the value of 'bunding' in the conservation of soil moisture is becoming more generally recognised. On the botanical side, numerous problems are arising as to the most economical method of tapping, the question of the optimum length of the rest period and the possibility of stimulating the yield over a short period, in connexion with old trees prior to their removal, being among the points upon which information is being collected. Increased yields have already been obtained by the practice of completing the tapping earlier in the day. In addition, fundamental research is in progress on the chemical and bacteriological aspects of latex and rubber. It has been shown that the presence of yellow pigment in latex does not affect the quality of sole crepe although owing to the demands of fashion it lowers the market value. Unfortunately, fractional coagulation, which adds considerably to the cost of preparation, is necessary for the production of the white form of crepe. The possibility of producing air-dried sheet as a substitute for smoked sheet and the questions of temperature and ventilation etc. of the drying sheds are also under investigation. Extensions in the field work have been made, and several lectures and conferences held with encouraging results.

THE second International Congress of Soil Science was held in Russia on July 20–31, the first week at Leningrad and the second at Moscow. The countries from which members came included Chile, Czechoslovakia, Denmark, France, Germany, Great Britain,

Holland, India, Japan, Malaya, Palestine, Rumania, Spain, Sudan, Sweden, Switzerland, and the United States. The Congress was entertained at receptions and banquets by the provincial administration in Leningrad and by the central government in Moscow, and the hospitality shown left no doubt as to the desire of the authorities to make the visit as pleasant as possible. Three concerts and a cinema performance were specially arranged for the delegates, and a day in each city was set aside for sight-seeing. At the opening meeting in Leningrad, it was announced that Prof. K. K. Gedroiz, president of the Congress, was prevented by ill-health from attending, and it fell to Dr. D. J. Hissink, of Groningen, to act as president throughout the meetings. Apart from a few addresses of a more general nature, the work of the Congress was done by the six commissions into which it is divided, for soil mechanics and physics, chemistry, biology and biochemistry, fertility, classification and mapping, and applications to cultivation. Abstracts of the papers were distributed at the beginning of the Congress, and the full text will be printed in the *Proceedings* of the Congress, which are to be published by the Russian organising committee.

A SPECIAL feature of the Congress was the number of joint meetings of commissions on such subjects as physical properties, reaction, organic matter, soil utilisation, and alkali. The international soil map of the world has made considerable progress since the Congress of 1927, and further steps were taken for the mapping of the Mediterranean region, Africa, and South America. Visits were paid to a number of institutions in or near Leningrad and Moscow, and the foreign delegates were impressed by the energy with which these are being developed and by the generous financial provision for their equipment and support. Of special interest was the Dokuchaev Institute for soil science, containing a collection of hundreds of monoliths representative of the soil types of European and Asiatic Russia. At the conclusion of the Congress on July 31, many of the delegates left for a three weeks' tour arranged to cover the most important soil zones of European Russia. It was decided to hold the next Congress in 1935 in England, and Sir John Russell was elected president. Amongst other new officers, Prof. Robinson, of Bangor, succeeds Prof. Novak, of Brün, as president of the commission for soil mechanics and physics, and Dr. Joseph, of the Imperial Bureau of Soil Science, succeeds Prof. Marbut, of Washington, as president of the commission for soil classification, mapping, and morphology.

THE British Non-Ferrous Metals Research Association has secured a leasehold factory property in London, where it is proposed to centralise its offices and provide accommodation for a laboratory and workshops for its research and technical development departments. A special appeal for increased annual support and contributions to a headquarters' fund has recently been launched. The Association, founded ten years ago, has made steady progress under the direction of Dr. R. S. Hutton, and now carries out work for all sections of the non-ferrous metals industry on a scale of expenditure of £20,000-£25,000 per annum. It already has to its credit the discovery of new engineering materials and of methods of increasing efficiency of production, which should commend it to the metal and engineering trades. Dr. D. H. Ingall has just been appointed assistant-director and research manager of the Association, as from January next. Dr. Ingall is well known for his metallurgical research and administrative work, and as first principal of the Constantine Technical College, Middlesbrough, has been largely responsible for its equipment and organisation. Dr. O. F. Hudson will continue as senior metallurgist of the Association. Mr. G. L. Bailey, of the Metallurgy Section, Research Department, Woolwich, has been appointed, from Sept. 1, as development officer to fill the position recently vacated by Mr. S. J. Nightingale, who resigned to take up a post in industry.

SINCE Dr. John Hopkinson first suggested novel methods of charging for the electric light in his presidential address to the Junior Institution of Engineers in 1892, many such systems have been adopted in practice. In the journal for July issued by the A.E.G. Electric Co. of Victoria Street, London, a description is given of a 'two part tariff' prepayment meter which automatically records the consumer's payments and his consumption of electricity. This type of meter receives the two payments of the consumer, namely, his fixed monthly or quarterly payment and his payments for the energy taken. The latter charge is rated very low, so that once the fixed charge is paid the consumer finds that he can use his lighting or heating appliances most extravagantly at small cost. The objections urged against a one-part tariff is that the takings of the company in the summer time do not cover the running costs and that the consumers find that their winter bills are very high. From the supplier's point of view this system is very attractive, as he receives an appreciable revenue in the summer and the consumer finds that the winter bills are no longer too heavy. If the company ever desires to alter the price the meter can be easily adapted by simply changing the gear wheels. The only objection urged against this two-tariff method of charging is that it tends to make the consumer extravagant in his use of light.

THE chapter on the number of electrical accidents which have occurred during 1929, which is given in the chief inspector's report (Cmd. 3633, London: H.M. Stationery Office, 2*s*. 6*d*.), is instructive. Compared with the period 1910–14, there is no doubt that installations have been made very much safer and that devices that in certain circumstances can become dangerous are seldom used. We agree with Mr. Scott Ram, the senior electrical inspector of factories, that this is largely due to the making and enforcing of stringent regulations and also to the increased inspection by qualified officials. Although the use of electricity last year was four times as great as its average annual use during the period 1910–14, the number of accidents diminished. The maximum number of

recorded accidents during a year was 512 in 1913. Unfortunately, however, the number of fatal accidents from shock or burns with low voltages seems to be increasing. The number of accidents with pressures not greater than 250 volts last year happens to be the same with both direct and alternating current, but the latter are much more dangerous to life; whilst 21 of the a.c. accidents were fatal, none of the d.c. accidents were fatal. As the standard system of electric supply is now a.c., it will be seen how important it is that the regulations be enforced and the inspectorate strengthened. Several extraordinary accidents due to recklessness or absent-mindedness are given, but in several cases employees have taken totally unwarranted risks in order that the supply to a few consumers may not be cut off for a brief period. In some cases they may possibly have done this with the connivance of their superiors. It has to be remembered that dangerous shocks occur with low pressures when the body makes contact with conductors of opposite polarity or more often with a live conductor and a good earth such as a water or gas pipe, the water in a bath or a damp wall or floor.

THE Safety in Mines Research Board has just issued its eighth Annual Report, for the year 1929. Apart from the suggestion that this report should have been published at an earlier date, it may be looked upon as a satisfactory statement of a year's work. As usual, the bulk of the work is chemical and microscopic; there is no doubt that a thorough knowledge of the constitution of coal may lead to important results in the future, though its direct effect upon the prevention of accidents in mines may be but small. It is, however, highly satisfactory to see that the Board has at long last come to the conclusion that a number of the problems concerning safety in mines are not chemical but mechanical, and that it has accordingly appointed a highly qualified mining engineer to commence the investigation of such problems. The researches upon wire ropes that have been carried on under Prof. Dixon are another step in the right direction. The value of free international communication and collaboration in these matters is shown by the fact that the work at Sheffield, where they had the advantage of the presence for a considerable period of one of the workers of the United States Bureau of Mines, has resulted in a very satisfactory new apparatus, a modification of a well-known American apparatus, which is likely to prove very useful in rescue work. It is satisfactory to see that such international co-operation has been extended to France, and, although it does not appear in the present report, it is well known that similar arrangements are being concluded with Belgium. It need scarcely be said that most of the matters referred to in this report have been dealt with at length in the Safety in Mines Research Board Papers, issued during recent years.

ACCORDING to a report in the *Daily Telegraph* of Aug. 12, Mr. Lansbury has announced the appointment of a Committee representing the Board of Education and the Office of Works to consider the question of the establishment of an open-air folk museum in London. The sum of £50,000 is promised towards the cost of the scheme. The terms of the report, while making no definite statement, suggest that the land in Regent's Park now held by the Royal Botanic Society under a lease which terminates in April 1932, but then to be added to the Park and, as announced in the House of Commons, thrown open to the public, may be available for the purpose. This land was one of two alternatives suggested by the Royal Commission on our National Museums in its report. Its suitability in situation and character has been strongly urged by the Committee appointed by the Royal Anthropological Institute with the object of securing the establishment of such a museum for England. It would appear that the proposal to be considered is on the lines suggested in the article on this question which appeared in the issue of NATURE of Aug. 24, 1929, p. 289, and will follow the plan of the Continental folk museums in which exhibits are housed in peasants' dwellings typical of various periods re-erected in the museum grounds for that purpose.

IN Great Britain it is difficult and costly to obtain for use before such bodies as field clubs and schools good educational films of Nature subjects. In California the State considers it to be good propaganda for fish and game conservation to issue free of charge, to responsible organisations within its territory, films depicting the natural history of the State. The reels are 1000 feet long, and illustrate great variety of fish, bird, and mammal life in its natural haunts, as well as commercial fisheries, trout cultural operations, and other human aspects. Not only does the Division of Fish and Game lend the films, but it is prepared also to supply lectures describing the pictures, many of which are designed for school use. A list of these motion picture films appears in *California Fish and Game* for April, pp. 152-156. It is full of interesting items and makes us wish that for our own information we could have the privilege of seeing many of them. Would that we could imagine the Ministry of Agriculture and Fisheries or any other British Government Department developing educational activities on lines so interesting and effective.

THE Ministry of Agriculture and Fisheries has taken advantage of the recent meeting of the International Poultry Congress in London to recast the form of its agricultural publications. The majority of these will now appear as *Bulletins*, printed in good type and bound in attractive stiff paper covers with the titles overprinted in contrasting colours. Most of the volumes will be illustrated. We have received half a dozen of the *Bulletins*, which appropriately deal with various aspects of poultry-keeping, from general principles of poultry feeding to special instructions for the rearing of birds for the table or for egg production, and for the treatment of the most common diseases. In appearance and in the quantity and quality of their matter, these publications are a

vast improvement on the earlier pamphlets of the Ministry, and the prices, which vary from 6*d.* to 1*s.* 6*d.*, are very moderate. Since it is impossible even for the interested person to keep in touch with all the *Bulletins* as they appear, we suggest that a useful addition would be a list of the titles of such as have been published, printed on one of the cover blanks.

WE have received from Mr. W. J. Lewis Abbott a friendly criticism of the paragraph in our issue of July 19 referring to Tertiary man in East Anglia. In pointing out the occurrence of a redundant 's' in 'lithoclasiology', he deplores our implied criticism of the term; but at the same time imputes to us a failure to appreciate the importance of the study which it designates that is far from the fact. He goes on to point out that all the examples of early man's handiwork to which he referred in his previous communication were his own discoveries. The flints found and accepted by Mr. H. B. Woodward at Thorpe, Norwich, were subsequent to Mr. Abbott's finds, as were Mr. Savin's discoveries in the Cromer Forest-Bed, *begun*, not renewed, in 1895, and it was Mr. Abbott's collection and not that of Mr. Savin that was exhibited at Burlington House. We regret that the facts were not clearly stated; but for this, we fear, Mr. Abbott's characteristically modest phrasing of his communication must be held responsible.

IN the *Journal of the National Institute of Industrial Psychology* for July, Dr. A. Macrae discusses some of the problems involved in the selection of a career. He says that it is frequently assumed, if a child shows a definite vocational interest, he will necessarily have a real aptitude. Actually the facts are that while many people have been successful by following their inclinations, many others have failed. Practically every occupation makes many varying demands on the worker at it, and it is impossible for a child to feel drawn to some aspect of a particular kind of work which may, or may not, be the most important. To select, for example, the occupation of commercial traveller because one likes seeing new places is not of necessity to guarantee success, nor is a fondness for arguing a criterion of legal proficiency. In a study of a hundred boys leaving a secondary school, it was found that ten had no vocational inclination, forty-six seemed reasonably fitted for the work they had selected, and the others seemed definitely unfitted on the grounds of temperament, general intelligence, special mental capacities, health, and physique.

THE one hundred and eleventh annual meeting of the Swiss Society of National Sciences will be held at St. Gallen on Sept. 11–14, under the presidency of Dr. H. Rehsteiner. The work of the meeting will be distributed over sixteen sections covering pure and applied science and medicine. The general programme includes addresses by Prof. Emil Abderhalden, of Halle a. S., on the significance and mechanism of ferments in Nature, Prof. P. Niggli, of Zurich, on ten years' work of a mineralogical and petrographic institute, Prof. R. Chodat, of Geneva, on the symbiosis of lichens and the problem of specificity, and Prof. C. Wegelin, of Berne, on endemic cretinism. Correspondence respecting the meeting should be addressed "Jahresvorstand der Schweizerischen Naturforschenden Gesellschaft in St. Gallen, Postfach St. Fiden No. 17".

THE centenary of the opening of the Liverpool and Manchester Railway will be celebrated at Liverpool during the week Sept. 13–20. The celebrations have been arranged on a scale appropriate to the occasion by a committee under the joint presidency of the Lord Mayors of Liverpool and Manchester and Sir Josiah Stamp, the chairman of the London, Midland and Scottish Railway. Included in the programme is a great pageant of transport referred to as "probably the most ambitious pageant ever attempted in Great Britain". Some 3500 performers will take part in the pageant, the aim of which is to illustrate the progress of transport from the earliest times. A train of 1830 will convey visitors around a circular track specially laid down, and there will be an exhibition of models and historical material in St. George's Hall. The Libraries and Museum Committee of Liverpool has also arranged lectures for both adults and children. Mr. C. J. Allen will lecture on a century of railway travel; Mr. Dendy Marshall on the Rainhill locomotive trials of 1829, while Engr.-Capt. E. C. Smith will lecture on two hundred years of steam power on land and sea.

THE eighteenth annual meeting of the Indian Science Congress will be held in Nagpur on Jan. 2–8, 1931. His Excellency Sir Montagu Sherard Dawes Butler, Governor of the Central Provinces, has consented to be patron of the meeting, and Lieut.-Col. R. B. Seymour Sewell, director of the Zoological Survey of India, will be president. Copies of papers to be offered to the Congress must reach the president of the section concerned not later than Oct. 15 next. The sectional presidents are as follows: Sir T. Vijayaraghavacharya, vice-chairman, Imperial Council of Agricultural Research, Simla (Agriculture); Dr. C. W. B. Normand, Director-General of Observatories, Poona (Mathematics and Physics); Prof. K. G. Naik, professor of chemistry, Baroda College, Baroda (Chemistry); Principal B. L. Bhatia, Government Intermediate College, Hoshiarpur, Punjab (Zoology); Prof. T. Ekambaram, professor of botany, Teachers' Training College, Saidapet, Madras (Botany); Dr. G. de P. Cotter, superintendent of the Geological Survey of India, Indian Museum, Calcutta (Geology); Rai Upendra Nath Brahmachari Bahadur, 82/3, Cornwallis Street, Calcutta (Medical and Veterinary Research); Mr. K. P. Chattopadhyay, Education Officer, Calcutta Corporation, Calcutta (Anthropology); Prof. G. C. Chatterji, professor of psychology, Government College, Lahore (Psychology). The General Secretaries of the Congress are Prof. S. P. Agharkar, 35, Ballygunge Circular Road, Calcutta, and Dr. H. B. Dunnicliff, Government College, Lahore. The Local Secretaries are Principal M. Owen, Victoria College of Science, Nagpur, and Rao Saheb S.N. Godbole, Victoria College of Science, Nagpur.

THE eighth International Congress of the History of Medicine will be held in Rome on Sept. 22–27, with His Excellency Benito Mussolini as president of honour, Prof. Pietro Caparoni as president, and Profs. Bilancioni and Castiglioni as vice-presidents. The principal subjects for discussion will be (1) How Europe protected herself against leprosy in the Middle Ages, introduced by Prof. Jeanselme of Paris; (2) the medical and scientific relations between Italy and other European countries during the scientific renaissance in the sixteenth and seventeenth centuries, introduced by Prof. Karl Sudhoff of Leipzig and Prof. Arturo Castiglioni of Padua; (3) the necessity of making the study of the history of medicine a compulsory subject in all universities, introduced by Prof. Ladislaw Szumoski of Cracow. Numerous papers on miscellaneous subjects are also included in the programme, such as the problem of medical historiography, by Prof. Siegerist; van Helmont, by Prof. Ostachowski; Girolamo Cardano and Leonardo da Vinci, by Prof. Bilancioni; plastic surgery in Italy and Europe at the time of the Renaissance, by Dr. G. Sansevero-Roselli; and the influence of folk-lore on medicine, by Dr. Dan Mackenzie. The subscriptions, which should be sent to the treasurer, Prof. Vincenzo Rocchi, Corso Vittorio Emanuele 173, Rome, are 100 lire for members of the International Society of the History of Medicine and members of the Italian Society of the History of Medical and Natural Sciences, 150 lire for all other members of the Congress, and 50 lire for members of the families of those taking part in the Congress and medical students.

THE sixth annual Norman Lockyer lecture of the British Science Guild will be given by Sir William Pope on Thursday, Nov. 13, at 4.30 P.M., in the Goldsmiths' Hall London (by permission of the Goldsmiths' Company). The president of the British Science Guild, the Rt. Hon. Sir Samuel Hoare, Bart., will take the chair at the lecture, the title of which will be announced later. The second annual Alexander Pedler lecture will be given by Lt.-Col. Sir David Prain on Wednesday, Oct. 22, at 5.30 P.M. "Science Discipline" is the general subject of this lecture, which will be given in Liverpool under the joint auspices of the University of Liverpool and the British Science Guild.

IT is announced that two of the sectional presidents, Lord Eustace Percy and Prof. T. E. Gregor, who were to have presided over the sections of Education and Economics respectively at the Bristol meeting of the British Association next month, are unavoidably detained by business abroad. Their presidential addresses will be read in their absence.

WE have received the annual report of the Calcutta School of Tropical Medicine, Institute of Hygiene, and the Carmichael Hospital for Tropical Diseases, 1929. The Director, Lieut.-Col. H. W. Acton, details the teaching and research work of the School and reviews recent advances in tropical medicine. This review, together with the reports of the work of the various departments, constitutes a valuable survey of the progress of tropical medicine. The attendances at the Calcutta Pasteur Institute for anti-rabic treatment numbered 10,219 for the year, a record, probably, for any Pasteur Institute in the world.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An assistant at the Road Experimental Station of the Ministry of Transport, Roads Department, at Harmondsworth, near Colnbrook, Middlesex—The Establishment Officer, Ministry of Transport, Whitehall Gardens, S.W.1 (Aug. 25). A full-time assistant lecturer in chemistry at the School of Mines, Treforest—The Director of Education, Glamorgan County Hall, Cardiff (Aug. 26). Entomological and mycological posts in the Cambridge University School of Agriculture, in connexion with a survey and other investigations on sugar beet pathology—The Secretary, Appointment Committee, School of Agriculture, Cambridge (Aug. 30). A biochemist in the Pathological Department of the Royal Victoria Infirmary, Newcastle-upon-Tyne—The House Governor and Secretary, Royal Victoria Infirmary, Newcastle-upon-Tyne (Aug. 30). Assistant lecturers in agriculture under the Education Committee of the Cornwall County Council—The Secretary for Education, County Hall, Truro (Sept. 5). A junior scientific officer in an Admiralty Establishment at Portsmouth—The Secretary of the Admiralty (C.E. Branch), Whitehall, S.W.1 (Sept. 6). An assistant lecturer and demonstrator in botany at the West of Scotland Agricultural College—The Secretary, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow (Sept. 8). Nautical surveyors under the Board of Trade—The Senior Staff Officer, Establishment Department (Mercantile Marine Branch), Board of Trade, Great George Street, S.W.1 (Sept. 12). An advisory entomologist at the South Eastern Agricultural College—The Secretary, South Eastern Agricultural College, Wye, Kent (Sept. 13). A registrar of the University of Birmingham—The Secretary, The University, Birmingham (Sept. 15). A head of the gas engineering and supply department of the Westminster Technical Institute—The Education Officer (T.1), County Hall, S.E.1 (Sept. 30). Test assistants at the Royal Aircraft Establishment for, respectively, calculation and experimental work in connexion with aero-engine investigations, work in connexion with the technical development of aeronautical instruments and small precision apparatus, and work in connexion with strength tests and experimental work on aircraft structures and materials—The Chief Superintendent, Royal Aircraft Establishment, South Farnborough, Hants. A full-time teacher of woodwork and pattern-making at the Smethwick Junior Technical School—The Director of Education, 215 High Street, Smethwick. A whole-time radiologist at the General Hospital, Wellington, New Zealand—"Radiologist, Wellington", c/o The High Commissioner for New Zealand, 415 Strand, W.C.2. A senior clinical assistant and clinical tutor and a non-resident clinical assistant in the department of ophthalmology of the Royal Infirmary of Edinburgh—The Superintendent, Royal Infirmary, Edinburgh.

Research Items.

A Cypriote Threshing Sledge.—In *Man* for August, Mr. J. Hornell describes a very ancient type of implement known as a *dukani* or 'threshing sledge' used by the Cypriote farmer for threshing grain. This is a broad board about six and a half feet long, of which a length of nearly five feet is straight, the remaining portion at the forward end being inclined upward at an angle of 18°-20°. The breadth varies in different dukani from 24 in. to 27 in. The board is made up of two planks joined lengthwise edge to edge. Except for a margin of eight inches at either end the bottom surface is studded with many rows of sharp-edged flints inserted by their bases in long and narrow triangular slots. In one example there were twenty-two rows in one plank and twenty-three in the other. Each row consisted of ten flints in each plank, each row being set alternately to the one in front and the one behind. The total for the two planks was 450 flints. The thickness of the two boards is 2½ inches, but the thickness is cut down slightly from the fore-end and the size of the flints for a short distance anteriorly is smaller. They range from 1¾ in. to 2¼ in. in length and from 1½ in. to 1¾ in. in height. The shape of the flints is roughly triangular with two long knife-edged sides and a thick and massive butt. The projecting edge is arched and one face is always convex, the other keeled. The slots into which the flints are inserted are made by a chisel of peculiar form. When all the flints have been inserted in the slots, hot pitch is poured along the rows just as the ancient Egyptians fastened the flints in their sickles with a plaster setting. The sledges are drawn by two oxen flint side downward over the threshing floor, which is thickly strewn with sheaves. The driver sits on a chair placed midway between the transverse battens. This form of threshing appliance is a survival of the Roman tribulum which persists in Syria, Asia Minor, Georgia, and Greece. In some parts of Spain and the Canary Islands it is in use without the flints as the straw is required whole.

The Physiology of Hibernation.—In a useful summary of results bearing upon the hibernation of animals, P. A. Gorer regards hibernation and æstivation as manifestations of the property of living organisms of withdrawing from an unfavourable environment (*Biol. Rev. and Biol. Proc.*, Cambridge Phil. Soc., vol. 5, p. 213, July 1930). However, since it is impossible to regard any one condition of the environment as being responsible, he turns to the physiological condition for the common factor, and examines the various suggestions which have been made from this point of view. The metabolism of hibernators, which is the lowest metabolism required to maintain the existence of protoplasm, is bound up with a marked decrease in oxygen consumption, but cannot be explained, as has been argued, by the varying solubility of carbon dioxide at different temperatures. In the metabolic changes the nervous system is involved, and a résumé of results shows that it is of primitive structure and remarkable adaptivity in hibernating mammals, in which decerebration causes comparatively slight effects on the heat-regulative and postural reactions. Apart from the nervous system, the endocrine system, and particularly the pituitary, must be looked upon as the governor of metabolism amongst the higher animals, and a general truth appears to be that hibernation is associated with a change in the water content. The conclusion of hibernation, like its onset, varies from animal to animal, even amongst related species, and is associated with accumulation of waste products and sometimes with changes in moisture, the energy required being obtained perhaps by shivering, perhaps from the activity of the liver.

Type Specimens of Myctophine Fishes.—Mr. Albert Eide Parr, in his paper "Notes on the Species of Myctophine Fishes represented by Type Specimens in the United States National Museum" (*Proc. U.S. National Museum*, vol. 76, Art. 10, No. 2807, 1929), gives a detailed account of the fishes belonging to the sub-family Myctophinæ which are deposited in the United States National Museum. The result of this investigation is a thorough revision and partial or complete redescriptions, with diagrammatic figures, of a large number of fishes belonging to this group. The whole is based on Lütken's and Brauer's system of classification by the photophores which has recently been used by Tåning (1918, 1928) in his "Mediterranean Scopelidæ" and "Synopsis of the Scopelids of the North Atlantic". The work of Tåning and that of the present author fit in well together, dealing as they do with fishes chiefly from very different areas. Mr. Parr is of the opinion, however, that the subdivision of the *rafinesquei*-like forms of the genus *Diaphus* into entirely separate species according to the definitions rendered by Tåning is absolutely impracticable, although it may be of great value for differentiating ecological races or local subspecific forms within restricted oceanographical areas.

Nematode Parasite of the Frit-Fly.—In the *Philosophical Transactions of the Royal Society*, B436 (June 28, 1930), Dr. T. Goodey describes a new genus and species of Nematoda, namely, *Tylenchinema oscinellinae* from the frit-fly (*Oscinella frit*) of oats. It appears that ensheathed larvæ and the young adults of this worm occur in oat stems. The male worms ultimately die after impregnating the females, while the latter enter the frit-fly larvæ, most probably by boring their way through the skin. They remain in this host during the time the latter completes its metamorphosis, and are afterwards to be found in the body-cavity of the newly emerged flies. The female worms grow within their host into comparatively large sausage-shaped organisms: their gonads occupy most of the body space and reproduction is viviparous. Large numbers of motile larvæ of both sexes are discharged into the hæmocœl of the fly, and these creatures bore their way into the gut of that insect, finally reaching the exterior via the anus. The presence of the *Tylenchinema* within the fly inhibits the normal growth of the gonads to a very marked degree and the sex cells, both male and female, fail to develop. In the few cases that were observed in which the gonads of the host were normal, the parasite proved to have been degenerate. The parasitisation does not directly entail the death of the host, and infected individuals fly about and visit their host plants (oats and grasses). It is during this period that the Nematode larvæ become deposited on the plants. They make their way into the stems where the frit-fly larvae are feeding, and here they undergo moulting, and become young adult males and females. The latter, after impregnation, enter the frit-fly larvæ, and so the cycle is carried on. This interesting Nematode has been found by Dr. Goodey to have a wide distribution in England and Wales. Frit-flies of the stem generation were found to be parasitised to about 14 per cent and those of the panicle generation about 5 per cent. This Nematode, therefore, is to be regarded as an organism the relation of which to agriculture is of a beneficial character.

Bryozoan Fauna of the Galapagos Islands.—Dr. Ferdinand Canu and Dr. Ray S. Bassler have described a particularly interesting collection from the dredgings of the United States Fish Commission steamer *Albatross*, preserved in the United States National Museum, from a few stations in the vicinity of the Galapagos Islands (No. 2810, *Proceedings of the United States National Museum*, vol. 76, Art. 13, 1930). Amongst the many species described ten are common to the Gulf of Mexico and to the Galapagos, indicating an ancient communication between the Pacific and Atlantic and the recent formation of the Isthmus of Panama. There are not many of these forms common to the two regions. In the Galapagos the great southern current has modified considerably the nature of the plankton and all the marine fauna. Simple forms, such, for example, as *Aplousina filum*, which are indifferent to the thermic influences, have alone been able to persist. Sometimes species so far only found fossil in the Gulf of Mexico are found living in the Galapagos Islands. Of fifty-three species determined and studied, twenty-nine are new, and four new genera belonging to the Cheilostomata are here created, three of which are peculiar to the region. So far no species occurring in South America have been recognised in the Galapagos Islands.

Recent English Earth-movement.—The widely adopted conclusion that the British Isles have undergone no change in level since Roman times has been frequently confronted by the claim for recent subsidences along the coast. The existence of Roman sites and pottery below sea-level is not conclusive of a general movement, since the land surface may be lowered by the shrinkage of water-logged ground after drainage. Mr. C. J. Gilbert has summarised in a short paper—"Land oscillations during the closing stages of the Neolithic depression" (Second Report of the Commission on Pliocene and Pleistocene Terraces, Union Géographique Internationale, Florence, 1930, pp. 93-101)—evidence of changes of level of Romney Marsh, the Thames Estuary, and the Arun Valley in Sussex, indicative of a marked post-Roman subsidence. The Roman settlements are now 8-9 ft. below ordinary high tide level at Westminster, 16½ ft. at the Albert Dock, 17 ft. at Crossness, and 14-15 ft. at Tilbury. Mr. Gilbert concludes that at Romney Marsh there have been three well-marked subsidences. The first was part of the widespread and well established Neolithic depression; it was during the Neolithic, as it was followed by an uplift that produced surfaces occupied by Neolithic man. The second subsidence was post-Neolithic and pre-Roman. The third was from the eleventh to the thirteenth centuries A.D. and led to the final submergence of the Goodwin Sands, the devastation of the south-western part of Romney Marsh, and the destruction of Broomhill and of the older outlet of the Rother. Mr. Gilbert claims the agreement of these movements with those on the coast of Flanders and those recently adduced by Mr. R. D. Oldham from the Rhone delta. Nevertheless, despite the wide range of these changes, he regards them as local and as due to oscillations of the land. If they were due to changes in ocean level parallel phenomena would be widespread around the British shores and on the Continent; such he concludes "manifestly do not exist". The earth movements of Scandinavia, he states, have been fundamentally divergent from those of Britain.

Peat Profiles in North America.—An investigation of thirty-four peat bogs in the region from Niagara to Nova Scotia has been made by V. Auer, and his results appear in *Mem.* 162 of the Geological Survey of Canada, 1930. The materials described include inorganic, organic, limy, and jelly-like oozes and *Carex*, *Amblystegium*, *Sphagnum*, grass, and forest peats. The stratigraphical succession indicates that the lower layers were formed during a warm dry (Boreal) period; this was followed by moister conditions with deciduous trees (Atlantic); then a dry period succeeded (sub-Boreal); and finally a moist and comparatively cool climate is suggested (sub-Atlantic). In a general way, as indicated by the terms in brackets, the changes correspond to those of post-glacial Europe. Peat profile studies in Maine (*Jour. Wash. Acad. Sci.*, April 4, 1930), and in the Puget Sound Basin of Washington (*Ibid.*, June 4, 1930), are recorded by A. P. Dachnowski-Stokes. The South Lubec peat of Maine is a member of the 'highmoors', and is characterised by a three-layered succession derived from marsh, forest, and sphagnum moss plant communities. The marginal soils show that podsolising processes are now active. The Washington peat-lands are of two groups: low moor, with two- or three-layered limnogenic profiles, with a reed and sedge assemblage at the surface; and acid oligotrophic peats with sphagnum moss at the surface.

Geology of Queensland.—Some interesting problems of Queensland geology are discussed by J. H. Reid in "The Queensland Upper Palæozoic Succession" (*Pub.* 278, Queensland Geol. Surv., 1930). It is concluded that between the base of the Devonian and the top of the Permian there is evidence of three effective folding movements with trends nearly parallel to the present coast. The first of these was probably in the Lower Devonian, but determination of the age depends on correlations that have not yet been satisfactorily established. There followed a Middle Carboniferous movement without thrusts, and still later a more intense orogeny of late Permian age which led to thrusting from the oceanic side. This was accompanied or succeeded by intense igneous activity, to which the origin of the metalliferous deposits of the Queensland copper-gold province is reasonably thought to be related. Glacial formations of three distinct, though not well determined, ages are established: Upper Carboniferous, Lower Permian, and Middle Permian. It is important to notice, however, that the deposits are all apparently the result of material transported by floating ice from a land area lying to the south. The suggested periods correspond to those in New South Wales, where terrestrial glacial deposits occur in the 'Permo-Carboniferous'.

Oil-well Deviation.—The subject of oil-well deviation, or 'crooked holes' as it is known in the industry, is one which has come very much into the limelight since the technique of deep drilling attained its present high standard. With a shallow well, deviation from the vertical either mattered little or, if it was a bad case, it could be corrected by various devices known to the driller. But where wells reach to a mile or more in depth, the cumulative error of deviation becomes too great to be ignored; hence the necessity of careful control on drilling wells and of survey of these or existing wells where deviation is thought to be excessive. Actually a straight hole of any depth is almost an impossibility, even with the most modern plant, since the attitude and nature of the rocks penetrated influence the run of the bit; for example, if a hole already 15°-20° from the vertical is suddenly continued in soft shale, dipping 60°-65°, no check being placed on behaviour and tendencies, the probability is that the bit will run down dip, that is, at increased deviation, so that not only is there a serious error in supposed depth of the well from the surface, but also important horizons such as oil sands may be missed

altogether, to say nothing of the consequent straying of subsurface calculations. This subject was dealt with ably at some length by Mr. D. P. Rees at a meeting of the Institution of Petroleum Technologists in May last. Apart from the engineering factors involved, the author showed that the method now generally adopted to counter the effect of deviation of wells in oilfields is to run a survey in those wells which are being drilled, where there is any chance of the deviation being sufficient to upset calculations of oil and water horizons. Although the time taken to survey a well being drilled may interfere somewhat with progress, this is more than made good by the value which increased accuracy of record has in the economic working of the field as a whole.

Variometer for Measuring Vertical Magnetic Force.—The Danish Meteorological Institute has recently issued a further part (Nos. 8, 9) of its *Communications Magnétiques*; No. 8 consists of an extremely able article by the Director, Dr. la Cour, on a new form of variometer for the vertical magnetic force. He has called this the 'Godhavn' balance, in celebration of the institution, by Denmark in 1928, of the observatory at that station in Greenland (69·2° N., 53·2° W.). The principal features of the new instrument are: (1) the magnet, mirror, and knife edges consist of a single piece of tungsten steel, the length of the magnet being about 6 cm. and the total weight about 2·5 grams; (2) the magnet is placed in a sealed vessel in dry clean air at a low pressure (about 100 mm. of mercury), thus preserving it from any influence of moisture or dust; (3) the influence of temperature changes on the magnet is compensated optically, by a prism supported by a bimetallic suspension and placed outside the vessel containing the magnet, thus enabling the prism to be adjusted without affecting the magnet; (4) the price of the instrument is relatively low, being about £25 without the compensator, or £33 with it. The detailed account of the instrument is full of examples of careful thought and ingenuity in its design and use.

Gyromagnetic Effect for a Paramagnetic Substance.—When a body is magnetised, electron theory requires that it should simultaneously acquire a mechanical spin, small even for ferromagnetic substances, about the magnetic axis. The extremely difficult experimental determination of the spin generated in a specimen of the paramagnetic substance dysprosium oxide by this effect is described by W. Sucksmith in the July issue of the *Proceedings of the Royal Society*. The methods used for iron and nickel were too crude to be applied directly in this case, and it was found necessary to set up a resonant torsional vibration of the specimen by applying an alternating magnetic field of the same period, and to take great precautions both to avoid ferromagnetic impurity and to obviate electrostatic and other disturbances. Even then, with a logarithmic decrement of about 10^{-3}, and magnetic fields of some hundred gauss, the amplitude of vibration was only about ten minutes of arc. The result obtained is that the Landé splitting factor (g) of spectroscopic theory is $1·28 \pm 0·07$ for the ion Dy^{+++} in dysprosium oxide, in excellent agreement with the value 4/3 which corresponds to the state ${}^6H_{15/2}$ predicted by Hund to be the most probable for this ion.

Soft X-Rays and Electrons in Crystals.—When soft X-rays are excited by bombarding solids with electrons or when the secondary electrons emitted from the surface are examined, evidence is obtained that a complex system of energy levels exists which cannot be correlated with the Bohr systems for the atoms of the solid. The experiments are difficult, and the results obtained by different investigators not very consistent, but it is pointed out by Prof. O. W. Richardson, in a paper in the July issue of the *Proceedings of the Royal Society* (p. 63), that if it is assumed that there is present in a crystal a class of structure electrons which are neither free nor associated with individual atoms, frequencies of the observed order of magnitude can result. Pursuing the analogy that a crystal is like a large molecule, Prof. Richardson remarks that the structure electron levels should be built up in a very similar way to that of the levels to which the source of a system of vibration bands in molecular spectra is attributed, and shows that there is in certain cases a relation between the magnitudes of the energy levels observed, and the integral numbers. The quantum mechanics of electrons in crystals has also been developed recently by P. M. Morse (*Physical Review*, June 1, p. 1310), but although it accounts well for many details of the experiments of Davisson and Germer, it has still to be considered in relation to soft X-ray phenomena.

Design of Radio Receivers.—An excellent report containing a review of recent literature on the design of radio receivers has just been published by His Majesty's Stationery Office (price 5*s*. net). It has been prepared at the National Physical Laboratory for the Radio Research Board. It gives a clear indication of the lines along which future research may be profitably undertaken. It will be of special use to workers who are studying the properties of radio receivers. All the abstracts of papers given are critically examined, and so workers will be able to tell whether it will be useful for them to make more detailed examination of the papers or not. The bibliography is practically complete from 1916 to 1929. Only those parts of the early literature of the subject prior to 1916 are included which are of outstanding importance. Periodic phenomena do not completely represent the operation of a receiver which is constantly being acted on by complex waves of non-periodic form. We know, however, that from a practical point of view, a knowledge of the steady state phenomena suffices for practical purposes in a great many cases. Unfortunately, the design of short wave amplifiers is as yet almost entirely empirical. The behaviour of a three-terminal thermionic tube at very high frequencies gives rise to phenomena which have not been satisfactorily explained. All the work on audio frequency amplifier design has been directed towards obtaining a linear frequency characteristic. Recent improvements of loud speakers are in the direction of obtaining a uniform frequency response and this is the ideal solution. The operation of the loud speaker might also be corrected by using suitable electrical filter circuits, but this would only be a partial solution. If we design the amplifier to correct the defects of the loud speaker, then the two would form an inseparable combination and so this solution would not be advisable.

Estimation of Water in Methyl Alcohol.—A method for the detection and estimation of small quantities of water in methyl alcohol is described in the June number of the *Journal of the Chemical Society* by D. C. Jones and S. Amstell. It depends on the fact that the critical solution temperature in the system methyl alcohol–*cyclo*-hexane is very sensitive indeed to the presence of water in the alcohol. *Cyclo*-hexane is readily obtained, can be purified easily, and has in its melting point a very sensitive criterion of its own purity. A quantity of 0·01 per cent of water in the alcohol produces a rise in miscibility temperature of 0·15°.

The Topographical Changes Accompanying Earthquakes and Volcanic Eruptions.*

THE twenty-sixth, and nominally the last, part of the *Publications* of the Earthquake Investigation Committee appeared in 1908. Though we have had to wait more than twenty years for the number that should have preceded it, it may be said at once that geologists have gained greatly by the delay, for Prof. Imamura, the well-known secretary of the Committee, has been able to avail himself of many valuable recent observations, and especially of those of the Kwanto earthquake of 1923 and the Tango earthquake of 1927, and the eruptions of the Usu-san in 1910 and the Sakura-jima in 1914. It is not too much to say that his memoir is likely to prove one of the classics of seismology. In these pages Prof. Imamura has described the changes that have occurred about the times of so many as 26 Japanese earthquakes, in 12 of which (from 1891 to 1927) the changes have been measured by one or more series of subsequent precise levellings. As might be expected in a young country like Japan, the changes are of two kinds, which he terms chronic and acute. The latter, of course, are associated with earthquakes. The chronic changes may prepare the way for the acute earthquake changes, but an example of remarkable interest, investigated by the late Prof. Yamasaki, is given in which chronic changes occur apparently alone.

The district in question lies along the coast of the Japan Sea in the provinces of Etigo and Sinano, and extends about fifty miles to the east of the lofty Hido range. It consists of two large blocks separated by a deep depression. The series of precise levellings were carried out first in 1894, and they have been repeated in 1927. During this interval, in 1897 and 1918, there were two strong shocks, but with neither was there any formation of new clefts or fault-lines. Yet a comparison of the two surveys has revealed the facts that, with a few trifling exceptions, both blocks have subsided, and that in each the amount of subsidence decreases gradually from west to east. In the western block, it is 94 mm. at the west end and 38 mm. at the east end, where, along an old fault, it suddenly increases to 113 mm. In the eastern block, the subsidence is 96 mm. at the west end, while at the east end there is a rise of 4 mm., succeeded, again along an old fault, by a sudden depression of 70 mm.

In the present notice, it is only possible to refer briefly to some of the interesting conclusions at which Prof. Imamura arrives. While most of the earthquakes with which topographical changes were associated were of destructive strength, a few (such as the Susaka earthquake of 1897 and the Oomati earthquake of 1918) resulted in no loss of life. As a rule, elevations of the land are confined to formations of Tertiary or more recent age, depressions to formations of pre-Tertiary age. The changes considered consist, for the most part, of discontinuous tiltings of consecutive mosiac blocks, but, in some earthquakes, as in the Kwanto earthquake of 1923, there is also a rotational movement about a vertical axis or bodily displacement in a vertical direction. Discontinuous tiltings of contiguous blocks result in the formation of faults or flexures along their boundaries. In local earthquakes, such a fault-system is simple, but, in great earthquakes, it may be extremely complex. Sometimes, as in the Mino-Owari earthquake of 1891, it consists of several segments arranged *en échelon*, in the earthquake mentioned crossing the whole of the Main Island. In others, as in the Kwanto earthquake of 1923 and the Tango earthquake of 1927, it is distributed over the epicentral area along pre-existing tectonic lines.

In the Kwanto district, there have been four great earthquakes during the last two thousand years, shortly after the beginning of the Christian era, and in 818, 1703, and 1923. Prof. Imamura summarises the changes at the last epoch and probably at each of the other epochs, as consisting of the following stages: (1) a practical absence of any tilting for a century or so; (2) slight chronic tilting for a few decades in the direction opposite to that in which it afterwards occurs, accompanied by many local earthquakes; (3) slight reversed tilting, with more frequent and stronger local earthquakes; (4) pronounced acute tilting accompanying a disastrous earthquake; and (5) a repetition to and fro of the tiltings, which gradually diminish in magnitude until they cease.

The changes that precede, accompany, and follow volcanic eruptions have been measured in only two eruptions. The earlier changes are similar to those that occur before earthquakes. In the immediate neighbourhood of the volcanoes, they consist apparently of an upward bulge of the land, but essentially they are discontinuous tiltings of mosaic blocks as in great earthquakes. The principal difference lies in the leisurely way in which the volcanic changes take place as compared with the quick and sudden changes that occur with earthquakes. C. DAVISON.

* *Earthq. Inves. Com. Publ. in For. Langs.*, No. 25, pp. 1-143, 1930.

Estimating Stream Flow from Evaporation.

MR. FOLSE'S monograph referred to below* embodies the data and results of a research begun in 1912 and continued until 1925 by the late Dr. John F. Hayford and completed by the author. To a certain extent, as stated by the author, it overlaps *Publication* No. 317 by Dr. Hayford.

The object of the investigation was to formulate laws governing the flow of streams and rivers on the basis of more specific laws of evaporation. The numerous intensive studies of evaporation pans of small area have been supplemented by an examination on the full scale of Nature and under natural conditions. For this purpose, each of the Great Lakes was considered as an evaporation pan and from day to day evaluations were made of the change of content, the income and outgo including evaporation. From these observations it was found possible to segregate that part of the outgo which is evaporation, and to determine the laws of evaporation, and their application to the problem of stream flow.

The observations consisted of the daily mean elevations of the water surfaces, barometric pressures, wind velocities, temperatures, vapour pressures, and rainfalls.

The outcome of the investigation claimed by the author is briefly as follows:

(1) An evaporation formula has been derived which enables one to estimate the daily evaporation from any free, open surface of water in terms of air temperature, vapour pressure, and wind velocity.

(2) An estimate has been made of the constant part of the run-off into each of the Lakes Michigan, Huron, and Superior, from their respective drainage areas, and

* A new Method of estimating Stream Flow: based upon a new Evaporation Formula. By J. A. Folse. (Publication No. 400.) Pp. xi+237+22 plates. (Washington, D.C.: Carnegie Institution, 1929.) 5 dollars.

certain knowledge with reference to the variable parts of the run-off in each case has been obtained.

(3) A reasonably accurate numerical expression has been obtained from the effects of barometric pressures on the elevation of the water surface at the Marquette Station on Lake Superior, and constants enabling one to compute the hourly or daily effect of a wind of any velocity and direction upon the water-surface at the same station.

(4) The knowledge gained in (1) and (2) has been applied to the estimation of evaporation losses from land surfaces, and the combined effects upon stream flow.

Space does not permit any detailed description of the investigation or of the evaporation formula. They have, however, involved an immense amount of work and many thousands of calculations.

In applying his conclusions to stream flow in the second part of the treatise, the author assumes that the evaporation from a land surface follows the same laws as, and bears a constant ratio to, the evaporation from a free open water surface in each watershed. In his expression for the 'normal' flow of any stream there appear eleven terms, one of which is termed the 'constant' part of the flow, and the remaining ten terms functions of the rainfall in varying periods extending to 257 days preceding the day of the observation. The coefficients for these terms have been determined and the results tested against actual stream flow records.

The impression gained by a study of this work is that the author has unquestionably advanced the study of the laws of evaporation from water surfaces, but that in its application to stream flow he has devised a process on assumptions which are not fully justified by results. H. L.

The Origin of the Irish Fauna and Flora.

WHILE the flora and fauna of Ireland are essentially those of Great Britain, differing chiefly in the absence of Germanic species, the occurrence of the so-called Lusitanian and American elements has made Ireland an area of special interest to biologists and geologists who have sought to trace the history and origin of its floral and faunal life. The Lusitanian flora, as is well known, has its continental centre in the Iberian Peninsula, while a correspondingly small faunal group, comprising no large animals, has a somewhat similar distribution. In Ireland most of these Lusitanian plants and animals are found in the south and south-west, although some extend northwards. The American element, even smaller than the Lusitanian, is separated from its main area of distribution by the Atlantic Ocean. Reference may be made also to an Arctic-Alpine element which, although better represented in Britain, is fairly widely distributed in Ireland. The absence of certain British species and the presence of Lusitanian, American, and Arctic-Alpine species are some of the outstanding facts which any complete theory of the origin of the Irish fauna and flora must explain.

So long ago as 1846, Edward Forbes, in a paper dealing with the geographical distribution of plants and animals in the British Isles, was among the first to inquire into the geological changes affecting their area, and since then biologists have repeatedly attacked the problem from different angles. In seeking a solution to the problem it has always been recognised that the most important factor was the intervention of the glacial period, but the effects of the changes thus brought about have been very variously estimated. Some have advocated complete extermination of the Irish fauna and flora; others have believed in a considerable survival dating from Miocene times. In these discussions the voice of the geologist has not been sufficiently heard, and biologists will welcome, therefore, the authoritative views recently expressed by Prof. J. Kaye Charlesworth.[1] The author describes the complete burial of Ireland beneath the Pleistocene ice-sheet at the maximum of glaciation as an indisputable fact, and the possibility of survival during glacial times of even the smallest part of the Irish fauna and flora as we know it to-day must be definitely excluded from our calculations.

Survival in some unknown southern or western asylum beyond the limits of the ice has been, however, frequently postulated and commonly accepted among biologists. This question is largely a geological one, and Prof. Charlesworth enters into it fully, examining critically the evidence regarding changes of sea-level during the Pleistocene, and the climatic conditions of the ice-free strip, if any such existed. The problem of the glacial sea-level is complicated, but obviously of fundamental importance. When glacial conditions set in, Ireland was an island with a coast line very similar in position and level to that of the present time. During glacial times the sea-level did not remain constant, otherwise all possibility of survival could be "most categorically denied". From all the available evidence, too detailed to summarise, the conclusion is reached that during the glacial period the sea-level around the Irish coasts was lowered by about 50 fathoms. To the south of Ireland this line encloses an extensive area which might provide a place of refuge, but taking the most favourable view for survival, Prof. Charlesworth thinks that probably only arctic and boreal species persisted on the southern ice-free strip. To the west there was no ice-free area.

Immigration of the present Irish flora and fauna took place, therefore, subsequent to maximum glaciation. The view is held that a considerable fauna and flora, including Lusitanian species, reached Ireland during the "Aurignacean Oscillation" when the ice-sheet withdrew from the southern half of the island. Prof. Charlesworth leaves to biologists to decide what species may have survived the ensuing Early Magdalenian Glaciation when the ice readvanced to the line of the 'South Irish End-moraine' running from Wexford to the mouth of the Shannon. For immigration into Ireland a post-glacial land connexion with Great Britain existed, but the connexion was never complete. The 'bridge' between Ireland and the Scottish mainland was severed by the Sound of Jura, while the more southerly 'bridge' between Ireland and Wales was broken by a narrow strait or wide river west of Anglesey. Over this broken drift plain the greater part of the Irish fauna and flora seems to have entered, and clearly some accidental dispersal would be necessary to effect the crossings. The later submergence during the "Atlantic Period" prevented further immigration, and those forms which continued to extend their range westwards in Britain after that date could enter Ireland, if they did so at all, only by chance dispersal.

Prof. Charlesworth's exposition of the geological factors which must be taken into account is of the greatest importance to biologists and provides a much safer starting-ground than any hitherto available for tracing the history of Irish plant and animal life.

J. R. MATTHEWS.

[1] "Some Geological Observations on the Origin of the Irish Fauna and Flora." By Prof. J. Kaye Charlesworth. *Proc. Roy. Irish Acad.*, 39B, pp. 358-390; 1930.

University and Educational Intelligence.

THE emphasis laid by American educationists to-day on the importance of relating institutions, whether university, college, or school, as closely as possible to the actual daily life of the people, may be seen in the rapid increase (to which attention is directed in *Education Bulletin*, 1929, No. 30) in the number of schools adopting the form of organisation known as the 'general shop' for providing in the school curriculum instruction in a number of different manual activities for pupils of twelve to fifteen years of age. The bulletin points out that modern life has become so complex and production so highly specialised that the consumer has, apart from some such school instruction, little opportunity to learn much about trade operations, materials, or manufacturing processes. The 'general shop' training is not for actual skill in the trades represented, but rather for an understanding and appreciation of values in the final product, and incidentally for the acquisition of a certain amount of unspecialised 'handyman's' dexterity.

NATAL University College celebrates this year the twenty-first anniversary of its foundation. In a handsome commemoration number of the College magazine appears an interesting retrospect by Prof. J. W. Bews, chairman of the College Senate and Dean of the Faculty of Science of the University of South Africa, whose connexion with the College has been continuous since 1910, except for a break of two years, 1925–27, when he held the chair of botany in the University of Durham. The progress of the College since the War has been rapid, the number of students (420 in 1930) having been multiplied nearly tenfold. It was established in Maritzburg, the old capital of Natal, but its work was in 1922 extended to Durban in co-operation with the staff of the Natal Technical College. Durban as a commercial city and seaport has developed at such a pace that it has far outgrown Maritzburg in importance, and seems destined to have a great future in which the College will take a prominent part.

THE Department of Agriculture for Scotland has approved the following appointments at the Hannah Dairy Research Institute, Ayr: *Director*, Dr. Norman C. Wright; *Secretary*, Mr. T. W. Gibson; *Research Assistant in Physiology*, Mr. S. Morris. Dr. N. C. Wright was educated at Christ Church, Oxford, and at Gonville and Caius College, Cambridge. He received the degree of Ph.D. at Cambridge for work on the calcium metabolism of dairy cows. In 1924 Dr. Wright joined the staff of the National Institute for Research in Dairying at Reading, and in 1926 he was awarded a Commonwealth Fund Fellowship, working for two years in the United States, first in the Department of Dairy Industry at Cornell University, and later in the Bureau of Dairying of the United States Department of Agriculture. He was the first member of the staff of the Hannah Institute and has been largely responsible for the general development of the work of the Institute. His research work has been largely in the field of applied physiology. With Mr. W. L. Little he demonstrated for the first time the reduction in the lime content of the blood in cases of milk fever, an observation which forms the basis of the new calcium treatment of this disease. He has also published papers on the physiology of milk secretion, the significance of 'bulk' in the rations of dairy cows, and the occurrence of tuberculosis in cattle. Dr. Wright succeeds Prof. E. P. Cathcart, who will retain his active connexion with the Institute in the position of vice-chairman of the Committee.

Historic Natural Events.

Aug. 24, 358. Great Storm in Black Sea.—A violent storm, accompanied by a great inundation of the sea, occurred in the Black Sea; at noon the sky was quite dark. Macedonia and Asia Minor suffered severely. The storm was followed by a great earthquake.

Aug. 24-26, 1905. Rainstorm in Eastern Ireland.—Rain began to fall shortly after 9 P.M. on Aug. 24 in Dublin, and continued steadily for 34 hours, during which period about 4 inches of rain fell generally, the amount increasing to 5·50 inches on high ground at Bray. Floods caused a great deal of damage to roads and bridges, while part of Bray was submerged to a depth of 4 feet, and the electric light generators were put out of action.

Aug. 25, 1839. Red Snow.—Although the occurrence of patches of red colour in old snow had been known for long, one of the earliest detailed determinations of the true nature of the colouring matter was that made by R. J. Shuttleworth in 1839 (*Edinburgh New Philosophical Journal*, 1840, p. 54). He examined microscopically melted red snow from the neighbourhood of the Hospice du Grimsel, and found that the red colour was due to a number of minute organisms, both Flagellata and Algæ. The snow was described as having a rosy hue, like very pale blood; being old, it was granular, and the colouring matter was contained in the intervals between the particles, giving the surface a veined appearance. The colour extended to a depth of several inches or a foot.

Aug. 25, 1890. Thunderstorm in Eastern Alps.—At about 4 P.M. a thunderstorm occurred at Pesaro in north-eastern Italy, travelling very rapidly north-eastwards across the Adriatic and eastern Austria so far as Vienna. The rainfall was not especially heavy, the largest total being only 3·5 in., partly in the form of hail, but the storm was notable for the sharp rise of pressure, at Pesaro more than 5 mb., which accompanied the onset of the storm, and the violent winds. At Pesaro the wind velocity reached 80 miles per hour, and at Pola 62 miles per hour. Much damage was done, trees uprooted and houses unroofed; many ships were wrecked. The violent winds blew from the south-west, parallel with the track of the storm and at about the same speed.

Aug. 25, 1925. Lightning at San Joaquim Valley, California.—On Aug. 25, 1925, a lightning storm broke over the valley. A flash of lightning struck a 750,000-barrel oil reservoir of the Shell Company at Coalinga and caused an immense fire. The heat developed by the fire was sufficient to raise 1000 cubic kilometres of air through 10° C. Owing to this intense heat, whirlwinds were formed over the fire, and D. Brunt found that the energy supplied by the fire was ample to account for the formation of violent tornadoes. This lightning stroke cost the fire insurance companies more than one million dollars.

Aug. 26, 1346. Crécy Storm.—It is related that just before the battle of Crécy a shower broke over the French and English armies, and largely disabled the Genoese crossbowmen with the former by wetting their strings. The English archers, keeping their bows in cases, were not affected, and it has been said that this incident influenced the course of the battle.

Aug. 26-28, 1883. Great Eruption of Krakatoa.—The great eruption of Krakatoa, in the Sunda Strait, attained its maximum phase during these days. In a series of great outbursts, two-thirds of the island disappeared. The sounds of the explosions were heard at Diego Garcia (2375 miles) and Rodriguez (3080 miles). Waves of longer period cracked walls at

Batavia (100 miles), and others, registered by barographs, travelled at least three times round the earth. Sea-waves, causing the loss of 36,500 lives in Java and Sumatra, were registered by tide-gauges in French and English ports. The dust drifting in the upper atmosphere gave rise for months afterwards to sunset glows of great brilliancy.

Aug. 26, 1912. The Norwich Floods.—Heavy rain began to fall in East Anglia in the early morning of Aug. 26 and continued until the morning of Aug. 27. The total period was not much longer than twenty-four hours, but in Norwich and neighbouring parts the fall exceeded 7 in. and reached 8·09 in. at Brundall and 8·25 in. at Sprowston. The fall of 7·31 in. entered to Aug. 26 is the heaviest known in a day in the east of England. The area with more than 5 in. was estimated as 1039 square miles, and in an area of 1939 square miles the volume of rain exceeded 150,000 million gallons. Serious floods occurred in several of the eastern counties, and particularly in Norwich, where the water level in the flooded part of the city reached a higher level than on any previous occasion. Many bridges were destroyed, and road and rail traffic was dislocated over a wide area.

Aug. 28, 1722. Hurricane in Jamaica.—This was the greatest hurricane on record in Jamaica, and devastated the whole island. It began at Port Royal at 8 A.M. and lasted fourteen hours, during which time the rain was incessant and the storm veered all around the compass. In Kingston most of the buildings were thrown down or much shattered, including the church. The fort suffered very much, and some of the guns were washed into the sea. Out of fifty vessels in port only four men-of-war and two traders were saved, and about 400 lives were lost. After the hurricane there was a calm and the air was so poisoned by the smell of decaying bodies that an epidemic broke out.

Aug. 29, 1776. Fog at Long Island.—After the defeat of Washington's army by the British in the battle of Long Island, the Americans were apparently caught in a trap, for their retreat was cut off by a British fleet in East River. That night, however, a dense fog blinded the British look-outs, and the American army was able to escape across the river to New York.

Aug. 29, 1885. Sirocco at Palermo.—An intense sirocco began at Palermo at 1 A.M. with a strong hot wind. At 9 A.M. the temperature had risen to 104° F., and at 1 P.M. the thermometer in the shade stood at 121° F., by far the highest ever recorded in the town. The distribution was, however, very irregular, differing by 20° in different parts. The air was very dry, the relative humidity being only 10 per cent.

Societies and Academies.

EDINBURGH.

Royal Society, July 7.—**A. J. Clark, C. P. Stewart, and R. Gaddie**: The metabolism of the heart. The frog's isolated heart, perfused with Ringer, maintained a regular contraction for 48 hours, and more than 90 per cent of the energy was derived from a non-carbohydrate source. The sugar consumption of the heart could not be increased materially by addition of glucose, serum, and insulin to the perfusion fluid. There was a small but steady excretion of nitrogen from the heart, and the oxidation of the protein equivalent of this nitrogen would have corresponded to about half the oxygen consumption of the heart. The respiratory quotient of hearts perfused with Ringer's fluid lay between 0·80 and 0·85, and did not rise above 0·90 when insulin and sugar were added. The results suggested that the isolated frog's heart used proteins as its chief source of energy.—**E. T. Copson**: The definite integrals of interpolation theory. The cardinal function of interpolation theory, introduced by Prof. Whittaker, has been represented by definite integrals in two distinct ways, the first due to W. L. Ferrar, the second to Ogria and J. M. Whittaker. In this note the relation between these representations is discussed.—**J. Geronimus**: On some persymmetric determinants.

PARIS.

Academy of Sciences, June 30.—**Bigourdan**: The observatory of Méchain, in the rue Vieille-du-Temple.—**A. d'Arsonval**: An X-ray tube of the Coolidge type working at 400,000 volts.—**G. Cerf**: A class of Bäcklund transformations leading to partial differential equations of the second order with double characteristics.—**Mme. N. Samoïlowa-Jachontowa**: The calculations of planetary perturbations by means of a new independent variable.—**Raoul Gautier**: Concerning Tempel's first periodic comet, 1867 II.—**H. Muraour and G. Aunis**: The comparison of calculated explosion pressures with experimental explosion pressures. In a previous paper the authors have shown that there is good agreement between the experimental explosion pressures, corrected for cooling by the walls, and the pressures, starting with the Nernst-Wohl specific heats. This work has now been supplemented, working with a powder giving a very high explosion temperature (3600° C.). Bearing in mind that a large extrapolation was necessary for the specific heats, and that the calculation of the amount of dissociation was somewhat uncertain, the differences between the calculated and observed pressures, −0·6 per cent to +3·4 per cent, are satisfactory.—**Horia Hulubei**: A photo-electric cell for the ultra-violet. Method of sensitising. Palladium was chosen for the metal, sensitised by active hydrogen. With an accelerating potential of 120-480 volts, the threshold was about 2850 A.—**Henri Marcelet and Henri Debono**: Spectrographic analysis of the various types of fluorescence of olive oil, observed in ultra-violet light.—**Marcel Guillot**: The relation of several reactions carrying down polonium with the existence, in the form of colloidal precipitates removable by the centrifuge, of insoluble derivatives of this radio-element. In all cases, where more than 97 per cent of the polonium can be carried down by a foreign precipitate, it is possible by centrifugation, without the addition of a foreign element, to prove the precipitation of an insoluble compound of the radio-element.—**A. Sanfourche and L. Rondier**: The irreversible reduction of the oxides of nitrogen by sulphurous acid.—**A. Astruc and M. Mousseron**: The microanalysis of the calcium ion. The method is based on the precipitation of the calcium as the double nitrite $CaK_2 . Ni(NO_2)_6$, washing with aqueous acetone (20 per cent) and alcohol-ether, and reduction of the nitrate to ammonia. The method gives good results for amounts of 0·3-1·0 mgm. of calcium.—**P. Brenans and K. Yeu**: Bromo-diiodophenols, symmetrical trihalogen compounds.—**G. Darzens**: Styryallyl-allylacetic acid and its conversion into a tetrahydronaphthalene derivative.—**Wyart**: The study of heulandite by means of the X-rays.—**Pierre Bonnet**: The thrust in the south trans-Caucasian geosyncline.—**Marcel Roubault**: The glacial formations of the Néoubielhe massif (Hautes-Pyrénees).—**P. Russo**: The dipping of the Middle Atlas under the plain of Moulouya (North Morocco).—**H. Derville**: Lunel marble: its varieties.—**C. Dauzère**

and J. Bouget: The influence of the geological constitution of the soil on the points where hail falls. In a hailstorm near Bagnères, the heaviest fall of hail was on siliceous schists and metamorphic rocks: limestones are protective against hail. These results confirm the views previously published by the author on the influence of the constitution of the soil on the distribution of hail.—Pierre Dangeard: Observations on the living protoplasm of Algæ.

CRACOW.

Polish Academy of Science and Letters, May 5.—T. Wazewski: Asymptotic Jacobians and the change of the variables in multiple integrals.—S. K. Zaremba: Remark on the singularities of systems of differential equations not solved with respect to the differentials.—J. Pagaczewski: The provisional elements of the variable stars Algolides, 40, 1929 Eridani and 43, 1929 Orionis.—Wl. Gorczyński: The degrees of transparency of the atmosphere for solar radiation on several oceans and some other regions.—W. Swietoslawski and S. Bakowski: Some experiments on the velocity of evaporation of liquids on a surface of heated platinum.—Mme. H. Blaszkowska-Zakrzewska: The velocity of evaporation of liquids on heated metallic surfaces.—K. Dziewoński and A. Obtulowicz: The benzoyl derivatives of fluorene.—M. Ramult: The Cladoceran fauna of Pomeréllie.—M. Ramult: A case of gynandromorphism in the species *Alona affinis*.—Wl. Szymonowicz: The innervation of the tactile hairs of the seal.—B. Petschenko: The grafting of Jensen's rat sarcoma on the mouse.

GENEVA.

Society of Physics and Natural History, May 22.—Th. Tommasina: The experimental proof of the existence of the ether given by that of the ultra-red dynamical rays. The author recalls the phenomena observed on a radiometer with triple glass walls; he attributes the motion to the action of ultra-red rays which he calls dynamic, and considers that his experiments prove the existence of the ether. The latter is the agent conveying the energy which, in contact with matter, can take any of the forms known in physics.—R. Galopin: Some new minerals in the scoria of blast furnaces. One of the minerals studied, from its optical properties, belongs to the peridote group; the other suggesting the mixtures in variable proportion of gehlenite and akermanite studied by Fergusson and Buddington.

June 5.—L. Duparc: The molybdenite deposit of Azegour (Morocco). The molybdenite is contained in grenatites, a product of contact metamorphism of a granite. From the research work on this deposit, it would appear that there are important quantities of this mineral, in proportions reaching more than 3 per cent.—E. Briner and J. Deshusses: Researches on the formation and decomposition of cyanogen. Study of the chemical action of electric discharges. Submitting the carbon-nitrogen system to heat and to electric discharges of various kinds, the authors have been unable to prove the production of cyanogen. The velocity of decomposition of cyanogen at various temperatures has been measured; it is insufficient to lead to the complete destruction of any cyanogen which might have been formed. The absence of the formation of this substance can be explained by the peculiarities of the chemical action of electric discharges.—N. Danoz: The calculation of the Newtonian potential of a certain heterogeneous sphere. The author establishes a formula giving the value of the potential at a point inside the sphere.

SYDNEY.

Royal Society of New South Wales, June 4.—F. W. Booker: A review of some of the Permo-Carboniferous Productidæ of New South Wales, with a tentative reclassification. The several forms comprised in *Productus Brachythaerus*, G. B. Sowerby, 1844, were reviewed in the light of recent researches. They belong to a distinct genus *Terrakea* containing at least four species.—H. G. Raggatt and H. F. Whitworth: The intrusive igneous rocks of the Muswellbrook-Singleton District. (1) Introduction. Three groups of intrusive igneous rocks are recognised as follows: (1) Alkaline basic sills; (2) plugs; (3) dykes and small sills. The alkaline sills include the Savoy, Plashett, Carrington, and Fordwich intrusions, each containing acid and basic phases and presenting an interesting study in magmatic differentiation. The plugs consist of basaltic types of rock poor in felspar and rich in ferro magnesian minerals. Many contain nepheline. The dykes and small sills are numerous. The former include porphyritic and non-porphyritic types of rocks. The sill rocks resemble very closely the latter type. The age of the first two groups is almost certainly Tertiary; the third group requires further study before the age can be stated. Apart from their scientific interest, a study of the intrusive igneous rocks has considerable economic interest in relation to coal reserves, and the possible occurrence of oil and gas.—A. R. Penfold: The essential oils of *Zieria Smithii* (Andrews) and its various forms. This Rutaceous shrub grows in moist situations throughout New South Wales, Victoria, and Queensland. The chemical composition varied according to the locality from which plant material was obtained. Yield of oil from Queensland material is about 0·5 per cent on fresh material or 0·9 per cent on air-dried leaves. The principal constituents are safrol with a little methyl eugenol (70-80 per cent), together with d-a-pinene, sesquiterpenes, etc. Material from Narrabeen, New South Wales, contains 95 per cent methyl eugenol, and the phenol esters from Toronto material are a mixture of elimicin and safrol.

Official Publications Received.

BRITISH.

Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society. Edited by H. Munro Fox. Vol. 5, No. 3, July. Pp. 177-271. (Cambridge: At the University Press.) 12s. 6d. net.

Department of Scientific and Industrial Research. Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for the Year 1929. Part 1, with Report of the Geological Survey Board and Report of the Director. Pp. iv+199. (London: H.M. Stationery Office.) 2s. net.

City of Leicester Museum and Art Gallery. Twenty-sixth Report to the City Council, 1st April 1929 to 31st March 1930. Pp. 24. (Leicester.)

Journal of the Chemical Society. July. Pp. iv+1513-1711. (London.)

FOREIGN.

Proceedings of the California Academy of Sciences, Fourth Series. Vol. 19, Nos. 4 and 5: Some Rissoid Mollusca from the Gulf of California, by Fred Baker, G. D. Hanna and A. M. Strong; Some Mollusca of the Family Epitoniidae from the Gulf of California, by Fred Baker, G. D. Hanna and A. M. Strong. Pp. 23-56+3 plates. 25 cents. Vol. 19, No. 6; Pliocene Deposits North of Simi Valley, California. By W. P. Woodring. Pp. 57-64. 25 cents. Vol. 19, No. 7: Geology of Sharktooth Hill, Kern County, California. By G. Dallas Hanna. Pp. 65-83. 50 cents. Vol. 19, No. 8: Fossil Bird Remains from the Temblor Formation near Bakersfield, California. By Alexander Wetmore. Pp. 85-93. 25 cents. Vol. 19, No. 9: The Killifish of San Ignacio and the Stickleback of San Ramon, Lower California. By George Sprague Myers. Pp. 95-104. 25 cents. Vol. 19, No. 10: Contributions to Oriental Herpetology. By Joseph R. Slevin. Pp. 105-108. 25 cents. (San Francisco.)

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