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Scientific Aspects of Industrial Accidents

THE annual report of the Chief Inspector of Factories and Workshops for the year 1936 (Cmd. 5514. H.M. Stationery Office, 1937. 2s. net), raises several questions with which scientific workers are concerned, whether actually engaged in industries or as citizens interested in the protection of national health from conditions which would degrade it. Anyone reading the report would be disturbed at what is revealed in it as to the very long hours that are being worked in some of the newer industries. While in the nineteenth century, broadly speaking, Great Britain undoubtedly led the world in imposing limitations on hours of work and the observance of minimum standards of safety and health in factories and workshops, in the last few decades it is clear that the country has fallen sadly behind other important industrial countries in these matters.

The report shows that although the 47 or 48 hour week is considered normal, many cases are reported where the working week exceeds 48 hours, not only for busy periods but often also continuing for months at a time or even for most of the year. Work up to 50 and even 60 hours a week has been common in laundries, the metal trades in the Midlands, as well as in leather, bakelite and other industries and in the woollen and worsted trades, and some disconcerting examples of illegal employment of women and juveniles are cited in the report. Despite the improvement in the employment situation, unemployment is still far too severe and widespread for this situation to be regarded with equanimity. Obviously the inspectorate requires very much stronger and clearly expressed support from public opinion if even the minimum standards required by the law are to be enforced

and these abuses suppressed, nor can we feel confident that the advance represented by the provisions of the new Factories Act now passed will effect any improvement unless there is a very considerable increase in the inspectorate.

A significant share of that support may well be looked for from scientific workers, whether engaged in industrial work or not. Apart altogether from the posts of responsibility in the management of industry which many of them hold, they should not require this report to realize the connexion between long hours of work and industrial accidents and sickness, which is once again so clearly portrayed in its pages. On this subject parts of the report are painful reading. A substantial increase in accidents over the previous year is again recorded—about 15 per cent for accidents generally and 9 per cent for fatalities. Although the analysis and graphs submitted by the chief inspector afford some evidence that the risk of accident is tending to decrease, through such factors as the work of the inspectorate, the educational work of the National Safety Association, the Industrial Welfare Society and similar organizations, the closer supervision of the growing number of factory safety organizations, and especially through the growing recognition of their responsibility in this matter by employers, disturbing fluctuations in the risk of accident as well as in the numbers of accidents still occur from year to year.

Some of the causes of these fluctuations are obvious. The longer hours to which reference has already been made are a significant factor. The greater speed of production, the absorption of more inexperienced or unpractised workers, both old and young, and the installation of new plant

and machinery with unknown risks, are among other factors which are responsible for the rising toll of death and injury, and appear at present to be associated with increased production and prosperity.

That this position should be accepted as inevitable may well be challenged. Already there are many firms, both large and small, in which the safety of the worker is a first consideration, and where no new machinery or process is put into operation without every possible measure being taken to ensure that it is as safe as it is eventually intended to be. It should not be too difficult a task for professional associations and safety organizations to arouse public opinion in such matters to a point which would ensure not merely that the minimum requirements of the law were rigorously enforced, with adequate penalties if need be, but also that a high incidence of avoidable accidents, especially among the young workers, would be regarded as a definite slur on the reputation both of the firm and of its management.

The position of the juvenile worker requires special stress because of the exceptionally high accident rates among workers under eighteen years of age to which the report again directs attention, and also because of the possibilities of a much more rapid reduction in this accident rate among juvenile workers than among adults in the same occupation. While accidents to young workers are usually of the less serious kinds, the situation was regarded as sufficiently important to receive special attention from the inspectorate, and a separate chapter of the present report deals with accidents to young workers and methods of preventing them. In relation to young workers the question of industrial safety presents its own problems, and too often it appears beyond doubt that the special protection which should be accorded to young workers is wanting.

An attempt to apportion responsibility between the employer and the victim indicates that in only 23·8 per cent of the accidents to boys could no blame be attached. In 32·3 per cent of the accidents the firm was mainly responsible and in 44·3 per cent the boy. The figures for girls do not differ greatly, but in 51·1 per cent of the accidents the girl was mainly responsible. The inquiry also emphasized the greater liability to accident in the initial stages of employment; about 10·4 per cent of the boys and 24·4 per cent of the girls who were injured in the first six months being injured during the first week.

These figures alone emphasize the significant part which a sense of responsibility on the part of the management, combined with active oversight, can play in determining the standard of safety in a works, and they stress, too, the importance of educating the young worker in the risks attached to his work as well as the importance of selecting that work, and adequate supervision and training in the initial period of employment. In spite, however, of the attention directed to this matter as a result of a memorandum issued following a conference convened by the Home Office, in which the National Confederation of Employers' Organizations participated, the general progress has been unsatisfactory. The publicity given to the matter has as yet aroused little, if any, interest in many employers, and others have had no knowledge of it.

A large proportion of the accidents to juveniles appear to occur in the smaller factories, where only individual approach is likely to be effective, and the chief difficulty lies here rather than in the larger and better organized factories. Whether the factory is large or small, however, the interest of the occupier, managers and foremen is indispensable before there can be much hope of a noticeable reduction in these accidents.

For this reason, the interest and co-operation of the scientific worker in this matter is of prime importance. Whether or no he occupies a position on the management side, an experienced chemist or engineer, for example, is usually able to initiate steps leading to improved working conditions and to secure the formulation and observance of strict safety rules. He has also an indispensable contribution to make on the technical side in improved design or safer operating methods and conditions in new or established processes. His personal interest may largely determine the success or failure of attempts at educating the young recruit or in securing that the training and supervision he receives is efficient and not perfunctory.

Nor is this the only contribution which scientific workers can make in the field of industrial safety and accident prevention. Besides the enthusiastic and skilled leadership and co-operation of the man of science, whether in a technical or an administrative capacity, there is needed an alert and informed public opinion which will not tolerate the continuance of the abuses revealed in this report. Ridiculously inadequate penalties are at present inflicted for such exploitations of health and safety as the employment of boys of fourteen to

seventeen years of age for as many as eighty hours a week, of girls of fourteen from fourteen to fifteen hours a day, and women for an unbroken twenty days work, which are in themselves an obvious cause of industrial ill-health and accidents. Clearly the strong pressure of public opinion is urgently needed to stir some magistrates to a sense of responsibility in this matter, and a Government which professes so great an enthusiasm for physical health and training might do well to convey a strong hint to the offending quarters to discourage lenity as ill-timed as it is reprehensible.

This problem of arousing a public opinion will secure the observance not so much of the minimum standards of the law but rather of the practice of the more progressive firms, whether large or small, and supply the support which such firms, no less than the factory inspectors, themselves require, is less a matter for an individual scientific worker than for his professional associations. They indeed can afford the individual worker the

moral support he may need in making his stand against specific negligence or abuses which he may encounter in his ordinary industrial life, as well as supplying the stimulus and vision which may induce him to initiate constructive measures whether in the technical or more general sphere. Equally they could, if they chose to speak with a united voice and authority, mould public opinion and bring to an end the neglect and indifference which are as detrimental to industrial efficiency as to the health and well-being of the whole nation, and not only that of the individual workers, young and old, of whose lives and happiness so distressing a toll is now taken. The present report may well stir such professional associations as the British Association of Chemists and the Institute of Chemistry to take a more active part in creating an informed public opinion and in strengthening the hands of their members, especially when employed in professional isolation in the small firms where improvement is most needed.

National Factors of Physical Fitness

National Fitness:

The First Steps. (Issued by the National Advisory Council and the Grants Committee for Physical Training and Recreation.) Pp. 24. (London: H.M. Stationery Office, 1937.) 2d. net.

Physical Education in Germany

(Board of Education: Educational Pamphlets, No. 109.) Pp. 80. (London: H.M. Stationery Office, 1937.) 1s. net.

ON Tuesday, July 20, a striking leader appeared in *The Times*, entitled "The Empty Chair". It referred to the fact that physical culture had no conspicuous place among the subjects to be discussed at the annual meeting of the British Medical Association at Belfast. "If the doctors will not fill the empty chair, others less well qualified than they will fill it". "Into this pageant of life in action the science of nourishment and the science of personal hygiene will fit easily and with propriety. . . . This is the larger physiology. . . ." The complaint is just and timely. Physical training is largely neglected by doctors and physiologists in Great Britain, and it is almost impossible to obtain expert scientific advice on it.

The Physical Training and Recreation Act passed through Parliament this year. The little

pamphlet "National Fitness" shows how the National Advisory Council and the Grants Committee are beginning to plan the organization by which the Act may achieve its ends. It is curious that Great Britain—the home of 'sport'—is so backward in matters relating to the physical education (in its widest sense) of the people. How many of its towns have running tracks, gymnasia, swimming baths? How many of its schools and universities have means and personnel for the physical examination and assessment of their students? How many of our young people, lacking advice and encouragement, know anything of the joys of bicycling, tramping, camping (and singing) about the countryside? How many more than at present, even without help and leadership, might find out for themselves, in their holidays and week-ends, were the Youth Hostels multiplied ten times in number and capacity? How much health, happiness and content might result were there reasonable means of physical recreation, with organization, leadership and advice, within the reach of all instead of a small fraction of our people?

The beginning of a national effort is being made. Its success will depend on various factors: first, on public opinion, which, as the pamphlet truly says, "in this country means the opinion of the

people". It will be a sad thing for democracy if "the opinion of the people" in this matter of health and happiness continues to lag behind the accepted teaching of dictatorship. Secondly, on the provision of teachers and leaders: here again democracy has proved lamentably slow, but the pamphlet promises that "a new National College is being established". Will people of sufficient character, intelligence and enthusiasm come to be trained? And will there be assured careers for those who come? Thirdly, on the provision of financial and material means: the funds available to the Grants Committee are not small, but will they be sufficient? This is, or ought to be, a big business. Fourthly, on expert scientific advice on the physiological, medical, nutritional and psychological aspects of a many-sided problem. Such expert advice implies, not mainly consultation in committee (though that is necessary), but chiefly the handling of human beings: it requires, on one hand, something analogous to the clinical experience, the aptitude and sympathy of the good physician, on the other a trained capacity for making correct assessments and drawing accurate conclusions from human data. The "empty chair" will remain empty, or will be filled—as *The Times* said—by someone less well qualified, unless physiologists, medical men, experts in nutrition and psychology, realize that the production of health and fitness is at least as important as the treatment of disease.

The other pamphlet is the "report of a delegation who visited Germany in November last to investigate Physical Training there". It will be deplorable if a great and generous achievement, from which Great Britain might learn much, is disregarded or depreciated because of the indignation which many of the manifestations of national socialism have rightly evoked here, or because of some of the exaggerations and excesses of the achievement itself. The Hitler-Youth, with its six million (most of them) eager youngsters, is admittedly political: that, as the report points out, is—no doubt unfortunately—the German habit in physical education: and it has many aspects which, from the British point of view, are odd or objectionable. It takes children unduly from their homes; it sometimes injures them by over-exertion; although nominally voluntary "he is a rash lad who ventures to say that he proposes to stay out of it". It encourages its children to read some queer literature. Its potential military value, also, may be enormous; but so indeed is that of any group, sufficiently large, of happy, healthy people, disciplined in outdoor sports and activities, inured to hardship, bound by common loyalties. The fact that healthy loyal youngsters may make better and more ready soldiers is no

reason why unhealthy, cramped and discontented ones should make a better population.

The truth is, whether we like it or not, and as a comparison of these pamphlets shows, that, in its encouragement to youth (and middle age) to find happiness and recreation in the open air, and to develop health, skill, stamina, strength and self-respect by games and bodily exertion, Germany has gone very far beyond Great Britain. In some respects it has gone too far, but that may be repaired as experience is gained. The achievement is not due only to enthusiasm and devotion. In the "Napoli" schools "the doctor is a most important member of the staff". Research in physical education "is beginning to be of interest to the biologists in the universities". The National Physical Training Academy offers "facilities which are far beyond those which any institution in this country can provide". The training of teachers in physical education, and of leaders in sport, gymnastics and outdoor recreations (teachers and leaders of either sex), is rigorous and scientific: and some of the best and most eager of the young people are enrolled. Architecture, music and psychology are called in: "the spaciousness, simplicity and very often the beauty of the surroundings of establishments in Germany were most noticeable". Singing is widely encouraged and "is invariably excellent". "Kraft durch Freude" (strength through joy) may have a slightly comic ring in English ears, but its appeal to the German masses is based on sound psychology and on skilful, arresting propaganda. This organization affects the lives of millions of young (and older) workers: it is generous and reasonable in spirit: it provides, apart from anything else, cheap, ready and beneficial holidays for the masses: it is "possibly the most instructive phenomenon of the Third Reich". If its cost is great, so also will be its result in health and happiness to the German people.

A free democracy such as ours is liable to be slow in its enthusiasms and to be inhibited by criticism, and it may be a long time before we learn to do for our young people what Germany is already doing for hers. A comparison of these pamphlets shows how far, in eagerness, in organization and in science we are behind. Our best, in physical education, is doubtless at least as good as the German best, but Germany is doing well for far more people. Britain may have little else to learn from national socialism, except by way of warning, but we shall be fools—or worse—if we allow prejudice to blind us to a real achievement in human betterment, if we refuse to acknowledge the one generous experiment which, whatever its motives, exaggerations and shortcomings, Nazi Germany is now making. A. V. HILL.

Enzyme Research

Ergebnisse der Enzymforschung

Herausgegeben von F. F. Nord and R. Weidenhagen. Band 6. Pp. x + 289. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1937.) 23.60 gold marks.

THIS year's volume of the "Ergebnisse" deals in the main with the remote sections of the subject and to that extent is of special rather than general interest. Inasmuch as progress on the experimental side depends on the development of new technique, some of the contributions are of importance. For example, two Indian investigators in Bangalore deal with the application of dilatometry to enzyme reactions, which involves the measurement of volume changes under carefully standardized conditions. Though the mechanism through which volume change is caused is not clearly understood, it is claimed that the validity of its application has been established in specific cases by a comparative and critical study. The practical difficulty is to be sure that the reaction, or rather mean result of possibly several reactions measured, is the one which the experimenter describes.

Perhaps the most interesting chapter is that by Hugo Theorell of Stockholm on the yellow ferment and its component, known in crystalline form as lactoflavin, which appears to be vitamin B₂ and about which so much has been discovered working with extremely small quantities of material. In the ferment, the presence of which must be regarded as essential to life, the lactoflavin is joined to a pentose sugar, phosphoric acid and protein, a combination which seems usual in the cell. It acts as a hydrogen carrier, the physiological problem being whence comes this hydrogen and whither it goes. Lactoflavin has been synthesized. The summary is a useful one of this most important subject.

Miss Stephenson, of Cambridge, writes of hydrogenylase—an alarming word to describe bacterial enzymes which produce molecular hydrogen from formic acid. The work done on this reaction indicates that since all substances so far known to yield hydrogen by bacterial action also yield formic acid, the hydrogen is liberated from this substance.

A somewhat lengthy paper contributed from Lwów, by J. K. Parnas, deals with the vexed question of the changes which take place during the breakdown of glycogen in muscle. The changes are complex, and they involve phosphates; there

is much controversial matter in the article, which would have been improved by a summary. The editors of the "Ergebnisse" should encourage authors, even in the most specialized fields, to make clear wherever possible the probable position in relatively simple language and not leave it to the unfortunate general reader to become lost in the confusion of contradiction and detail.

Everyone must experiment with heavy water in these days, and there is a section on ferment reactions in its presence from K. F. Bonhöffer of Leipzig. It is largely mathematical and does not make any particular point.

The chapter by Emil Abderhalden on the protective ferments demands careful study. Apparently when foreign substances of a hydrolysable character are introduced into the blood stream, it is not long before appropriate new enzymes appear capable of breaking them down, and these enzymes afterwards appear in the urine. These protective proteinases are characterized by being sharply specific towards the substrate which has called them into being. Their origin has not been discovered; they can be detected in blood serum and in urine within less than 24 hours of the introduction of the foreign substance. The subject is a new one and obviously of outstanding importance. It is interesting to note the two conflicting trends in enzyme theory—some emphasize the absolute character of the specificity, others consider a particular enzyme, for example emulsin, to have a wide range of activity though it acts on some substrates with extreme slowness.

Lastly may be mentioned an American contribution, by J. B. Summer of Ithaca, on antiurease, a member of the class of anti-enzymes of which sixteen have already been mentioned in the literature. Crystalline urease being available, it was possible to study the production of antiurease by injecting it into an animal. The author speaks of having made the purest antibody preparation yet obtained, though he has not yet succeeded in crystallizing it. This work is of importance.

These brief extracts must suffice to show some of the directions in which hopeful progress is being made. The work is truly international, the laboratories of the world are co-operating in it and it is worth while to stress this, the real and the predominant aspect of scientific chemical activity, as the true state of affairs, and to regard the excessive reference to warlike activities as largely an overstatement.

E. F. A.

The Rengma Nagas: A Changing Tribe

The Rengma Nagas:

By J. P. Mills. (Published by direction of the Government of Assam.) Pp. x + 381 + 17 plates. (London: Macmillan and Co., Ltd., 1937.) 25s. net.

MORE than fifteen years ago, the reviewer in *NATURE* of an earlier monograph in this series expressed the hope that it might be followed up by monographs on other Naga tribes including the Rengma, and Mr. J. P. Mills, honorary director of ethnography for Assam, in dealing with that tribe, has now filled in one gap in our existing knowledge, so that we have a series of works dealing with all the tribes occupying the middle of the major portion of the administered area of the Naga Hills.

The gaps in our knowledge have been filled in more ways than one, for while Mr. Mills has found less to say about the social organization, for example, of the Rengma, than he had to say about the Ao in his last monograph, he has given even greater details of minor observances, formulæ and superstitions of daily life. Thus we are told exactly what a man should do when he is going out to snare hornbills, or precisely what misfortunes befall a man who remarks how good a wild yam tastes.

The author is, by the way, perhaps too sweeping in describing the Great Indian hornbill as feeding "exclusively on fruits and berries"; at any rate, a tame one, which belonged to the reviewer and lived unpinioned in his garden, spent much time in searching for spiders in the thatch, and preferred butter even to mulberries. Incidentally, also, the Angami dye referred to in a footnote on p. 66 is made from the leaves not, strictly speaking, of an oak tree, but of the *Macaranga denticulata*, and, in order to obtain the true black, a cloth must first be boiled with macaranga leaves and then steeped in black mud, the iron salts in which act on the gallic acid from the tree to make a fast black.

Particularly interesting are the details which Mr. Mills gives of a purificatory ceremony of a kind not previously described, the reviewer believes, in any monograph of this series.

The Rengma are a tribe now split into three groups; one of these migrated westwards to the Mikir Hills in the first quarter of the nineteenth century; the other two remained in the Naga Hills, but have become widely separated by the northward migration of the Sema tribe. It is with the last two sections that Mr. Mills's monograph deals, and he speaks of them throughout with reference to the Naga Hills administrative district as the

Western and the Eastern Rengma, but the Middle, or Central, and Eastern would be more precise terms. It is unfortunate that official duties made it impossible for him to deal with all three groups, since the changes which have taken place in the westernmost group, everywhere in contact with other peoples, have been very great, and would have afforded an interesting, if depressing, example of the effects of cultural contact and subsequent sophistication.

Even so, Mr. Mills has some very important reflections to make on certain aspects of missionary teaching, particularly as to the policy sometimes pursued of discouraging the payment of marriage prices. The tendency of the mission has been, if not actually to discourage, at best to refrain from encouraging the practice of paying a substantial sum for the privilege of marrying a man's daughter. The practice is a healthy one, as it provides some economic insurance for proper treatment of the bride by her husband, who stands to lose the sum paid if his wife leave him under provocation, and for the good behaviour and fidelity of the wife, who in turn must refund the payment if she give good ground for divorce. In some Sema villages where the custom had been dropped on conversion to Christianity, a tendency was manifested towards a quite uncalled-for and unjustifiable putting away of wives, or desertion of husbands, since the unfaithful party stood to lose nothing by the change.

Mr. Mills defends the payment of marriage prices among the Rengma on similar grounds, and it might be added that the retention of the custom is particularly desirable in the interests of the bride where there has been a recent change from polygyny to Christian monogamy, and where the tendency towards marrying more than one wife is likely to show itself in divorce and re-marriage if there be no serious obstacle.

The Government of Assam is the one administration in the Indian Empire that has the wisdom, the foresight and the interest in good governance to produce a series of detailed accounts of the customs and lives of the peoples of primitive culture surviving in the wilder parts of its province. This one is more than worthy of its precursors; it is well produced, well illustrated and well indexed. Two misprints only (on pp. 69 and 92) were detected by the reviewer, but he badly missed a map. Both Mr. Mills and the Assam Government are to be congratulated on this addition to their unrivalled series of tribal monographs.

Mitogenetic Radiation and the Theory of Nerve Excitation

Mitogenetic Analysis of the Excitation of the Nervous System

By Prof. A. G. Gurwitsch. Pp. ii + 114. (Amsterdam: N. V. Noord-Hollandsche Uitgeversmaatschappij, 1937.) 3.75 f.

THE outcome of Prof. A. G. Gurwitsch's latest monograph is a new 'chain reaction' theory of excitation, based, in its more concrete form, on the experimental results described in the body of the book. The peculiarity of the new theory is that it allows for the existence of many qualitatively different states of excitation, while ignoring completely the electrical, thermal and chemical phenomena studied by classical methods. The more general considerations which appear in the concluding chapter will perhaps receive better attention, and will doubtless awaken the sympathy of those who, with Gurwitsch, feel that the study of electrical changes in artificially stimulated nerve affords an inadequate basis for the comprehension of the "unlimited variability . . . and the continuity of functional states" of the nervous system. These ideas are derived from Driesch and from Gurwitsch's earlier work on the "cerebral field", and owe little to his study of mitogenetic radiation.

The experimental foundation of the new theory is somewhat as follows: Resting medullated nerve, in common with many other biological systems, is said to emit a complex ultra-violet spectrum of exceedingly low intensity, which originates in the nerve fibre itself. The medullary sheath, although highly opaque to ultra-violet radiation of macroscopic intensity, contrives to transmit the radiation emitted from the nerve fibre by a remarkable chain process of absorption and secondary emission, so that it can conveniently be observed externally by its effect on the rate of division of yeast cells—an aspect of the subject that has already been subjected to destructive criticism (see *Biol. Rev.*, 10, 42 (1935); and *NATURE*, 133, 860 (June 9, 1934)). "Biological" spectral analysis of the radiation, and comparison with that produced by enzyme reactions proceeding *in vitro*, suggest that it can be used as an index of the chemical processes occurring in nerve. It is found that whereas the resting sciatic emits radiation due to glycolysis, oxidation and proteolysis, the stimulated nerve gives a different radiation, the composition of which depends on the mode of excitation—mechanical, electrical, reflex, etc. Thus, in Gurwitsch's opinion, the existence of a qualitative variability of states of excitation is established. Sub-threshold stimuli, moreover, also give rise to a propagated

disturbance, accompanied by characteristic chemical changes, so that the all-or-none law appears to be a mere artefact, ascribable to the too exclusive interest of classical physiologists in action currents, excitability, and so forth.

Not only does nerve show this variability of response to stimuli of the usual type; it also responds, with a propagated wave of chemical action, to intermittent exposure to mitogenetic radiation from some other source. This so-called "mitogenetic excitation" appears after a latent period of 0.001 sec., is transmitted at a rate of 30 m./sec., and its nature varies with the nature of the exciting radiation. A single line from the glycolytic spectrum, of wave-length 217–218 μ , say, will set up a propagated disturbance involving emission of this same line, and, in addition, of other lines of the glycolytic spectrum—one, for example, at 190–192 μ . An interesting case, as Gurwitsch puts it, of "antistokes". A pure glucose solution, it may be mentioned, shows a similar secondary excitation which travels through the solution at a rate of 10–12 m./sec.

With regard to the behaviour of the central nervous system, Gurwitsch has studied the radiation emitted from the surface of the optic chiasma, the optic lobes, the hemispheres and the medulla of a frog stimulated visually. He finds that the "visual act" is accompanied by emission of radiation from all these regions; the stationary spatial distribution intensities in the cortex are a function of the nature of the stimulus—varying, for example, when a white visual field is replaced by a moving black pattern on a white ground, although a half white and half black field gives the same pattern, whether the black or the white portion forms the upper half. The spectra from the optic nerve and the hemispheres are also different with stimuli of different colours.

Sufficient has been said to indicate the general nature of Gurwitsch's experimental evidence, although it is not possible in a short review to deal with all its complexities, and surely not necessary to indulge in any lengthy criticism. Gurwitsch's discoveries speak for themselves, and the reviewer may be forgiven for taking to heart the author's advice, in a footnote dedicated to his critics, "to act more cautiously in the future, in order not to find themselves in a ridiculous position". He may nevertheless be allowed to suggest that the discoveries in question are open to serious doubt on physical, chemical and physiological grounds.

J. B. BATEMAN.

The Nature of Human Nature :
and other Essays in Social Psychology. By Prof. Ellsworth Faris. (McGraw-Hill Publications in Sociology.) Pp. xii+370. (New York and London : McGraw-Hill Book Co., Inc., 1937.) 21s.

AMERICAN sociology has been often described as suffering from two major though mutually exclusive complaints: a tendency to systematization which borders on vacuous verbosity; or, in contrast, a raw empiricism satisfied with increasingly detailed descriptions and the endless and aimless collection of fact, numerical in preference. On the whole, this indictment is as unfair as in a few exceptional cases it is amusingly apposite.

The present volume by one of the veterans of American sociology is a proof that Prof. Faris—and he represents the best and most numerous group of his colleagues—can be at the same time concrete and theoretically inspired; interested in facts, yet always infusing them with theoretical insight and human sympathy. The volume consists of collected essays ranging over a variety of subjects, and written over a period of years.

Some of the chapters are vigorously controversial. His robust, almost brutal handling of Pareto will be a delight to those of us who dislike irrational fashions in science (or pseudo-science) and quasi-religious cults in abstract sociology. The chapters on race and racial problems show once more the American mind at its best. Prof. Faris is, needless to say, strongly opposed to all extreme racial theories. He does not, however, dismiss the factor of race as a mere figment but deals with it in a truly scientific spirit. The group of essays on ethnographical subjects are based on the author's personal acquaintance with Central Africa, where he has lived for seven years. In his treatment of psycho-analysis and behaviourism, in the fundamental problem of human instincts in society and in his discussion of the Jewish question, we find everywhere an outspoken, honest, shrewd and at the same time, widely read and rarely cultivated mind. The book is written in simple and direct English; it is witty and full of vigour; it is as interesting as it is instructive; it vindicates the scientific character of American sociology.

B. M.

Comets :

their Nature, Origin and Place in the Science of Astronomy. By Mary Proctor and Dr. A. C. D. Crommelin. Pp. xi+204. (London : The Technical Press, Ltd., 1937.) 8s. 6d. net.

THIS work is written in simple and non-technical language and for this reason it will prove attractive to the general reader. The student of astronomy too will find it a most useful book, especially for references, as it supplies very useful information on famous comet hunters and also on the history of some of our well-known comets, Pons-Coggia-Winnecke-Forbes, Halley, Biela, Encke, etc. There is a description of the return of Halley's Comet in 1910—a return which caused considerable interest in the astronomical world especially, as Drs. Cowell and Crommelin had devoted a lot of time to the

computation of the perturbations by the planets. They predicted the time of perihelion passage as April 17, 1910, and this prediction was correct to less than three days.

Miss Proctor's father, Richard A. Proctor, showed many years ago that there were insuperable difficulties against the theory of the capture of comets by planets, and this is discussed in the present book. Dr. Crommelin supports Proctor's position and has devoted much attention to the view that the comets are not extra-solar. He agrees with Proctor that the short-period comets were expelled from the giant planets, but considers that Proctor was in error in postulating this expulsion millions of years ago. Crommelin believes that it took place in comparatively recent times—a view which is supported by the well-known fact that these short-period comets are rapidly disintegrating and last only a few centuries, not millions of years.

The book has a number of useful illustrations and an index is a great convenience. It is a very readable and interesting work.

M. D.

Das Gallium :

eine kritische Würdigung der Erkenntnisse mit experimentellen Beiträgen. Von Dr. Erich Einecke. Pp. 155. (Leipzig : Leopold Voss, 1937.) 12 gold marks.

THIS monograph gives a detailed account of the element gallium, which is now available on the market. After a historical introduction, it specifies the sources of gallium and the methods of extracting the element from them. The physical and chemical properties of gallium and of its alloys and compounds, including organo-metallic compounds, and the analysis of gallium, are described with 450 references to literature and 15 patents. Since 1932 gallium has been separated from the by-products of the copper schist of Mansfeld by the Vereinigten Chemischen Fabriken at Leopoldshall, and the price is now about 10 marks per gram. The metal has a very low melting point, 29.78°, and remains supercooled much below 0°, and a high boiling point, so that its use in high-temperature thermometers in quartz has been the object of research. Gallium compounds have also found application in pharmacy. The book contains some original observations by the author and is a valuable survey of the present knowledge of gallium and its compounds.

Photography

By Dr. C. E. Kenneth Mees. Pp. xii+214+63 plates. (London : G. Bell and Sons, Ltd., 1936.) 7s. 6d. net.

IN January 1936 the "Christmas Lectures" at the Royal Institution were given by Dr. Mees. His book covers the ground of the lectures in a very readable and extremely well-illustrated way. The history of photography is fairly fully summarized in a chapter of thirty-three pages. Another chapter describes the manufacture of photographic materials. The remainder of the book deals with the principles and applications of photography.

Mechanics of Sport*

By Sir Gilbert Walker, C.S.I., F.R.S.

IN games with a ball in their most primitive stages, the ball may be simply a convenient lump to be thrown or hit; but effects of spin soon play their part. It is well known that Prof. P. E. Tait measured the starting speed of a golf ball and thought he had proved mathematically that its range could not be more than about two-thirds of the distance that his son proceeded to drive it. The cause lay in the upward force due to the under-spin, and the explanation of such an effect had been given by the late Lord Rayleigh, as well as in general terms by Sir Isaac Newton. Similar effects may be seen in a slice at golf, a swerve in cricket or baseball, or an American service at lawn-tennis.

Another game in which a swerve occurs is curling, and the path of a stone happens to have the same relation to its spin as that of a ball moving through the air. Now the bottom of a stone is not flat, but is hollowed, so that it is in contact with the ice over a circular line about 6 inches in diameter. Let us suppose that the direction of spin is such that the forward side is travelling towards the left. If we think of the sideways friction on the circle of contact, that in the front half of the circle is to the right and on the rear half to the left. Now the stone moves to the left, so the friction on the rear half must be the greater. But as the forward motion of the stone as a whole is retarded by friction on the ice, the pressure on the rear half must be less than that on the front half; and if the stone were moving over a glass plate the rear friction would be the less and the stone should swerve to the right. This actually happens. On ice, however, it swerves to the left and so there must be better lubrication on the front half, or greater pressure, than on the rear half. Now we know that when ice is not far from the melting point, pressure in excess of a critical value melts the ice and reduces the friction: it is this property that makes skating possible, for it produces a film of water between the skate and the ice. So there should be more melting in the front half; also a stone should refuse to curl when its pressure cannot melt the ice, that is, when it is very cold. This agrees with experience.

Curiously enough, there is yet another case in which rotation sets up deviation in the same direction as for a ball. It is that of a falling long strip of cardboard. As Maxwell pointed out, if a spin is started, the downward velocity will be

least after the plane of the strip has passed through the horizontal and greatest after passing through the vertical. So the couples tending to increase the spin will be greater than those tending to decrease it; and the spin will grow. Also the horizontal forces will be greater after the vertical position has been passed through, and the sideways motion will appear. An example of this may be seen in the bull-roarer, an implement used in magical rites by primitive men over a large part of the earth. When the bull-roarer is twirled round, the string describes a cone on the side indicated by the theory, and when it has twisted so far that it must start untwisting, the cone shifts over to the other side.

Some effects of the 'nap' of a cloth may now be considered. A billiards player learns by experience that the path of a ball travelling slowly with much 'side', that is with a rapid spin about a vertical axis, will be diverted to the right or left according as the spinning motion on the right side is with or against the nap. The deflexion may be something like an inch in the length of the table. I have seen pages of mathematical analysis vainly devoted to the subject. But if we state the result in the form that the path bends away from the side on which the nap is being rubbed up and toward that on which it is being rubbed down, the explanation is obvious; for on the rubbed-up side the effective surface is higher than that on the stroked-down side, and the ball moves, as it were, on an inclined plane.

Let us consider now some of the weapons of primitive people. Slings and stones are still widely used, but the range of an arrow or a throwing spear is much greater than that of a stone of the same weight starting with the same speed. A few efforts to throw a wooden stick five feet long by hand will show that, unless precautions are taken, there is a marked tendency for it to travel in the stable transverse attitude with its length at right angles to its path, so that the range is poor in the extreme. For steady flight, with the axis longitudinal we must either provide resistance in the rear end, as in an arrow, or put the centre of gravity forward, or spin the weapon about its axis; in a throwing spear both the latter devices are commonly employed. The natural way to give the spin is by wrapping the thumb and fingers round the spear, so that it rolls off the hand on release. The assegai is thrown in this way, and flies like an arrow from a bow; its penetration is very great.

* Substance of a lecture delivered at Derby on September 6 in connexion with the British Association meeting at Nottingham.

In the course of time, primitive peoples have developed two devices for throwing, the spear-thrower and the beckett. The former is a stick about two feet long and in its use the spear lies along the spear-thrower with its butt resting against a projecting peg. This makes possible an invaluable flick of the wrist and, strangely enough, imparts a considerable spin. This would be impossible if the spear were not slightly 'whippy', so that an imperceptible flick to one side in its slightly bent state will apply a couple about its longitudinal axis. I believe that a range of 150 yards can easily be attained in this way.

The beckett is a short cord wrapped around the spear and also the first finger of the thrower's hand. It enables the wrist to be freely used and gives the valuable spin. The Roman *pilum* was thrown in this way with a thong called *amentum*.

A boomerang can to-day be looked on as an anticipation of the 'autogiro'; for as with the horizontal fan of the autogiro, its rotation provides support similar to that of the wings of an aeroplane. The couples necessary for its steering are produced partly by the warping of its plane and partly by the lack of symmetry in its cross-section. Returning boomerangs may describe paths of various types; we may have several circuits in front, or a figure of eight. But for an ordinary missile to be thrown at an animal, the shape is designed to give a straight and very flat trajectory. Its efficiency is considerable; when my range with a cricket ball weighing $4\frac{3}{4}$ oz. was seventy yards I could throw a straight-going boomerang weighing twice as much a distance of 185 yards. One of my literary friends used to maintain that a boomerang alighted rotating faster than when it left the thrower's hand; and I used to reply, with the cocksureness of a mathematician, that such a thing was impossible. But we are now familiar with the way in which, except in recent patterns, the rotation of the fan of an autogiro was provided, not by the direct drive of an engine, but by the forward rush of the machine through the air. So my literary friend was not far wrong.

A well-known tool of the Stone Age is the adze, of which the head, or celt, may have a curious property; when placed on a fixed plate of clean glass it may spin in one direction but not in the other. The celt is oval and at the point of contact with the plate the lines of curvature are not, in general, precisely parallel with the dynamical axes—the axes based on the distribution of matter. There is rotational asymmetry, and this shows itself when the celt is spun. Theory brings out another paradox; when tapped at one end rotation is set up, and the direction of this may be reversed merely by raising the centre of gravity.

Let us now turn to some problems of the motion of living beings. The art of swimming has been revolutionized by copying primitive peoples in methods so obvious that we ought to have thought of them. Thus in 1892 the record for the mile was 29 min. 25 sec.; it is now 21 min. 7 sec., an improvement of about forty per cent. In the crawl stroke the body is horizontal instead of sloping, so that the resistance is reduced and the energy is nearly all spent in propulsion, whereas much was spent in keeping the head out of the water. In it, also, useless resistance is not caused by moving the arms forward or sideways in the water, instead of backwards, and the legs, which are not well designed for propulsion, remain nearly straight; their movement, whether the flutter or the scissors, is made three or four times to one of the arms and has a very small range; its object is largely that of controlling the position of the body.

We will now consider a high jump. A good performer crosses the bar in a nearly horizontal attitude, so that as he approaches it vertically he would, unless something occurred, turn through another right angle in descending and alight nearly upside down. In fact he learns to make violent contortions to avoid a dangerous descent. Perhaps the best exponent of this art is the cat, which, if suspended by the paws with its back only a few inches above a table and released, will fall on its feet. It performs the whole operation of rotation in the air in about a quarter of a second. This can be illustrated by mounting a platform able to rotate without appreciable friction, when, by repeated use of the arms, a man can turn his body completely round as often as he wishes, although at no instant is there the slightest angular momentum about the vertical.

Another theme is that of sailing flight. In the tropics when the sun has sufficiently heated the earth's surface, we see kites and vultures flapping their way upwards until about fifty feet above ground; and then, having reached an up-current, their labours cease and they soar in spirals to a height of perhaps 2,000 feet; they may wander at will all day and descend at sunset. At the first glance it would appear from the inclination of the wings that the up-current would drive the bird backwards, not forwards, but on plotting the motion of the bird relative to the air and remembering that its wings are slotted the paradox is solved.

I believe that the mechanical efficiency of a modern sailplane easily beats that of a vulture, the flight of which is handicapped by carrying much flesh; so that in the tropics a skilful and experienced pilot should be able to roam all day at will. But even in our comparatively feeble European sunshine, the distance record is 313 miles and a height of more than 19,000 feet has been reached.

Tests in Common Use for the Diagnosis of Colour Defect*

By Dr. Mary Collins

THE testing of colour-blindness in all its forms presents a problem of great practical importance involving the adoption of a definite technique.

The spectrometer is undoubtedly the most fundamental test of colour vision, but it is seldom available for practical purposes, and the majority of tests, apart from those in scientific laboratories, are carried out either with some kind of lantern test or some kind of pigment test. There are various types of lantern tests available. The Edridge-Green colour perception lantern is the only one which has been used by the writer. A newer model is the Board of Trade lantern test, recommended with modifications by the committee set up to consider colour vision requirements in the Royal Navy. In using this the eyes have to be dark-adapted for 15 minutes. The Giles-Archer perception unit is also a new and simple model, and it, too, requires the eyes to be dark-adapted. These lantern tests, and many others, have the advantage that coloured lights are used instead of pigments, which brings conditions of testing nearer to everyday conditions in the Services, the railroad, navigation and aviation.

Certain pigment tests have also been extensively used, and it is these I should like to discuss in some detail. In some of these tests, it is puzzling to find mistakes made sometimes by individuals with normal colour vision which should only be made by colour-blinds. The printing of the tests may be partially to blame, but it must be recalled that decisions are constantly being made on the results from these tests, and therefore it is essential to recognize which responses are diagnostic and which can be ignored. In order to reach a valid basis for diagnosis, I have given a battery of tests under constant conditions of distance and illumination to an unselected group of about 340 candidates, exclusive of colour-blinds, applying to be accepted as apprentice printers. Their responses, therefore, to the tests may be compared with the responses of a group of colour-blinds tested under the same conditions. This normal group acts as a control group against which the results for each test used can be evaluated at its proper worth.

Owing to exigencies of space it will not be possible to discuss the details of the results obtained with all the tests which have been used. I can indicate the type of investigation under progress by giving the results from one of the tests only, "The Ishihara Tests for Colour Blindness" (5th Edition).

*Continued from page 534.

The Ishihara test is composed of a number of pseudo-isochromatic plates in which coloured numerals appear on coloured backgrounds. In some of the plates only part of a numeral appears to a person who is colour-blind, this being dependent on the colours used. For example, an 8 may be the numeral read by one with normal colour vision, but only part of it may be seen by the colour-blind, and he reads it as 3. Or a totally different numeral may be seen by the colour-blind from the arrangements of the spots before him, and instead of seeing a 5 as the majority would do, he sees a 2 standing out distinctly from the background. Further, in some plates, the position is reversed as it were, and although the person with normal colour vision sees nothing but a blur of colour, the colour-blind sees a numeral quite clearly. If one with normal colour vision looks at these plates through a blue glass, the 'hidden' numbers become visible.

The individuals forming the control group who were tested were found to vary markedly in their colour discrimination. It seemed advisable to divide them into two groups termed respectively N (normal) and $N-$ (showing greater deviation from the normal). The classification is of necessity an arbitrary one because it is difficult to know where to draw the dividing line; in fact, the line of demarcation between colour-blinds and non-colour-blinds may itself vary according to the purpose in hand. In the report of the "Colour Vision Requirements in the Royal Navy", already referred to, it is stated of a certain test that if used alone it causes extravagant rejection of candidates who may be fit even for the seaman branch. This merely indicates that the standard for rejection can be changed in accordance with the post to be filled. It is interesting to note that three grades, so far as colour discrimination is concerned, are suggested in this report.

The colour-blinds in the present test have been classified thus because of their responses not to any single test but to at least six tests, and in some cases a spectrometric examination was also made. Similarly, in the N and $N-$ groups, their allocation to these classes is based on the results obtained from the same battery of tests.

The accompanying table shows the results from the Ishihara test when given to these three groups. The percentage frequency of the responses in each group has been calculated with regard to normal responses and colour-blind responses. The table

is read thus: in plate 5, 56 per cent of group *N* read the figures correctly as the normal do, that is, read them as 74, whereas 11 per cent of group *N* read the figures as the colour-blinds do, that is, read them as 21. The frequency of responses other than normal and colour-blind has been omitted. In the *N*- group, 29 per cent gave the normal response, 31 per cent the colour-blind response. In the colour-blind group, 0 per cent gave the normal response, 81 per cent gave the colour-blind response.

ISHIHARA TEST.

Frequency in percentages of normal and colour-blind responses for *N*, *N*-, and colour-blind groups.

Plates	As read by normal	As read by C.-B.	Normal		<i>N</i> -		Colour-Blind	
			<i>N</i> .	C.-B.	<i>N</i> .	C.-B.	<i>N</i> .	C.-B.
1	12	12	100	0	100	0	100	0
2	8	3	100	0	100	0	40	55
3	6	5	100	0	100	0	21	71
4	5	2	99	5	92	4	12	74
5	74	21	56	11	29	31	0	81
6	2	—	99	0	83	1	0	100
7	6	—	100	0	96	4	5	95
8	5	—	100	0	98	2	5	95
9	7	—	100	0	100	0	2	98
10	—	5	91	4	89	6	0	95
11	—	2	72	27	48	48	0	100
12	26	2) or 6)	99	0	90	1	5	59) 10)
13	42	4) or 2)	100	0	100	0	10	55) 26)

The frequency of responses other than normal and colour-blind has been omitted.

N = 286 males : *N*- = 48 males : C.-B. = 45 males.

Plates 2 and 3 are never wrongly read by either the *N* or *N*- group, but Plate 3 seems the better diagnostic test of colour-blindness, as 71 per cent of the colour-blinds failed on it, and only 21 per cent passed. Plate 4 is equally good, although 0.5 per cent of the *N* group and 4 per cent of the *N*- group gave the typical colour-blind responses. Plate 5, which is read as 74 by the normal and as 21 by the colour-blind, is said by Miles to be "certainly the most sensitive indicator of colour weakness that we possess", and in the summary at the conclusion of the article, he suggests that in testing men for mercantile establishments only Plate 5 need be used at the original interview. It is also regarded in the "Report on Colour Vision Requirements in the Royal Navy" as one of the most searching plates. It is true that 81 per cent of the colour-blind read the figures as 21, and the others in different erroneous ways, but if we look at the results from the *N* and the *N*- groups, we must modify our opinion. Only 56 per cent of the *N* group passed, whereas 11 per cent failed, that is, read the 74 as 21. The remainder read the 7 as a 2 or as a 9 or as a 1, so that the figures read as 24 (7 per cent), or 94 (2 per cent), or 14 (1 per cent): or the 4 was read as a 1, and the numbers read as 71 (20 per cent), or 91 (2 per cent) or 11 (1 per cent). In the *N*- group, the

percentage of those passing is even smaller, 29 per cent, and the failures 31 per cent. The other variations also occurred. It may be, of course, that this plate offers a very delicate test of colour weakness, and therefore is very effective in picking out colour defect of varying degree. But sometimes it was the only error the individual made not only in this test but also in a group of tests.

The next four plates seem to be very significant. The normal group shows a perfect pass in all four and the colour-blinds almost a complete failure.

The next two plates containing the hidden numbers differ very much as regards efficacy for detection. The hidden 5 is certainly not visible to the normal eye, and the fact that 4 per cent with normal colour vision saw it easily is a curious result. These 4 per cent have perfect colour vision on all the tests, and one would be almost inclined to rate them as *N*+. Whether the supersensitive see the 5 or not requires further investigation. The 2, on the other hand, is not satisfactory. It could be seen fairly easily by all groups, as will be evident from the percentages quoted. Twenty-seven per cent of the *N* group and 48 per cent of the *N*- group were able to read it.

The last two plates are very satisfactory.

The Ishihara test is a very reliable test of colour-blindness and did not allow any of the colour-blinds to pass. It also seems to detect colour weakness in a highly efficient manner.

The results from this test may be sufficient to give some idea of the type of investigation which has been carried out. A similar analysis of the results obtained with other pigment tests—the Stilling, Schaaff's mosaic plates, the Nagel, the Podesta, the Edridge-Green, etc., leads to similar conclusions, namely, differences in the value of individual tests, inconsistencies in the findings arrived at with any single series, and so on.

There is a good deal of doubt whether we ought to speak of reliability and consistency in connexion with the results of this analysis. It may be that the discrepancies disclosed are due to the great variety of those deviations from normal colour vision which are so marked as to justify their being regarded from a practical point of view as cases of colour-blindness. This interpretation of the facts is to some extent confirmed by the results of filter analysis. Plates which all profess to diagnose deuteranopia, for example, show very differently under filter analysis, and similarly evoke different responses from different deuteranopes. The inference would appear to be that we are dealing not with linear variations in degree but with multidimensional variations. A wide new field for investigation is thus disclosed, the working of which may yield valuable results for the whole theory of colour vision.

Work of the Discovery Committee

FIFTH COMMISSION OF THE R.R.S. *Discovery II*

THE Royal Research Ship *Discovery II* is again on the point of departure from London for the Antarctic: she is expected to sail from St. Katharine Dock on October 7 and will be away from England for twenty months. During this time she will be continuing the research on the distribution of whales, hydrology and plankton, the progress of which has been the subject of the recent report referred to in NATURE of September 25.

The first seven months (the southern summer) are to be spent in making a circumpolar cruise planned to provide data for comparison with those obtained on the winter circumpolar cruise of 1932 and with those of the survey of the southern part of the Pacific Ocean in 1934. A circumpolar cruise in summer was started in 1935-36, but this was not completed as it was necessary to revise the programme after a voyage had been made to the Ross Barrier to pick up the American airman Mr. Lincoln Ellsworth.

Leaving Cape Town in November, the ship will steam south-south-east as far as the edge of the pack-ice. On the way southwards a full station will be worked every day: this includes temperature measurements and collection of water samples from a series of 22-25 depths between the surface and the bottom, and the fishing of fine and coarse nets vertically and obliquely down to a depth of at least 1,000 metres.

When the ice-edge is reached, a course will be set towards the east, but tacks will be made north-east and south-east so that the conditions in the warmer water of the open sea to the north of the pack-ice can be examined as well as those at the ice-edge itself. While the vessel is to the southward of the Antarctic convergence—the boundary between antarctic and sub-antarctic conditions at the surface—a constant look-out will be kept for whales; estimations will be made of the relative numbers of Blue and Fin whales seen, and some comparison will then be made of the relative abundance of whales in the different sectors.

In Antarctic waters special nets will be fished for krill (the food of whales) and particular attention will be paid to the collection of young krill near the ice-edge. Where the ice conditions allow the ship to reach the continental shelf, there will also be more intensive work.

In order to complete the circumpolar voyage, the ship must steam northwards to Australia and

New Zealand to replenish her bunkers with oil fuel, and she is expected to be in Fremantle late in December and in Dunedin early in February. Further supplies of fuel will be taken from the Falkland Islands and South Georgia. On both northward and southward voyages the routine observations—at least one full station daily—will be continued; they will give sections across the Antarctic, sub-Antarctic, and sub-tropical zones, and comprehensive data for further research on the problems of the meridional circulations of water and plankton.

In the Atlantic Ocean four lines of stations will be worked across the cold current which flows towards the east from the northern part of the Weddell Sea, and observations will be made between 0° and 20° E. in the current that flows westward into the Weddell Sea along the fringe of the Antarctic continent. The purpose of these observations is to obtain a substantial sample of the krill population in the Weddell Sea current.

The ship is expected to complete the circumpolar voyage and to arrive back in Cape Town early in May 1938, and she will sail southwards again, in midwinter, about July 1.

The second half of the commission will be spent in the eastern part of the Atlantic Ocean and the western part of the Indian Ocean, and repeated lines of observations will be made along the meridians 0° and 20° E. The repeated cruises will only differ in so far as they are affected by the position of the ice-edge, and great care will be taken to preserve a uniform method of making all the observations so that comparisons of the results of successive cruises will be as valid as possible. The work will include observations on whales; measurement of temperature, salinity, nutrient salt and oxygen concentrations between the surface and the bottom; intensive plankton fishing—particularly for krill—down to a depth of at least 1,500 metres; and meteorological observations and bird counts. It is hoped to repeat the cruise—southwards along 0°, eastwards near the ice-edge, and northwards in 20° E.—at least seven times before April 1939, when the ship will return to England.

The director of research, Dr. N. A. Mackintosh, will accompany the ship during the first part of the work, and the scientific staff will include Mr. H. F. P. Herdman and Mr. A. J. Clowes as hydrologists, and Dr. T. J. Hart and Mr. J. A. Nicholson as zoologists. Lieut. L. C. Hill, R.N.R., is again in executive command.

At the recent Imperial Conference the possibility was mentioned of some form of co-operation between the Dominions in any form of economic or scientific activities which might be undertaken in the future in the Antarctic. In this connexion the governments of South Africa, Australia and New Zealand have been invited to nominate scientific or other workers to sail with the *Discovery II*, each for a section of the circumpolar cruise, in order to study the methods of research used by the Discovery Committee.

WHALE-MARKING VOYAGE OF THE
R.R.S. *William Scoresby*

The Royal Research Ship *William Scoresby*, the Discovery Committee's smaller ship, which is now used mainly for whale-marking, has already sailed, the purpose of her early start being to search for

whales in sub-Antarctic waters before they have reached the Antarctic feeding-grounds. The route to be taken depends largely on the abundance and movements of whales. Fuel will be taken, however, at South Georgia in November, and it is probable that operations will then be extended eastwards towards Bouvet Island if ice conditions are suitable. In the second part of the season the ship will move to more westerly regions, near the South Shetland Islands and in the eastern part of the Pacific sector.

The *William Scoresby* sailed on September 16 and is expected to return about April 15, 1938. Mr. G. W. Rayner is in charge of the operations and Lieut. R. C. Freamer in executive command.

Some four thousand whales have now been marked and more than ninety marks have so far been returned.

Genetics and Taxonomy

VARIOUS articles and letters that have appeared in *NATURE* during the past few years suggest that workers in special branches of biology (particularly in cytology, ecology, and genetics) are showing an increasing interest in the impact of their discoveries on taxonomy, and that this interest is shared by their taxonomic colleagues. Papers and discussions at the annual meeting of the British Association may also frequently be accepted as an indication of what subjects are developing in scientific favour. At the recent meeting at Nottingham a morning was devoted by Section K (Botany) to "Genetics and Taxonomy", with a rather wider range in the papers and discussion than is suggested by this general title.

It would appear from Dr. W. B. Turrill's opening paper that plant taxonomy is to some extent at the cross-roads. The old orthodox (or 'alpha') taxonomy, based largely or entirely on morphology, has remarkable achievements to its credit and there is still much to be done by its traditional methods, especially in the floras of the botanically less explored parts of the world. On the other hand, the new methods, especially those with an experimental basis, are leading to the discovery of important characters or attributes, many essentially physiological, which show that the old classification needs improvement or even altering fundamentally if it is to be of the widest use. Cytogenetical investigations, while not the only lines of research which are making contributions to a new taxonomy, are of very considerable

value since they are throwing light upon the following problems which concern the taxonomist: the degree of plasticity of the genotype, the occurrence and constancy of correlation of characters, the occurrence and nature of sterility barriers, the evaluation of characters, the recognition of hybrids, and the phylogeny of species. Examples illustrating the influence of experimental investigations on taxonomic concept, with reference to the above problems, are furnished by the research at Kew and Potterne on species of *Ranunculus*, *Silene*, *Centaurea*, *Anthyllis*, *Plantago*, and other genera.

Not infrequently modern investigations support morphological classification, as Mr. W. J. C. Lawrence showed for the genus *Dahlia* and Dr. K. Blackburn for *Silene*. For an increasing number of genera, cyto-genetical and biochemical analyses enable rapid and precise comparisons to be made between species, thus providing the taxonomist with a further measure of the relationship and evolution of species. The work at the John Innes Horticultural Institute on *Streptocarpus* and *Delphinium* serves as an example.

In such a group of plants as the grasses, taxonomists have sometimes attached undue importance to easily observed but relatively inconstant characters. Dr. T. J. Jenkin suggested the desirability of close co-operation between the taxonomist and cytogeneticist in elucidating the history and behaviour of pasture grasses and thus preparing the way for a better general classification of these economically important plants than at present

exists. Problems of interspecific and intergeneric hybrids are the concern of both the cytogeneticist and the taxonomist, as is also the determination of phylogenetic relationships. The taxonomist has to evaluate the characters he uses, making some of generic, some of specific, and some of varietal value, and so on. In *Lolium*, genetical research shows that height has little value as an indicator of relationships and specific distinctness, since a plant two inches high may be a sib to a plant twenty inches high. In the genus *Dahlia*, corolla colour definitely characterizes two groups of species and the wide colour range shown by the garden *D. variabilis* is, in agreement with other evidence, a witness to its origin as a hybrid between species of the two groups. Such examples of recent research illustrate the help the taxonomist may expect from the biochemist and cytogeneticist in his attempts so to classify plants that the classification is not only widely useful but also indicates relationships.

In return for such help the taxonomist can assist his colleagues not only by identifying their original material on the basis of 'alpha' taxonomy, but also by indicating problems which are recognized as unsolved by the older methods. Prof. J. R. Matthews gave examples of closely allied species which were probably derived from a common ancestral stock but which have now a different geographical range. Cytogenetic research on such plants as *Ranunculus Flammula* and *R. reptans*, *Caltha palustris* and *C. radicans*, *Primula farinosa* and *P. scotica*, combined with other methods of investigation, might lead to the formulation of general views regarding the influence of isolation in speciation. Knowledge of the origin of the geographical race or subspecies may well give us a more complete knowledge of the origin of species.

The results of modern lines of work are beginning to influence taxonomic thought by making taxonomists consider the logical basis of their classification. There seems a general agreement that 'alpha' taxonomy (based essentially on morphology) should be maintained for the present. Subsidiary classifications, often based on a very limited and deliberately abstracted number of attributes are, however, essential for special purposes and especially for deductions from correlation of attributes. Such a classification as that of Turesson, which was ably advocated in the discussion by Dr. J. W. Gregor, has a considerable value both as a means of stating and comparing the results of eco-genetical research and as a guide in the practical application of such research to agriculture. Such special classifications, however, cannot replace a more general one, and exactly how far they can be combined with morphological criteria to lead to a practical and logically sound classification is a matter for continued experiment. As Dr. Turrill said: "by trials and errors this 'experimenting taxonomy' will enable, one hopes, orthodox relatively stabilized taxonomy to incorporate new data and so to advance, gradually and cautiously, from an alpha position towards a far-off omega perfection of the classification of all biological knowledge".

The formation of the Association for the Study of Systematics in Relation to General Biology (see NATURE, July 24, 1937, p. 163 and Aug. 7, 1937, p. 211) was cordially welcomed at several sectional meetings of the British Association. It has evidently awakened considerable interest amongst biologists and should do much to stimulate and co-ordinate research into the many problems of equal importance to taxonomists and their colleagues in other branches of biology.

Obituary Notices

Prof. Albert Heim, For. Mem. R.S.

THE news of the death on August 31 at the age of eighty-eight years of the veteran geologist Albert Heim, though not unexpected, comes as a sad shock to many admirers. A very great man has gone, and a treasured connexion with the early days of Alpine structural interpretation has at last been broken. As a student, Heim came under the spell of Arnold Escher von der Linth, an open-air researcher, a great talker, but no writer. Heim loved the mountain side no less, but fortunately he was an artist, excelling with both pen and pencil; and in his early publications he preserved in truly glorious fashion Escher's discoveries, enriched by numberless observations of his own. Heim's technical skill was such that he

himself engraved the copper plates of many of the illustrations that adorn his text.

The great drama of Heim's scientific life had its origin in one of Escher's favourite ideas, the 'double fold' of the Glarus. In 1841 Escher argued for the existence of 'colossal overshoving' of older rocks on to younger in the Canton of Glarus. He wanted to make the displacement involved as small as possible, and, as the cover of older rocks was discontinuous, he presently imagined that he could explain their situation by postulating two shoves from opposite directions, each with rather less than half the magnitude required if the shove were single. Heim adopted this theory in his classic "Untersuchungen über den Mechanismus der Gebirgsbildung", published in 1878;

and he maintained it for many years in face of slowly developing opposition.

We may recall Marcel Bertrand's paper unifying the movement in 1884, Suess's conversation with Heim in the same sense in 1892, and Schardt's one-way interpretation of Pre-Alpine tectonics in 1893. Schardt's revolutionary ideas led on to Lugeon's synthesis of Swiss Alpine structure considered as a whole, published in 1902. Lugeon was a pupil of Heim's, and while his masterpiece was passing through the press he received a noble letter from his old professor, in which the latter confessed that he now favoured Bertrand's interpretation and expressed joy at the new vision that had come.

The marvel of Heim's career is that it began in early youth and culminated in old age. When only twenty-four years old, Heim succeeded to the chair of geology at the Polytechnic in Zurich, and in the following year to that at the University of the same town, and held both posts until 1911; and yet, in 1919-22, he produced his three-volume "Geologie der Schweiz", the finest national text-book that is ever likely to be written.

Heim was keenly interested in many aspects of geology besides tectonics. Here there is only room to mention his work on glaciers, of the erosive powers of which he did not have a high opinion.

Heim became a member of the Swiss Geological Commission in 1888, and directed its activities from 1894 until 1925. With C. Schmidt he published a very valuable map of Switzerland on the scale 1:500,000. He received honorary doctorates from Bern, Oxford and Zurich, and was elected a foreign member of the Royal Society of London. He has left a distinguished son, Arnold, called after Escher, who was truly helpful to his father during the latter half of his long life's work. E. B. BAILEY.

Lord Rothschild, F.R.S.

IN Lionel Walter Lord Rothschild, who died on August 27 at the age of sixty-nine years, a scientific worker has passed away of whom it may justly be said that he was better known at home and abroad than any other contemporary zoologist. It was inevitable that a Rothschild deeply interested in biology and possessing large zoological collections which he was indefatigable in increasing for the benefit of science, should inspire the imaginative Press of many lands to publish fanciful reports, which gave him a publicity often very embarrassing and inundated him with offers of collections and service and with requests for help. But he would have gained high distinction in science without a family name already world-famous. His interest was so intense and so wide, his ever-ready support of science so valuable and his scientific publications so important, that he held a high place of honour in zoology and was elected an honorary fellow by many foreign scientific societies. Entomologists, ornithologists, herpetologists and mammalogists all claimed him as one of their own.

Being of delicate health as a boy, Rothschild was educated at home and then spent some years at Bonn and Cambridge, following all the time his great love for natural history. The boyhood collections of Lepidoptera and Coleoptera increased to such an extent that in 1889, when he became of age, he built a cottage at Tring for the safe housing of the collections, and soon after a public museum in which were exhibited mounted specimens of all classes of animals. Following family tradition, he entered the bank of Messrs. N. M. Rothschild and Sons to study finance, which left him little time for the supervision of the growing collections. In 1892, on the recommendation of Dr. Albert Günther, he put Mr. Ernst Hartert, the ornithologist, in charge of the collections, and six months later entrusted the Evertbrates to the care of the writer of the present lines. It became the definite policy gradually to build up in the research department collections of birds and Lepidoptera as complete as possible, and to increase the public department as resources permitted.

In 1888, Rothschild had bought a collection of New Zealand birds from Sir Walter Buller, and he became so interested in the fauna threatened by the spread of the white race that he sent a bird-collector to the Sandwich Islands, took up the study of the giant tortoises restricted to the Galapagos and Mascarene Islands, and of marsupials, and supported all measures for the protection of animals and plants by the creation of Nature reserves. His reputation as a zoologist was established before he was thirty years of age. In 1898, the University of Giessen conferred upon him the degree of Dr.phil. and in 1899 he was elected a trustee of the British Museum. He gave up finance in 1908 and then could devote himself entirely to science and to civic duties. From 1899 until 1910 he represented Mid-Buckinghamshire in Parliament, and in 1911 he was elected a fellow of the Royal Society in recognition of his services to the natural sciences. He travelled a good deal in Europe and North Africa, but being a bad sailor never visited the tropics. On the death of his father in 1915 he succeeded to the title.

At the time of Lord Rothschild's death the buildings of the museum had an aggregate floor-space of nearly an acre and a half. The public department now contains more than 2,000 mounted mammals, among them 13 gorillas, 25 chimpanzees, 24 echidnas, more than 200 marsupials; among the 2,400 mounted birds there is a magnificent series of 62 cassowaries, the great auk and other extinct species. The research department lost in 1932 the collection of 280,000 bird skins, which a sudden heavy call on his finances compelled Lord Rothschild to sell; the large collection of eggs contains the best series in museums of eggs of birds of paradise and two great auk eggs; but the greatest asset is the collection of some two million Lepidoptera invaluable for the study of geographical variation and other problems of evolution. The collections were placed with great liberality at the service of scientific workers, who always found a cordial welcome at Tring. The museum is left to the trustees of the British Museum.

KARL JORDAN.

President Masaryk

By the death of Prof. Thomas Garrigue Masaryk on September 14, Czechoslovakia has lost its first president and the world is deprived of an eminent and much-respected philosopher and statesman.

Thomas Masaryk was born of humble Slovak parents at Hodonin, Moravia, on March 7, 1850. He had a chequered boyhood and youth. A primary school inspector secured for him the consent of the authorities to allow him to attend a secondary school to train for a teaching post. His parents' poverty, however, made it necessary for him to earn his living, and he was apprenticed first to a locksmith in Vienna and then to a country blacksmith. A former teacher arranged for his return to school, and in 1865 he entered Brno Grammar School. He made good progress, but his passion for truth brought him into conflict with the authorities, who forced him to leave. Fortunately, he was able to continue his studies at Vienna where, in 1878, he graduated as a doctor of philosophy.

A work on hypnotism in 1880 was followed by "Suicide and Modern Civilization" (1881). It was an analysis of causes of the high number of suicides recorded in Central Europe, and attracted attention both at the time and later. This philosophical study secured for Masaryk a Vienna lectureship, but in the following year he was made a professor at Prague. In 1885 he completed a lengthy work, "Concrete Logic", having previously written several shorter philosophical works, which were also translated into German. His later books mostly took on a political aspect. Thus "The Czech Question" appeared in 1895, and the "Philosophical and Sociological Foundation of Marxism" in 1898. Besides writing for the literary and philosophical journal, *Čas* (Time), which he founded, he kept in touch with science sufficiently to contribute a weekly scientific column in the Prague newspaper, *Národní Listy*. He did not identify himself with blind nationalism, and his scepticism (justified as investigation proved) of the genuineness of some alleged old Czech manuscripts brought him much abuse.

From his philosophical studies he was led to the formation of a 'Realist Movement' amongst educated Czechs. This was "an attempt to popularise the whole realm of Science and Philosophy. Without distorting scientific exactitude, Realism strives to render science accessible to every class of the people. It is a protest against the monopoly of learning, its endeavour is to socialise scientific learning and philosophical culture".

In 1878 Masaryk married Miss Charlotte Garrigue, a distinguished American, and incorporated her name in his own. She entered ardently into all his work until her death in 1923. They paid several visits together to England, America and Russia, and Prof. Masaryk continued to write many philosophical works dealing particularly with modern problems. He entered the Austrian Reichsrat as a 'Realist' in 1902, and rapidly made a reputation for honesty and uprightness, and he was quick to express his dissatisfaction at the methods practised, it appeared, by

all parties. His realism was a reaction against this and against the Tolstoyan slavonic philosophy of non-resistance to evil. Just before the Great War he wrote "The Philosophy of History and Religion in Russia", one of the most important books on the subject, whilst after the War he described his work for Great Britain and the allies and for the liberation of the Slavs. He was, for a time during the War, a professor at King's College, London.

On October 28, 1918, the Czechoslovak Republic proclaimed its independence with Prof. Masaryk (still in exile) as its first President. He held this post until December 1935, when he relinquished it with the recommendation that his younger collaborator, Dr. Eduard Beneš, be elected to succeed him. During the seventeen strenuous and difficult years of his term of office, Masaryk gave very active support to many educational movements. The new University of Brno was named in his honour, whilst the Masaryk Academy of Work, which concerns itself with supplying funds for researches in pure and applied science and in securing publication of the results, received his very keen approval and valuable support. Masaryk was in no small measure responsible for many educational advances associated with his country. Through his ministers, he was able to institute an enlightened policy advancing not only the hitherto restricted culture of the Czechoslovaks themselves, but also not overlooking the needs of the German, Hungarian and Polish minorities living within the frontiers of Czechoslovakia.

Prof. Masaryk leaves a son, Mr. Jan Masaryk, the Czechoslovak Minister Plenipotentiary in London, a married daughter and Miss Alice Masaryková, who had been his companion during the last years and is well known for her Red Cross and humanitarian activities.

G. D.

Mr. F. A. Potts

We greatly regret to record the death in London on September 15 of Mr. F. A. Potts, University lecturer in zoology and fellow (formerly tutor) of Trinity Hall, Cambridge. He was a member of a remarkable group of young men who were specializing in zoology at Cambridge in 1906-8, his group including Prof. W. E. Agar (Melbourne), the late Dr. W. S. Perrin (London Hospital) and the late Rev. S. A. McDowall (Winchester). In his final examination he obtained first classes in both zoology and geology, being one of the last students to obtain the double honour.

Mr. Potts, after visits to Naples and Plymouth, then settled in Cambridge, assisting in the teaching of the Zoological Department until the outbreak of the Great War. During this period he became well-known for his activity in the then rather modern lines of research. He directed his interest first of all to the effects of *Peltoaster* and *Sacculina* on their crustacean hosts, *castration parasitaire*, extending this to a general consideration of phenomena associated with parasitism. His next investigations were devoted to the Rhizocephalan *Mycetomorpha* and to Nematoda, here a notable research dealing

with the free-living, hermaphrodite species. In 1913 he commenced an association with A. G. Mayer which continued until the latter's death in 1923. He several times visited the Carnegie Station off Florida, and in 1913 joined the Carnegie Expedition to Torres Straits. This association produced three important researches, now almost classical, namely: on the Rhizocephalan genus *Thompsonia*, which gave suggestions as to the evolution of the group; on the crabs forming galls in corals, including a study of their modes of life and their adaptations; and on the Crustacea, Ophiurans and Polychaets in association with the Crinoids of coral reefs. A post-War visit to Samoa and to further coral reefs was responsible for studies of rates of growth of Cirripedes and other forms. In addition to the above, there are a series of papers dealing with the systematics of Polychaets of the Indian Ocean and an important study of *Teredo*.

On the outbreak of the Great War in August 1914, Mr. Potts was much exercised as he had been brought up to abhor war—but he felt strongly the devastation of Belgium and Louvain. His brothers had families and could not serve; therefore he must play the family's part. He at once put himself in training and in November almost "coerced" the colonel of one of the Duke of Wellington's West Riding battalions to give him a commission as he "had to get out to the trenches before Christmas". He was a great success, keeping the mess cheerful, and on the formation of a machine gun section was placed in charge "because he knew all about science". He was there on the Western front for four years—and the writer, knowing his upbringing, his psychology and his extraordinary powers of imagination, feels that here was the highest form of courage.

Mr. Potts was a man with a host of friends, whose sympathy will go out to his widow and son. He was always cheerful, bright, happy, helpful and full of fun. In his teaching he dealt with every grade of student and liked to undertake new courses; his special subjects were worms and molluscs. He was thus eminently suited to the production as editor of that text-book on "The Invertebrata", in which he was associated with Borradaile, Eastham and Saunders, and to which he devoted the last years of his life.

J. S. G.

Prof. J. E. Duerden

THE death of Prof. James Edwin Duerden, which occurred on September 4 as a result of a fall sustained on his way to attend the meeting of the British Association at Nottingham, removes a man who has rendered devoted service to science in many fields.

Prof. Duerden was a student at the Royal College of Science, South Kensington, during the years 1885–1889, and obtained his associateship of the College in zoology. His first appointment was as demonstrator in biology and palæontology at the Royal College of Science, Dublin, where he developed an enthusiasm for marine work, resulting in valuable published contributions to knowledge of the Hydroids and Polyzoa of the Irish coast. During this time, he was appointed

a member of the Irish Fishery Survey. In 1895 he accepted the position in Jamaica of curator of the Museum at Kingston. Here he commenced a series of studies of the Actinaria and corals of the West Indies. He pursued his investigations into living and fossil corals at the Johns Hopkins University, Baltimore, U.S.A., and was appointed Bruce Fellow there in 1901.

The value of Duerden's work was recognized when the Carnegie Institution of Washington granted him facilities for the study of European fossil corals, and he was also selected as leader of an expedition to the Hawaiian Islands to study Pacific corals. He was soon recognized internationally as an authority on the structure and development of corals, and became assistant professor of zoology in the University of Michigan. In 1905, he was appointed professor of zoology in the new Rhodes University College, Grahamstown, South Africa. Whilst there, he was placed in charge of ostrich investigations for the Government. He quickly became an authority on the development of ostrich plumes and showed how the serious defects known as bars in the feather were produced by a reduction in blood-pressure during the night period. After the slump, in 1913, of the ostrich plume industry, he became interested in the scientific aspect of wool production, and was appointed Director of Wool Research in the Dominion, whilst retaining his professorship at Grahamstown. He was a pioneer in work on the assessment of quality in the fleece and studied the embryology and evolution of the South African merino fleece.

Duerden served successively as president, member of council and honorary secretary of the South African Association for the Advancement of Science. He retired from Grahamstown in March 1932 and became an honorary member of the staff of the Wool Industries Research Association at Torridon, Leeds, in May 1932. Here he followed up embryological work on the coats of British sheep, specializing on follicular arrangement, and arrived at important conclusions on the specificity of the follicle. At the time of his death he was collating his results prior to publication. His enthusiasm and personality made him a delightful colleague and an inspiration to all who worked with him.

WE regret to announce the following deaths:

Prof. D. H. Bergey, formerly professor of bacteriology and hygiene in the University of Pennsylvania, known for his work on food preservation, on September 5, aged seventy-six years.

Prof. H. H. Collins, professor of biology in the University of Pittsburgh, known for his work on mammalian anatomy, on August 31, aged fifty-two years.

Prof. Adolf L. F. Lehmann, in 1909–30 professor of chemistry in the University of Alberta, and earlier associated with the Department of Agriculture of Mysore, on September 27, aged seventy-three years.

Senator Alessandro Lustig, formerly professor of general pathology in the University of Florence, known for his work on bubonic plague and sanitation, on September 23, aged seventy-nine years.

News and Views

The Globular Corona

THE sensational and distorted press comments on the coronal photographs secured from the stratosphere at the total eclipse of the sun last June, to which reference was made in *NATURE* of August 21, p. 310, have now been followed by more reasoned statements about the photographs. They amount to this: the photographs show more clearly to the eye what the measurements of von Klüber (*Z. f. Astrophysik*, 3, 159; 1931) and others have already proved, namely, that the successive isophotes of the corona round the sun are nearly circular. Graff, Bergstrand and Ludendorff were early workers in the same field of study and they have shown the differences in the behaviour during the solar cycle of this more regular corona and the superposed streamers. That some essential difference exists in the nature of the two main constituents of the corona was shown by the difference in the polarization between the inner corona and the streamers noted by Newall so long ago as 1905 and referred to again in a letter by K. G. Zakharin which appears in this issue of *NATURE* (p. 586).

The Storstrøm Bridge

A SHORT history and description of the Storstrøm bridge connecting the Danish islands Falster and Masnedo, which was opened by King Christian X on September 26, appears in *The Times* of September 25. Masnedo was linked up with Zealand by the Masnedund Bridge constructed in an earlier section of the bridge building programme initiated in 1933. The Storstrøm Bridge, which crosses an arm of the Great Belt, curving in a wide sweep of more than two miles, has been built for the Danish State Railways by the British firm, Messrs. Dorman Long and Co., Ltd., and completed seven weeks before the scheduled date. In its construction, the new 'chromador' steel, which has improved corrosion-resisting properties, has been used. The bridge has three navigable spans, the centre one 430 ft. in length and with about 80 ft. headroom, and forty-six shorter spans in the approaches. Tidal conditions, pack-ice and sea-scour were provided for by new and ingenious methods adopted in the building of the concrete and granite piers and in the erection of the steel girders. The bridge is described as being of a slender appearance but having a magnificence which can best be appreciated when the aluminium coloured steel is viewed in the morning sunshine. It provides a carriage way, a foot and cycle track, and a single line of railway on which trains can pass at a speed of 50 miles per hour. It completes the railway link between the Continent and Scandinavia for, by its opening, trains or cars can now run, via Warnemunde train-ferry, from Hook of Holland, Paris and Berlin, direct to Copenhagen, whence they can proceed by another train-ferry to Malmö, so that the Danish route now

compares favourably with that via Trelleborg-Sassnitz. It has the additional importance that it makes possible the extended use of modern streamlined 'lightning' trains in consequence of the longer journeys now undertaken.

Bimillenary of the Emperor Augustus

ON September 23, Signor Mussolini inaugurated the celebration of the bimillenary of the Emperor Augustus Cæsar, who was born on September 23 in the year B.C. 63, by declaring open the "Augustan Exhibition of Romanism". Great Britain was represented by delegates from the British Museum, the Society of Antiquaries of London, the Societies for the Promotion of Hellenic and Roman Studies, and the University of London. The assistance which had been given by Great Britain in the preparation for the exhibition was generously recognized by Prof. G. Quirino Giglioli, who has been responsible for its organization—the work of five years. Nor does this long period of preparation seem excessive, when the vastness of the field covered by the exhibition is taken into consideration. Not only do they illustrate every side of life and culture of the city of Rome itself as the centre of the Empire, but they also include reproductions of the most remarkable monuments Rome has left in other parts of the ancient world. Further, they cover the religions, the arts and the material culture of the many and varied peoples who came under the sway of Rome, as well as trace in a special section the rise and growth of Christianity from the birth of Christ down to the Edict of Constantine. In this aspect the exhibition has a double significance for the archæologist and the historian. On one side it emphasizes an internal mobility of peoples and cultures, which at a momentous phase in the history of civilization brought about such an interchange of beliefs and ideas as that, for example, which left for the contemplation of later generations a characteristic emblem of the eastern Mithraic cult in north Britain below the Roman Wall. At the same time, from the other side, it demonstrates the solidarity of the Empire, as against the rest of the ancient world, which has set its seal on European peoples, the heirs of imperial culture, no less effectually than the more familiar contrast of East and West.

Racial History in the Arctic

DR. ALĚS HRDLIČKA, of the Smithsonian Institution, Washington, D.C., on his recent return from his ninth expedition of anthropological investigation in the arctic regions of North-West America, has issued through the Smithsonian Institution a preliminary report on the results of his season's work in the Aleutian Islands, in which he discusses the character and distribution of early racial types in the Far North. The investigations and excavations carried out by

Dr. Hrdlička in 1936 and 1937 have been directed more particularly to the study of the problem whether racial migration from Asia, in addition to the Bering Sea route, may have made use of the more southerly passage by the Aleutian Islands—a suggestion which on a general line of argument would appear to have much to support it, but for which until recently positive evidence has been regarded as inadequate. In the expedition of 1936, it may be remembered, evidence was obtained which was held to support Dr. Hrdlička's view. Skeletal material and a large quantity of archaeological material accruing from the expedition's excavations in 1937, and now awaiting further detailed examination in Washington, Dr. Hrdlička holds, confirm his previously formulated theories, and afford him a basis for the racial classification to which reference is made above. "The finds," he states, "make more probable than ever the hypothesis of a 'race nursery' in the Far North for the aboriginal population of the New World."

BRIEFLY, Dr. Hrdlička's preliminary conclusions are that the present-day Aleutians, a broad-headed people, who do not fall precisely into either an Indian or an Eskimo classification, were preceded by an oblong-headed race, who had a much longer occupancy. This race he regards as the same as that which he discovered in the deepest parts of his excavations on Kodiak Island in 1931-35; while a similar type has been found in the lower layers of a mound at the mouth of the Frazer River, British Columbia. There are indications that this stock may have spread so far south as California. The Aleuts cannot be regarded as descendants of this people, and may, in fact, represent a backward migration from Alaska towards Asia. Dr. Hrdlička is now prepared to recognize in the North-West, not one or two racial types, as previously held, but five distinct, though basically related strains, as follows: (1) the long- and high-headed Eskimo of the Seward Peninsula, Barrow, and eastward along the arctic coast to Labrador and Greenland; (2) the broad-headed and medium-vaulted Eskimo of the Bering Sea coast and along the interior rivers from the Yukon southward; (3) the Aleuts with broad heads and low-vaulted skulls; (4) the Alaskan Indians; (5) the oblong-headed pre-Aleuts, whose remains were found by the expedition in the exploration of the past season. The archaeological finds included a new stone industry belonging to this people.

"Minnesota Man"

FURTHER investigations by Prof. A. E. Jenks in the northern lake area of Minnesota, from which were obtained the skeletal remains described elsewhere in this issue of NATURE (see p. 596) have brought to light evidence of what would appear to be an extensive camping ground of early man. From a kitchen midden buried some three feet under a bog of grasses and marsh weeds in Itaska State Park, Prof. Jenks has excavated some two thousand knife-marked bones, with knives of stone and other implements of both stone and bone. The bone bed varies in

thickness up to about four feet five inches. Associated with the bones of bear, elk, caribou and other big game animals in the kitchen refuse are the remains of an extinct form of bison (*Bison occidentalis*), confirming the early character of the site and the early date of its occupation by man. Prof. Jenks states in *Science* of September 10 that of five stone artefacts recovered from the bone bed, three are flake implements with retouch, while two are chopping tools, chipped to rough parallel faces, and retouched on the cutting edges.

Roman Jerusalem

THE discovery of an interesting and important relic of the Roman occupation of Jerusalem is reported. The Department of Antiquities, it is stated by the correspondent of *The Times* in the issue of September 28, while conducting excavations in connexion with the plan of the municipality for clearing away buildings from the Damascus Gate, has brought to light a Roman moulded plinth ten feet high, of which the top was found at a depth of thirteen feet below the surface. The plinth consists of massive blocks of stone, which, it is said, recall the finest work of the Roman period. The site has been identified provisionally with the city gate beside the "Women's Towers", mentioned by Josephus. It is hoped that excavation will be carried further in the expectation that it will throw light on the much-discussed problem of the Third Wall of Jerusalem.

Brood Diseases of Bees Investigations

EARLIER in the present year an appeal was made to beekeepers and beekeeping associations to support financially the continuation of the research on brood diseases of bees at Rothamsted Experimental Station. This work had been carried on for three years by Dr. Tarr with funds half of which were provided by the Government and half by the British Beekeepers Associations. The results of the first three years' work were so promising that it was unanimously decided by the Bee Research Advisory Committee at Rothamsted to continue for a further period of three years if possible. The estimated cost is £550 per annum, of which the Agricultural Research Council has promised £300, if £250 per annum can be raised from other sources. As the result of the appeal a sum of £226 has been received for the current year, which leaves a balance of only £34 to be made up. For the two following years, there is only at present a guaranteed fund of £103 per annum.

THE work carried out up to the present has already cleared up many difficult points. Dr. Tarr has shown that European and American foul brood are two distinct diseases caused by different organisms. He has confirmed that American foul brood is due to a bacterium, *Bacillus larvæ*, and that its incidence is independent of the strength of the colony. European foul brood, on the other hand, is a disease of weak stocks and is probably caused by *Bacillus pluton*, in association with other organisms. He has also shown that a third condition known as 'addled brood' is

very prevalent in Britain; it constituted about one third of the cases of so-called foul brood sent in for examination. It is liable to be mistaken for foul brood, but is really due to a defective condition in the queen, and once it is recognized can readily be cured by requeening. The work in the next three years will be concentrated on tests of control measures for both European and American foul brood and further work on the organisms causing European foul brood. It is to be hoped that further support will be forthcoming to supply the small amount still required for this year's work, and that as many contributors as possible will continue to subscribe for the three years.

Regional Planning in the United States

A broadsheet issued by PEP (Political and Economic Planning) describes some developments in regional planning in the six New England States of the U.S.A. which are of some interest in relation to the Special Areas Bill in Great Britain. The broadsheet is based on a report prepared by the Commission on Regional Planning for New England, issued last year by the National Resources Committee, a progress report, "State Planning, Vermont", issued by the State Planning Board of Vermont, and on general reports on "State Planning (Review of Activities and Progress)" and "Regional Factors in National Planning", both issued by the National Resources Board. While the population of the United States as a whole increased by more than 140 per cent between 1880 and 1930, that of New England increased by little more than 100 per cent and that of the State of Vermont by less than 10 per cent. Seventy-seven per cent of the New England population is now urban, and only 6 per cent remains on farms. Simultaneously, the occupied population has declined to 42 per cent (as against 47.2 per cent in England and Wales), the long established shrinkage of employment in agriculture, forestry and mining being accentuated by contraction of employment in manufacturing and mechanical industries. These contractions are balanced by expansion of employment in trade, transport, professional, public, clerical, domestic and personal services.

A SIGNIFICANT feature is the large increase in part-time farmers, and about one third of the area is still in farms. Attempts are being made to classify farms in relation to their suitability for profitable agriculture. It is anticipated that expansion of milk production on the better farms, for example, would more than make good any loss through winding up uneconomic holdings. The problem of the hill districts is also being tackled by a programme of woodland development and especially in planning for recreation. In building up a recreation industry, whether in relation to preservation of scenery and amenities, alliance between recreation and forestry, sports, improved communications, New England developments have perhaps most to teach Great Britain, and especially in regard to planned instead of piecemeal development. The Planning Boards in the

six States only date from 1935 and the six chairmen with an independent chairman and two co-opted citizens, make up the New England Planning Commission, which is assisted by consultants, a small staff of technical assistants, and an advisory committee of 546 members distributed throughout New England and representing all types of activities—housing, transport, town planning, industry, etc. This Committee does not meet as a whole.

Future of Air-Conditioning

IN the July number of *Water Works and Sewerage* the editor makes some timely comments on the future of air-conditioning. Apparently water supply managers have little definite information as to the probable demands on local water supply facilities that will be made in the near future. Another important problem that has to be considered is the question of sewerage facilities capable of handling the increased loading to be imposed in the form of spent water discharged from the cooling equipment into sewers that have not been designed for this load. At the recent convention of the American Water Works Association some interesting data were given. During the year 1935-36, the air-conditioning capacity installed had increased 35½ per cent in Chicago. During the same period, the water sold to air-conditioned premises had increased 38 per cent. The figures also show that the peak demand for a district which is now only 16 per cent air-conditioned is 130 per cent above the daily average demand. In July and August also, the demands per 24 hours in the districts most densely air-conditioned reached 170 per cent of the annual average. The average over non-conditioned districts during the same two months was only 10 per cent. In a block of buildings containing theatres, hotels and restaurants all using air-conditioning the maximum per cent of the daily average was 250. Chicago is in the happy position that its major mains and pumping capacity seem sufficient for ten years more at this rate of growth. On the other hand, deficiencies of sewers will have to be made good, unless wasteful evaporative type cooling devices are installed in air-conditioning plant.

Earthing the Metal Sheathing of Electric Cables

A DIFFICULTY in connexion with electric supply when metal sheathing of electric wiring and apparatus is employed is how to connect this sheathing to earth in such a way that, in the event of it becoming electrified owing to a fault developing between the sheathing and a main, the faulty circuit may be disconnected at once and consequently the pressure between the sheathing and the earth cease to be dangerous. To secure this it is necessary that the sheathing be a continuous conductor of small resistance and that it is maintained in good electrical connexion with the earth. The Wiring Regulations of the Institution of Electrical Engineers stipulate that the electrical resistance of the metal sheathing or tubing must not exceed one ohm between any two points of its length. In practice this can easily be measured by testing. The connexion of this metal

sheathing to earth is more difficult to specify but in general it is stipulated that its resistance must not exceed one ohm. When it has this low resistance, the cut-out of the faulty main will act and so the sheathing and the metal in contact with it ceases to be dangerous. Where it is economically impracticable to obtain an earth having a resistance of not more than one ohm, earthing must be supplemented by an earth leakage 'trip-coil' so adjusted that it will operate at not more than 30 milliamperes. The resistance of an earth electrode depends very largely on the humidity and the character of the soil in which it is buried.

IN many cases when the supply is taken from overhead mains and there is no water supply, compliance with the I.E.E. regulations is very difficult and practically impossible. In this case the neutral main of a four-wire system of supply gives an easy method of getting an approximate earth potential over the whole of the supply area. Where there are no parasitic currents from tramways, this system has many advantages. This system is used in some parts of Australia and New Zealand. The Electricity Commissioners and the Postmaster-General have given their special consent to its use in certain districts in Great Britain. When this system is adopted, no fuse must be inserted in any conductor connected with the neutral main. This leads to a simplification and consequent cheapening of electrical installation work. In Australia, the State Electricity Commission of Victoria has recently altered its wiring regulations. The provision of an automatic circuit breaker is made compulsory in all new installations. In addition, breakers have to be installed in all existing installations at the expense of the supply authority. It will be interesting to see how this works in practice.

The Enforcement of the Rules of the Road

SUGGESTIONS made by Dr. H. C. Dickinson, the chairman of the Highway Research Board of the U.S.A., are the subject of a recent report issued by Science Service. Traffic experts to-day are aiming at simplifying the traffic rules and reducing their number so far as possible. Dr. Dickinson has reduced them to four. The first is to keep to your own lane of traffic with only two thoughts in mind, namely, to watch the car ahead and to warn the car behind you whenever you do anything which changes your movement in your own traffic lane. Secondly, to realize that you have no right to cross or turn into another traffic lane. Thirdly, to give a clear signal, or indicate by the motion of your car, whenever you change from your own traffic lane. Finally, never exceed a speed at which the car cannot be stopped without interfering with other traffic in the lane. When an accident causes personal injury or damage to a car—other than fenders or bumpers—it should be obligatory for both parties to attend the action in court. In personal injury cases, the permits of all the drivers involved should be suspended pending the hearing, and the permit of innocent drivers, if any, could

then be restored. Dr. Dickinson makes the novel suggestion that when an accident has nearly occurred and has only been prevented by the quick-wittedness of one of the actors, regulations should be issued which would enable 'enforcing' officers to issue 'tickets' to drivers endangering other drivers or pedestrians. The charge he suggests is that of 'creating a public danger', and the penalty a small fine or dismissal on probation. Repeated offences could be dealt with more severely. The object of the proposal is to make it very unpleasant for anyone who puts another person in jeopardy even although no harm results.

Zoological Types in India

THE series of "Indian Zoological Memoirs" has been enriched by an excellent monograph, illustrated by 65 text figures, on "Palæmon, the Indian River Prawn", by Dr. S. S. Patwardhan (Pp. xi+100. (Lucknow: Lucknow Publishing House, 1937.) 2 rupees). These monographs are intended to assist in the teaching of zoology in India by the selection of a number of readily obtainable types, which can be worked out fully by students in their own time and perhaps at their homes. A single animal studied closely in respect to its anatomy with the consequent consideration of the function of all its parts is bound to be of great help. To this is added, in the judicious selection of types here, the possibility for the student to study his forms in Nature. The illustrations are good black and white drawings in close proximity to the descriptions of the parts, and there are directions for the necessary dissections. If we are to make any suggestions, we would plead for a greater consideration of function, and references might be inserted freely, so that interested students may be induced to examine their types in a more intelligent manner. For example, in this prawn a consideration of the mode of action of the mouth appendages may be deemed essential to the study of their anatomy—and we find no references to the considerable bulk of recent work on this matter. Form and function are inseparable, and both are essential to the study of the living animal. For a young student, the author assumes a little too much, the monograph being more useful to his teacher.

Institution of Professional Civil Servants

THE eighteenth annual report of the Council of the Institution of Professional Civil Servants covers the year 1936 and refers to a large increase in membership, which was 50 per cent greater than in 1935, when the figure of 10,000 was reached for the first time. One of the outstanding achievements of the year was the successful prosecution of salary claims on behalf of architectural and civil engineering and mechanical and electrical drawing office staffs. The satisfactory settlements which were reached are attributed largely to the extensive research of the Committee, which proved that such staffs were underpaid in comparison with similar employees outside. The report again emphasizes the importance of the National Whitley Council to members of the Institution. The

Council has also been concerned with the completion of the application of the recommendations of the Carpenter report to scientific establishments, and in his presidential address at the annual meeting on April 29, Sir Richard Redmayne emphasized the necessity for the upgrading of the highest professional and scientific posts in the Civil Service, which, so far as remuneration is concerned, compare most unfavourably with posts carrying a similar responsibility outside the Service. A sub-committee is considering appropriate salaries for those professional posts outside the scope of arbitration with the view of making representations to the authorities. The Association is also dealing with the salaries of architects, engineers and surveyors in the Civil Service. Sir Richard criticized the Treasury for refusing to allow the reference to arbitration of the Institution's claim that women scientific officers should receive the same scales of pay as their male colleagues in the same grade, and stated that the Chancellor of the Exchequer had been asked to receive a deputation on this question.

Fruit Supplies in 1936

THE Intelligence Branch of the Imperial Economic Committee has issued a volume dealing with fruit supplies during 1936 (H.M. Stationery Office, pp. 106. 2s. 6d. net or 2s. 9d. post free). 55 per cent of the total import of fruit was of Empire origin. So high a proportion has never before been reached. There are, however, some very potent lessons for the home producer. The present report gives the convincing information that each apple tree yielded an average of 12.7 lb. of fruit in 1935, and 68.3 lb. in 1936. The "untimely and unusually severe frost" in May of 1935 is mentioned as the main cause of that season's low yield. It cannot be emphasized too strongly that the effects of frost are now largely within the control of the grower. The pioneer work of Mr. George Harrington, the investigations into general principles by various scientific workers, and the practical experiments by the technical staff of Messrs. Geo. Monro, Ltd., have made the practice of orchard heating a practical proposition without heavy finance. Total imports of raw fruit into the United Kingdom remain fairly steady around an average of nearly 28,000,000 cwt., and apple imports are not very variable around a mean of about 6,500,000 cwt. Imports of grapes, peaches, lemons, pineapples and plums from Empire sources were higher in 1936 than ever before, and more bananas were imported by Great Britain than in any previous year. Supplies of fruit from South Africa reached a new record. Totals for most fruit imports were, however, lighter than in 1935.

The Ross Institute

A MEETING of the Industrial Advisory Committee of the Ross Institute, which is now incorporated with the London School of Hygiene and Tropical Medicine, was held on May 28, at which the activities of the Institute were surveyed. Useful discussions also ensued upon the housing of African labour, the

risk of malaria when replanting rubber, the Indore process of disposal of night soil and town refuse and courses of instruction for laymen proceeding to the tropics. Information was also given of an investigation by Dr. Crowden at the School of Hygiene of experiments on air-conditioned cubicles for use in the tropics.

Fast Atlantic Crossing by Air

THE Empire flying-boat *Cambria* crossed the Atlantic on September 28 in the fastest time ever recorded. The distance of 2,000 miles from Newfoundland to Foynes, near Limerick, was covered in 10 hr. 36 min., giving an average speed of 190 miles an hour. According to the account in *The Times* of September 29, Captain G. J. Powell made tests of speed at various altitudes. During the first part of the flight he remained at 4,000–5,000 ft. and made speeds of 172.6–185 m.p.h. Later he climbed to 7,000 ft. and attained a speed of 195 m.p.h. Bad weather then forced him to 13,000 ft. when his speed fell to 167 m.p.h. Eventually, he reduced the height to 10,000 ft., where the most favourable wind for the easterly part of the journey was found.

The Night Sky in October

SUMMER Time ends on October 3 at 2^h U.T. The moon is new on October 4 at 12.0^h and full (the Hunter's Moon) on October 19 at 21.8^h. Conjunctions between the moon and the planets occur as follows: Venus on October 2 at 4^h; Mercury on October 3 at 6^h; Mars on October 11 at 18^h; Jupiter on October 12 at 17^h and Saturn on October 18 at 8^h. On October 29 at 17^h, Mars and Jupiter are in conjunction; the two planets passing within 1½° of one another (heliocentric positions). On October 11 at 6^h, Venus is in conjunction with Neptune. On October 15, Uranus is near the sixth magnitude star α Arietis; the diameter of the planet is 3½". The satellites of Jupiter, which always offer an attractive field for observation, present a few special features this month. On October 5 at 2^h 24^m–27^m Satellite II will be partly eclipsed by Satellite I. On October 7 a similar eclipse of these two satellites takes place at 22^h 07^m–24^m, the magnitude of the eclipse being 0.4. On October 17, I is partially eclipsed by III at 3^h 27^m–36^m. Appulses between II and I occur on October 12^d 01.9^h and October 22^d 1.0^h, whilst a complete occultation of II by I will take place on October 25^d 17.9^m. On October 13, Jupiter will occult the seventh magnitude star *B.D.* –22° 5100 = *C.D.* 13939, the emersion being visible in Great Britain at 18^h 34^m at position angle 276° from the north point of the planet's image ("*B.A.A. Handbook*, 1937", p. 19). The light variation of Algol (β Persei) may be observed about 1½ hours before and after the following times: October 3^d 19.6^h; 18^d 03.7^h; 21^d 00.5^h and 23^d 21.3^h. The periodic comet, Encke, which was re-discovered by Jeffers on September 3 at the Lick Observatory, passes from Triangulum to Andromeda during the month. The comet, which was of magnitude 18 at the time of discovery, is still very

faint, its anticipated magnitude at perihelion on December 27 being about 5.5. An ephemeris for this comet is given by Dr. A. C. D. Crommelin in "B.A.A. Handbook", p. 34; corrections to this ephemeris are given by L. E. Cunningham, using the positions obtained by Jeffers at re-discovery. The zodiacal light may be seen before dawn in the first part of the month when the moon is absent. In view of the present general high level of solar activity, the northern skies may also be scanned for the presence of auroral light.

Announcements

H.M. QUEEN MARY has once again shown the keen interest she takes in the higher education of women by promising to visit the Royal Holloway College (University of London) at Egham on October 12. H.R.H. Princess Alice is chairman of the governors of this women's College, which has about two hundred students, and she shows a highly practical interest in the College and in the careers of its students. It is worthy of mention that during the university year just closing a student of Royal Holloway College, Miss Gladys E. Muddle, gained the Sherbrooke Studentship and the Sir John William Lubbock Memorial Prize, open to all students of mathematics in the University of London.

SIR THOMAS HOLLAND, principal of the University of Edinburgh, and formerly director of the Geological Survey of India, has accepted the presidency of the Geographical Association for 1938.

THE Le Chatelier Memorial Lecture of the Chemical Society will be delivered on October 28 at 5.30 p.m. by Dr. C. H. Desch, superintendent of the Metallurgical Department, National Physical Laboratory.

THE Sex Education Society has issued a programme of seven lectures to be given at the Conway Hall, Red Lion Square, W.C.1, during the present session. The first will be delivered by the president, Dr. Norman Haire, at 8 p.m. on October 5. The full programme can be obtained from the Honorary Secretary, 27 Harley Street, W.1.

THE Annual Conference of Greenkeepers will be held at St. Ives Research Station, Bingley, Yorkshire, on October 19. During the morning, a tour of the Research Station will be made, and during the afternoon a series of short papers will be given. A course on scientific greenkeeping will be held on October 20-26. The course will include non-technical lectures by members of the staff of the Research Station, coupled with practical work and demonstrations on the experiment ground. Further information can be obtained from the Director, St. Ives Research Station, Bingley.

THE British Drug Houses, Ltd., Graham Street, London, N.1, have issued a new edition of their

booklet dealing with B.D.H. standard stains, and including also a full range of the various materials required by the microscopist; the booklet may be obtained free on application. Useful notes are appended upon the bacteriological, histological and pathological applications of the various stains and materials, most of which can be supplied in small quantities suited to the requirements of the individual worker.

DR. S. C. BLACKTIN writes to point out that an error occurs in the short article contributed by Dr. J. S. Owens to NATURE of August 21 upon his "Electrotor Smoke and Dust Meter". The article was based solely upon a paper by Dr. Blacktin in the *Journal of Industrial Hygiene and Toxicology*, and not upon an examination of the instrument itself. Referring to the insertion of a new record disk, the words were used "and the cap with its disk screwed into position". Dr. Blacktin points out that this was a misunderstanding of the statement made in his paper; for the record disk is *not* supported inside the cap of the instrument but on a table under it.

THE Academy of Sciences of Cuba has recently celebrated the seventy-fifth anniversary of its foundation.

A CHAIR of social medicine has recently been created in the University of Paris. Its incumbent will initiate fifth-year students into certain elements of preventive medicine such as sickness insurance.

DR. JOHN E. GORDON, field director of the International Health Division of the Rockefeller Foundation, New York, has been appointed professor of preventive medicine and epidemiology at Harvard University Medical School.

THE John and Mary R. Markle Foundation of New York has presented one hundred thousand dollars to the National Research Council for the support of research in endocrinology in the next three years. The fund will be administered by the Division of Medical Sciences.

AS the result of years of agitation by social reformers, no marriage will be possible in the Argentine in future unless the bridegroom is able to present to the civil authorities a certificate that he is free from contagious diseases transmissible in wedlock. The law, which is to be enforced immediately, does not apply to women. Other clauses in the law provide for the compulsory hospitalization of refractory cases of contagious infection and the closing of houses of ill-fame.

ERRATUM. In the obituary notice of Prof. H. E. Armstrong in NATURE of July 24, on p. 140, col. 1, lines 17 and 16 from bottom, for "Sir George Grove" read "Sir William R. Grove".

(5) The relation of the remarkably stable compounds of chloranil and bromanil with hexamethyl benzene, etc.—for example, $C_6Br_4O_2 \cdot C_6(CH_3)_6$ —to the quinhydrones⁷ is confirmed. The same alternation of components along *a* is observed, with identical *a* spacing; this brings the planes of the bromanil and the hexamethylbenzene molecules practically into contact. In these compounds there can scarcely be any question either of hydrogen bonds or of the formation of co-ordinate links.

(6) The direction of maximum light absorption in the quinhydrones and both the maximum of light absorption and the slow vibrational direction in the even more strongly pleochroic bromanil-hexamethyl benzene compound coincide with *a*.

	<i>a</i>	<i>b</i>	<i>c</i>	β	<i>n</i>	Space group
Quinhydrone	7.70	6.04	21.8	90°	4	C_{2h}^5
$C_{10}H_6O_2 \cdot C_6H_4(OH)_2$	7.70	6.16	27.4	Rhombic	4	V^4
$C_6Br_4O_2 \cdot C_6(CH_3)_6$	7.40	8.83	28.7	Rhombic	4	V^6
$C_6H_4O_2 \cdot 2C_6H_5OH$	11.50	6.16	22.2	100°	4	C_{2h}^5
$C_6H_4O_2 \cdot 2CH_3C_6H_4OH$	11.83	6.2	24.6	97°	4	C_{2h}^6
$C_6H_4O_2 \cdot 2Br \cdot C_6H_4OH$	12.16	6.16	24.3	96°	4	C_{2h}^5
$C_6H_4O_2 \cdot 2Cl \cdot C_6H_4OH$	12.00	6.16	23.5	97°	4	C_{2h}^6

Along this direction the aromatic molecules are stacked plane to plane at a perpendicular distance of the order of 3 Å. The trend of the evidence makes the conclusion inevitable that this represents also the direction of bonding, in which case the mechanism (*c*) is the most probable. The formation of hydrogen bonds in quinhydrone is not necessarily excluded, and their presence is now being sought by the elegant method of Robertson and Ubbelohde⁸.

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¹ Bernal, *Trans. Faraday Soc.*, **33**, 211 (1936).

² Bennett and Willis, *J. Chem. Soc.*, 256 (1929).

³ cf. Briegleb, *Z. phys. Chem.*, B, **26**, 83 (1934).

⁴ Hertel, *Z. phys. Chem.*, B, **11**, 59, 77 (1930); **22**, 280 (1933).

⁵ *Anal. Fis. Quim.*, **30**, 421 (1932); **33**, 627 (1935).

⁶ cf. Chem. Soc., Annual Reports, **30**, 420 (1933).

⁷ Pfeiffer, *Ann.*, **404**, 1 (1914).

⁸ NATURE, **139**, 504 (1937).

Duality of the Coproporphyrins in Bovine Congenital Porphyria

OF the four theoretically possible isomeric types of porphyrins, only those belonging to Series I and III have so far been encountered in Nature. Hæmoglobin, bilirubin, cytochrome, etc., are Series III derivatives. Series III has thus come to be regarded as the normal or 'physiological' type. Excretion of excessive amounts of porphyrins belonging to Series III does, however, occur in certain pathological states including lead poisoning (Grotepass¹, Mertens², Fischer and Duesberg³), pigment cirrhosis of the liver (Dobrin⁴), hepatic tumours (Dobrin⁴) and after administration of salvarsan (Schreus⁵). The uroporphyrin excreted in acute idiopathic porphyria has been shown to be uroporphyrin III (Waldenström⁶, Mertens⁷), whilst Dobrin⁴ has detected the simultaneous presence of coproporphyrins I and III in the stool from one such case.

The pigments formed in excessive amount by congenital porphyrias were until recently thought to

belong exclusively to Series I, but Fischer and Hofmann^{8,10}, working with material from the human case 'Petty', and Rimington^{11,12} studying congenital porphyria in bovines, have shown that small quantities of uroporphyrin III accompany uroporphyrin I in this disease.

We have now been able to isolate coproporphyrin III from the urinary and faecal coproporphyrin mixture of the same bovines, thus extending the duality also to the coproporphyrins. Evidence strongly suggestive of the presence of coproporphyrin III in small amounts in the bile porphyrins of a previous bovine case had already been obtained chromatographically by Rimington¹¹, but the quantities available were insufficient to allow of crystallization.

In the present instance, the total coproporphyrin fraction (faeces or urine) was esterified and the more soluble coproporphyrin III methyl ester extracted by stirring with cold methyl alcohol (compare Dobrin⁴; we are indebted to Dr. E. Mertens for privately suggesting this technique). After several repetitions of this procedure, the Series III ester was dissolved in a few drops of dioxane, a little methyl alcohol added and then sufficient water, drop by drop, to render the mixture slightly opalescent. On standing in the ice-chest, the porphyrin was deposited in micro-crystalline form, m.p. 138/172° (Fig. 1). Synthetic coproporphyrin III methyl ester (the gift of Prof. H. Fischer, whom we wish to thank), crystallized in the same way, had m.p. 140°. Mixed m.p. 138°. Spectrum of ester in ether: 625.3; 599.3; 587.5–566.7; 531.6; 498.7. Three different preparations were made.

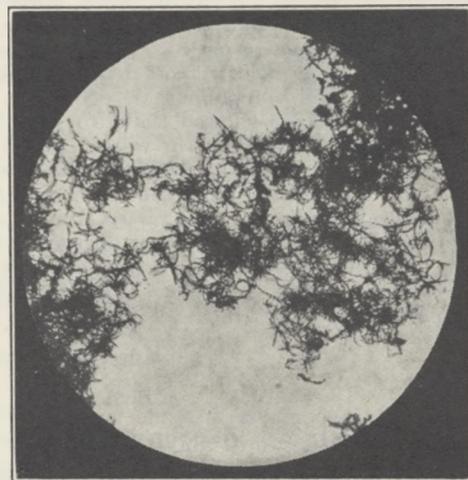


Fig. 1.

COPROPORPHYRIN III FROM URINE: BOVINE CONGENITAL PORPHYRIA. \times ABOUT 100.

The occurrence of Series III porphyrins together with those of Series I in congenital porphyria may be traceable to a secondary toxic effect (Fischer and Hofmann¹⁰), but is equally readily explicable on the basis of the scheme put forward by Rimington^{11,12} picturing a catalysed synthetic mechanism in the hæmatopoietic tissue.

We have also encountered another pigment in these urines which we believe to be a hitherto

undescribed porphyrin. The methyl ester crystallizes in rectangular or rhomboidal prisms, resembling protoporphyrin ester, has m.p. 233–38° and a spectrum closely similar to that of coproporphyrin. The quantity obtained is as yet insufficient for analysis.

CLAUDE RIMINGTON.
G. C. S. ROETS.

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Aug. 22.

- ¹ Grotepass, *Z. physiol. Chem.*, **205**, 193 (1932).
- ² Mertens, *Klin. Woch.*, **16**, 61 (1937).
- ³ Fischer and Duesberg, *Archiv. expt. Path. Pharm.*, **166**, 95 (1932).
- ⁴ Dobriner, *J. Biol. Chem.*, **113**, 1 (1936).
- ⁵ Schreus, *Klin. Woch.*, **14**, 1717 (1935).
- ⁶ Waldenström, *Deut. Archiv. Klin. Med.*, **178**, 38 (1935).
- ⁷ Mertens, *Z. physiol. Chem.*, **238**, 1 (1936).
- ⁸ Dobriner, *Proc. Soc. Expt. Biol. Med.*, **35**, 175 (1936).
- ⁹ Fischer and Libowitzky, *Z. physiol. Chem.*, **241**, 220 (1936).
- ¹⁰ Fischer and Hofmann, *Z. physiol. Chem.*, **246**, 15 (1937).
- ¹¹ Rimington, *Onderstepoort J. Vet. Sci.*, **7**, 567 (1936).
- ¹² Rimington, *NATURE*, **140**, 165 (1937).
- ¹³ Rimington, forthcoming publication in *Comptes Rendus Trav. Lab. Carlsberg: Sørensen Festschrift*.

Disintegration Processes by Cosmic Rays with the Simultaneous Emission of Several Heavy Particles

ON photographic plates which had been exposed to cosmic radiation on the Hafelekar (2,300 m. above sea-level) near Innsbruck for five months, we found, apart from the very long tracks (up to 1,200 cm. in length) which have been reported recently in a note in the Wiener Akademie-Berichte, evidence of several processes described below.

From a single point within the emulsion several tracks, some of them having a considerable length, take their departure. We observed four cases with three particles, four with four and 'stars' with six, seven, eight and nine particles, one of each kind.

The longest track corresponded to a range in air (15°, 760 mm. Hg) of 176 cm. The ionization produced by the particles is different in the different cases. Most of the tracks show much larger mean grain-distances than α -particles and slow protons.

In Fig. 1 a 'star' with eight tracks is reproduced. On account of the rather steep angles at which some of the particles cross the emulsion-layer (approximately 70 μ thick) it is not possible to have all the tracks of a 'star' in focus simultaneously. Fig. 2 shows a sketch of the same 'star'. Measurement of the tracks gives the results in the accompanying table.

Track	Length in cm. of air (15°, 760 mm.)	Number of grains	Position of the end of the track
A	30.0 cm.	113	Within the emulsion
B	11.0 "	15	" " "
C	44.6 "	71	Glass
D	6.2 "	11	"
E	7.0 "	22	"
F	1.2 "	5	Within the emulsion
G	13.6 "	67	Surface of the emulsion
H	23.9 "	58	Glass

Centre of the 'star' 25 μ under the surface of the emulsion.

We believe that the process in question is a disintegration of an atom in the emulsion (probably Ag or Br) by a cosmic ray. The striking feature

about it is the simultaneous emission of so many heavy particles with such long ranges, which excludes any confusion with 'stars' due to radioactive contamination. A similar configuration of tracks by chance is equally out of question. Brode and others¹

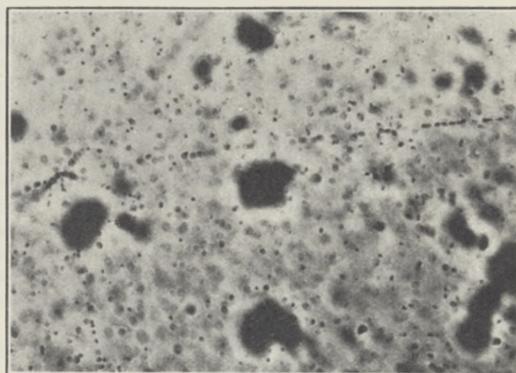


FIG. 1.

observed a single case of a disintegration with three heavy particles in a Wilson cloud chamber. The phenomenon which Wilkins believes was a shower of protons is perhaps a similar process, but he did not observe a centre².

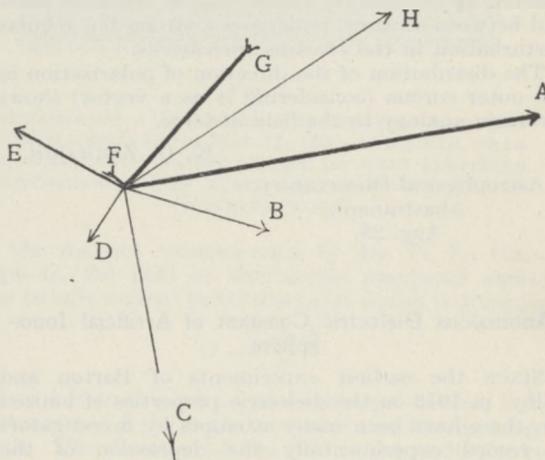


FIG. 2.

THICK LINES INDICATE A COMPARATIVELY LARGE NUMBER OF GRAINS PER UNIT OF LENGTH OF THE TRACK. AN INTERRUPTED LINE MEANS THAT THE TRACK IS TOO LONG TO BE REPRODUCED ON THE SAME SCALE. THE ARROWS INDICATE THE DIRECTION FROM THE SURFACE OF THE EMULSION TO THE GLASS.

The total energy involved in the process cannot as yet be calculated as most of the particles do not end in the emulsion.

We hope to give further details before long in the Wiener Akademie-Berichte.

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¹ Brode, R. L., and others, *Phys. Rev.*, **50**, 581 (October, 1936).
² Wilkins, *Nat. Geog. Soc., Stratosphere Series*, No. 2, 37 (1936).

Polarization of the Solar Corona

DURING the eclipse of June 19, 1936, at the observation station near the village of Kalenoe on the banks of the Ural River (U.S.S.R.), an investigation of the polarization of the solar corona was carried out by the expedition from Abastumani Observatory. The observations were made under perfect atmospheric conditions. A polarigraph with a reflecting analyser was used. The polarization was studied in two regions of the spectrum, corresponding to photographic and visual rays. In each series three plates were obtained with planes of polarization making angles of 60°. This enabled us to determine the degree and the direction of polarization at each point. On the plates the zone from 10' to 40' from the limb was found to be suitable for accurate photometric measurements. The effect of polarization is obvious.

From the study of the distribution of the degree and direction of the polarization, we can draw the following preliminary conclusions:

(1) The degree of polarization is different for different regions of the spectrum.

(2) The change of the polarization with increasing distance from the moon's limb is different for different heliographic latitudes, and depends on the structure of the corona. At places with a sharp radial structure (in corona streams) the polarization changes little, while between the streams it diminishes with the distance from the moon's limb.

(3) The direction of the polarization, while remaining approximately radial close to the solar poles and between streams, undergoes a strong but regular perturbation in the streams themselves.

The distribution of the direction of polarization in the outer corona (considering it as a vector) shows a certain analogy to the field of force.

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Anomalous Dielectric Constant of Artificial Ionosphere

SINCE the earliest experiments of Barton and Kilby¹ in 1913 on the dielectric properties of ionized air, there have been many attempts by investigators to record experimentally the depression of the dielectric constant of an artificial ionosphere (as the ionized air in a discharge tube may more properly be called) to a value less than unity. It has, however, been found by almost every investigator that the reduced value of the dielectric constant could be obtained only under very special experimental conditions such as low value of ionization in the experimental discharge tube or ultra-high frequency of the exciting wave; while, more often than not, the value of the dielectric constant recorded was greater than unity. This latter result is usually believed to be contradictory to the theory, and various explanations have been put forward to explain the apparent anomaly.

The purpose of this note is to show from a consideration of the ionospheric dispersion formula that the so-called anomaly is not an anomaly at all, since the formula itself yields values of the dielectric constant greater than, equal to, or less than unity, depending upon the experimental conditions of the discharge tube such as the degree of ionization, the

pressure (that is, collisional frequency) and the exciting wave frequency.

The complete dispersion formula is given by

$$\left(\mu - \frac{icx}{p}\right)^2 = 1 + \frac{1}{\alpha + i\beta} \dots (1)$$

Where $\alpha = -\frac{p^2m}{4\pi Ne^2}$ and $\beta = \frac{mpv}{4\pi Ne^2}$

The symbols have their usual significance.

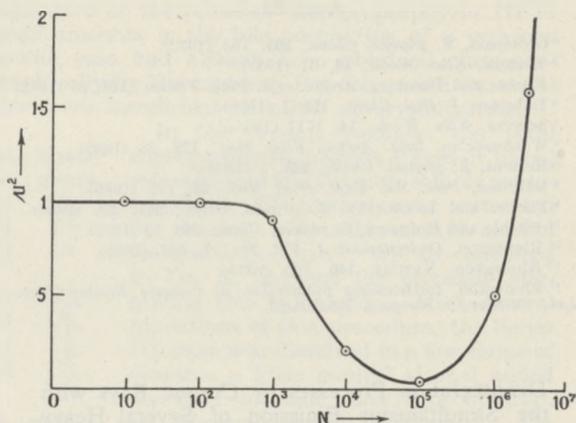


Fig. 1.

Separating the real and the imaginary parts, we have²

$$2\mu^2 = \sqrt{1 + \frac{2\alpha + 1}{\alpha^2 + \beta^2}} + \frac{\alpha}{\alpha^2 + \beta^2} + 1 \dots (2)$$

$$\frac{2c^2x^2}{p^2} = \sqrt{1 + \frac{2\alpha + 1}{\alpha^2 + \beta^2}} - \frac{\alpha}{\alpha^2 + \beta^2} - 1 \dots (3)$$

It is easily seen from expressions (2) and (3) that μ^2 is greater than, equal to, or less than, unity, according as

$$\frac{|\alpha|}{\alpha^2 + \beta^2} < \frac{c^2x^2}{p^2}$$

If $\alpha \gg \beta$, expression (2), reduces to

$$\mu^2 = 1 - \frac{4\pi Ne^2}{m(p^2 + v^2)} \dots (4)$$

The approximate formula (4), which apparently suggests that μ^2 cannot attain a value greater than unity, has been responsible for the widespread belief "that the theoretical expression for the dielectric constant of an ionized medium does not permit values greater than unity, whatever the ionic concentration may be"³. Calculation of values of μ^2 from the complete dispersion formula shows, however, that the theoretical expression for the dielectric constant does permit values both greater, and less than, unity.

Figs. 1 and 2 are plots of equation (2). In Fig. 1, the dielectric constant is plotted against the ionic density N , all other quantities remaining constant. It is seen that only within a limited range of N can values of μ^2 less than unity be recorded. If N is increased beyond this range, the value of the dielectric constant increases and becomes greater than unity.

Fig. 2 is drawn for values of v , N and p as were obtained in an actual experiment by Mitra and Banerjee⁴. The broken line prolongation of the left-hand portion of the curve is obtained by using the approximate formula (4). Mitra and Banerjee had explained the upward swing of the curve to the right

by assuming the effect of conductivity in their experiment. It is now seen that the existence of this portion of the curve is implied in the complete dispersion formula (2). The expression under the square root contains terms which take into account the

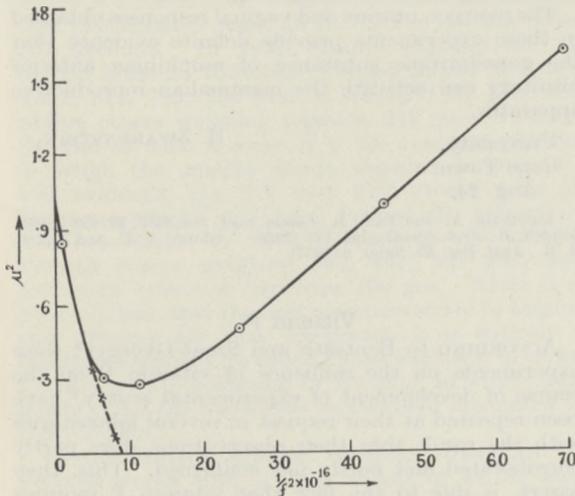


Fig. 2.

effect of conductivity. The fact that the experimental curve of Mitra and Banerjee, though similar in nature to Fig. 2, does not agree closely with it, shows that the disposition of the experimental apparatus had possibly some influence.

S. K. MITRA.
K. K. ROY.

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Calcutta.
Aug. 16.

¹ Barton, E. H., and Kilby, W. B., *Phil. Mag.*, **28**, 567 (1913).
² White, F. W. G., "Electro-magnetic Waves" (Methuen and Co., 1934), p. 58.
³ Appleton, E. V., and Chapman, F. W., *Proc. Phys. Soc.*, **44**, 253 (1932). (The remark quoted is for the case of no external magnetic field.)
⁴ Mitra, S. K., and Banerjee, S. S., *NATURE*, **138**, 512 (1935).

Effect of Near Lightning Discharges on a Magnetometer

DURING two thunderstorms at the beginning of the present monsoon, the recorded curves of the Copenhagen declination magnetograph recently installed at Alibag showed some characteristic features which on examination appear to be due to the effect of the magnetic field of the lightning discharge currents on the magnetometer. The magnetograms are reproduced in Fig. 1. The variations occurred between 2 hr. and 4 hr. and between 18 hr. and 22 hr. I.S.T. The storm was most intense in the second of the two intervals at about 20 hr. The magnetometer needle experienced a number of sudden kicks, and the subsequent oscillations gradually died down in 2-3 minutes. The maximum first deflection was about 1.5 mm.

It is easy to make a rough estimate of the deflection of the magnetometer needle that may be expected due to the magnetic field of a near lightning discharge. For impulsive discharges the total duration of which is small compared with the periods of the magnetometer, the instrument will behave as a ballistic galvanometer, the relation between the discharge current, its

duration, the constants of the suspended needle and the field in which it is suspended being given by the usual formula :

$$\int idt = q = \frac{HT}{\pi G} \sin \frac{\theta}{2} \left(1 + \frac{\lambda}{2}\right),$$

if the magnetic field due to the current is perpendicular to H . In the present instance, T was 3.95 sec. and H was $\frac{0.376}{4.9}$ gauss. The effective magnetic field was smaller in the ratio 1 : 4.9 because, in order to increase the sensitiveness of the magnetometer, the north pole of the needle had been made to face south by applying torsion to the suspending quartz fibre

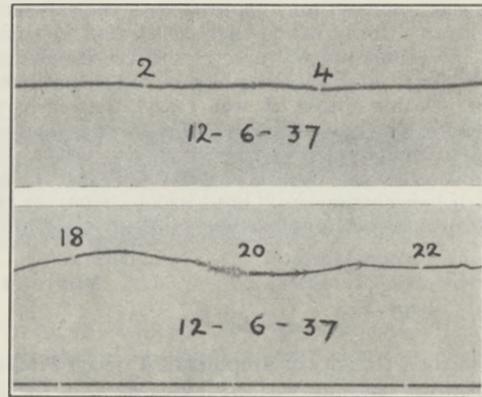


Fig. 1.

RECORDS OF A D. LA COUR DECLINATION MAGNETOGRAPH OBTAINED ON MAY 12, 1937, AT ALIBAG, NEAR BOMBAY, SHOWING THE EFFECT OF NEAR LIGHTNING DISCHARGES. THE TIMES ARE IN HOURS (INDIAN STANDARD TIME).

in the manner recommended by Dr. D. La Cour. Now G , the field at the needle (supposed short) due to unit current in the discharge circuit is given by

$$G = \frac{l \sin \theta}{r^2},$$

where l is the length of the discharge current, r its distance and θ the angle between r and the discharge path. The direction of the field is perpendicular to the plane containing l and the centre of the needle. Assuming $\sin \theta = 1$, $l = 2$ km. and $r = 2$ km., then $G = 5 \times 10^{-6}$. A probable value for q is 20 coulombs (see C. T. R. Wilson's article on Atmospheric Electricity in the "Dictionary of Applied Physics"). From these data the deflection of the needle can be easily calculated. It comes out to be $1/4820$ radian when the lightning discharge is most favourably oriented. The corresponding deflection on the chart when the distance of the photographic paper from the mirror of the magnetometer is 165 cm. is $2 \times 165/4820$ cm. or 0.7 mm. The observed and expected deflections are of similar magnitudes.

Attempts are being made to design a simple magnetometer with a Helmholtz compensating coil for the purpose of measuring the discharges of individual lightning flashes.

K. R. RAMANATHAN.

Colaba Observatory,
Bombay.
Aug. 6.

Sensitization of the Skin of Mice to Light by Carcinogenic Agents

WHITE mice painted twice a week for three weeks with benzpyrene in benzene are found to be sensitized to light. The mouse is painted and exposed to direct sunlight for a half to one hour; during the exposure the skin of the painted area becomes red and markedly oedematous. There is no latent period to this reaction; within a few minutes of the exposure the mouse becomes ill at ease, scratches the painted region and tries to hide it from the sun. The next day, the area shows a definite dermatitis.

Unpainted white mice having the hair closely clipped over the same region showed no reaction after three hours' exposure or at any subsequent time; unpainted areas in the experimental mice gave no reaction, nor did mice painted with the solvent.

Exposures to infra-red radiations and to ultra-violet radiations did not give rise to these reactions. By dividing the visible spectrum into three with Kodak gelatine filters, it was found that only the blue-violet light was effective: this corresponds with the absorption spectrum of benzpyrene.

Similar reactions have been obtained with tar and with di-benzanthracene, but which part of the spectrum is responsible has not yet been ascertained.

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Sept. 14.

I. DONIACH.
J. C. MOTTRAM.

Gonadotropic Activity of Amphibian Anterior Pituitary

PREVIOUS attempts, using infantile mice or rats as test animals, to demonstrate the presence of a gonadotropic substance in the anterior pituitary of frogs have been entirely negative¹. Since implantation of frog's pituitary into frogs causes ovulation, Zondek comes to the conclusion that the frog's pituitary contains a gonadotropic substance which is inactive in warm-blooded animals. The negative results obtained by Lipschutz and Paez and Zondek were probably due to the fact that the amount of pituitary tissue implanted was too small. Adams and Tukey, however, injected saline suspensions of from 16 to 96 frogs' pituitaries into each infantile mouse and still obtained negative results.

In view of the interest of this work from the point of view of comparative endocrinology, similar experiments were performed using *Xenopus laevis*, the South African clawed frog, as donor. Littermate female white mice 19-22 days old were used as recipients. In each experimental series one or two animals received a subcutaneous implant of frog anterior pituitary tissue; two to four mice received control implants of one of the following frog organs: brain, kidney, muscle, spleen, liver, ovary; one to three animals served as normal untreated controls. 72 hours later the mice were examined for opening of the vagina. They were then killed and the ovaries and uteri removed. The ovaries were dissected away from their oviducts and capsules. Fat and loose connective tissue were carefully removed from the uteri. All organs were immediately weighed on a torsion balance.

Implantation of 3.5 mgm. of anterior pituitary caused opening of the vagina but had no effect on the weights of either ovaries or uterus. Implantation of 8-20 mgm. caused opening of the vagina in all but two of twelve animals, also an increase in the weight of the ovaries and a two- to fourfold increase in uterine weight. In two mice hæmorrhagic follicles (*blutpunkte*) were present in both ovaries; the uteri

weighed 31.0 mgm. and 32.5 mgm. (controls, 8 mgm. and the ovaries 4 mgm. and 5 mgm. (controls, 2 mgm. In seven animals uterine weights of 17-23 mgm. were obtained. All control implants gave negative results. A few of the enlarged ovaries were sectioned and showed definite follicular growth.

The ovarian, uterine and vaginal responses obtained in these experiments provide definite evidence that the gonadotropic substance of amphibian anterior pituitary can activate the mammalian reproductive apparatus.

University,
Cape Town.
Aug. 24.

H. ZWARENSTEIN.

¹ Lipschutz, A., and Paez, R., *Compt. rend. Soc. biol.*, 99, 693 (1928).
Zondek, B., *Arch. Gynäk.*, 144, 133 (1930). Adams, A. E., and Tukey, G. R., *Anal. Rec.*, 67, Supp. 2 (1937).

Vitamin P

ACCORDING to Bentsáth and Szent-Györgyi¹, the experiments on the influence of vitamin P on the course of development of experimental scurvy² have been repeated at their request in several laboratories with the result that their observations were partly corroborated and partly not confirmed. This, they assert, is due to the fact that vitamin P requires for its activity the presence of traces of ascorbic acid.

In view of the fact that I repeated the above work independently, it is of interest to compare my results with the above. I was unable to record any vitamin activity with daily doses of 1 mgm. of either 'citri-nesperidin or a mixture of hesperidin and eriodictyol. When, however, sub-optimal preventive doses (0.1 mgm. and 0.2 mgm. of *l*-ascorbic acid a day) were administered alone to the experimental animals, a clinical and pathological condition was produced which resembled that obtained by Szent-Györgyi and his collaborators after the administration of vitamin P. This condition has always been known to occur when antiscorbutic doses lower than the minimum prophylactic dose have been offered to guinea pig on well-balanced scorbutic diets, including the Sherman-La Mer-Campbell diet, which Bentsáth, St. Rusznyák and Szent-Györgyi used in their original investigation.

According to Bentsáth and Szent-Györgyi's latest view¹, one is driven to the conclusion that the basal diet I used (bran, barley meal, middlings, fish meal, crushed oats and autoclaved milk) contained no traces of ascorbic acid, which is undoubtedly true, but contained the hypothetical vitamin P, whilst the Sherman-La Mer-Campbell diet as used by them contained traces of ascorbic acid, although this is not evident from their negative control experiment², but no vitamin P; alternatively, the biological action observed by them was due to the contamination of their 'citri-nesperidin', etc., with traces of ascorbic acid. The object of this note is to record the bearing of my results on the modified view of Szent-Györgyi and his collaborator, which was advanced since the appearance of my paper in the hope that it will help in the solution of this elusive subject.

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Sept. 7.

¹ Bentsáth, A., and Szent-Györgyi, A., *NATURE*, 140, 426 (Sept. 1937).

² Bentsáth, A., St. Rusznyák and Szent-Györgyi, A., *NATURE*, 133, 798 (1936).

³ Zilva, S. S., *Biochem. J.*, 31, 915 (1937).

Meteorites: the Number of Pultusk Stones and the Spelling of "Widmanstätten Figures"

IN criticizing others in NATURE of September 18 (p. 504), Prof. F. A. Paneth lays himself open to criticism. His calculation of the number of Pultusk stones is a remarkable example of what can be done with mathematics when all the factors are not taken into account. In 1868, Krantz supplied for the British Museum collection Pultusk stones weighing 3,545, 845, 793, 256 (half a stone), 139½ gm., and twelve others weighing together 243 gm. Towards the end of such a series it is the common practice to weigh the smaller stones together in one lot; and evidently the 212 (not 210) stones with an aggregate weight of 1 kgm. formed the tail-end of Krantz's stock. In 1908, Krantz was still offering Pultusk stones weighing 565, 492, 382 gm., and numerous others of less than 100 gm. While it is perfectly true that the best museums strive to acquire and preserve the best specimens, it is scarcely a balanced argument to quote, to the exclusion of these, a small private collection in Moravia, in which fragments of all the meteorites represented amounted to only 2 kgm.

In the British Museum collection there are 72 Pultusk stones with a total weight of 18,188 gm., the largest 9,095 gm. and the smallest 6 gm. (that is, less than the average in the Moravian collection); 264 in the Paris collection weigh 31,337 gm.; 175 in Chicago 14,291 gm.; 62 in Bonn 19,742 gm.; and 41 in Vienna 15,843 gm. These 614 stones account for half the total weight recovered. Individual stones of more than 1 kgm. in different collections (in addition to those in the British Museum) are 9,521, 8,070, 7,938, 7,150, 3,770, 2,500, 1,702, 1,040 and 1,025 gm. While it is not at all impossible or improbable that as many as 100,000 stones fell in this shower, the facts now available do not supply data for this to be proved mathematically.

In my paper in the *Mineralogical Magazine* in 1933 I collected fourteen variations in the spelling of "Widmanstätten figures" in the literature dating from 1813. Since then I have collected a few more. In the best books of reference the name of the discoverer is given as Widmanstetter (or Beckh-Widmanstetter). Prof. Paneth quotes the Austrian Biographical Lexicon, giving (from E. Cohen) the date and page, but not the volume (Theil 55), which suggests that he did not himself actually consult the original. Here the entry is under "Widmanstetter", and the same also in J. C. Poggendorff's "Biographisch-literarisches Handwörterbuch (1898, vol. 3). In the British Museum "Catalogue of Printed Books" a later member of the family, writing between 1870 and 1896, is catalogued under "Beckh-Widmanstetter" (Leopold von), with a cross-reference from Widmanstetter.

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Sept. 21.

Spiriform Morphology of some Lead Crystal Growths in Silica Gel

IT has been well known since A. L. Simon's description of the phenomenon¹, that fern-like crystal growths of lead can be obtained in silicic acid gels containing lead acetate solution. Whereas Simon used zinc to promote the electrochemical liberation of metallic lead in the gel, the use of tin for the same

purpose leads to the formation of crystals of a strikingly different morphology and lustre.

Under conditions recently studied in detail, which are characteristically critical as regards the concentrations of the reactants (particularly the lead acetate) a spiriform type of growth has been observed, to which no previous reference can be found in the literature. These growths arise electrochemically in a way entirely different from those helical and spiral precipitates of lead iodide, lead chromate and calcium phosphate described in the published work of Hatschek and his pupils², neither do they resemble the silver chromate spiral precipitates described in Hedges's "Liesegang Phenomena", nor the spiral crystals of M. Copisarow³. These spiriform lead growths often take a form resembling somewhat a very deeply cut screw having a minute barrel diameter, and with a very serrated edge to the pitch; sometimes the growths are like a thin ribbon of lead, twisted into a spiriform strip. The accompanying photograph

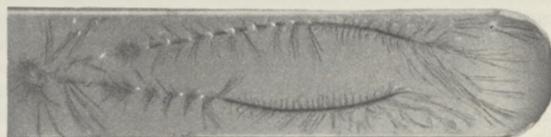


Fig. 1.

(Fig. 1), for which I have to thank Mr. E. Rowell of the Kodak Research Laboratories, Harrow, reproduces a six by one inch test-tube containing two such spiriform specimens. Whilst a non-stereoscopic view of them cannot adequately indicate the full screw-like features, a cinematic record reveals on rotating the tube that the two spirals in it are respectively right- and left-handed. At the points where they touch the glass walls, the spirals flatten out into serrated strips and these curl strikingly in opposite senses.

In collaboration with Mr. A. King of the Chemistry Department of this College, with whom work on these phenomena is being continued, it has been found that those gels, which are 0.02 normal with respect to the lead acetate concentration, can be made to reproduce spiriform growths, whilst identical gels containing a slightly different concentration of lead will produce many other strikingly different growths; the use of metals other than zinc or tin will also promote further modifications in their morphology.

NORMAN STUART.

Royal College of Science,
South Kensington, S.W.7.
Aug. 23.

¹ *Koll.-Z.*, 12, 171 (1913).

² *Koll.-Z.*, 27, 225 (1920); *Biochem. J.*, 14, 418 (1920).

³ *Koll.-Z.*, 47, 60 (1929).

Judgment by Hypothesis

PROF. J. B. S. HALDANE (see NATURE, Sept. 4, p. 428), in comparing my attitude towards Prof. E. A. Milne's cosmology with that of Lysenko towards the Russian geneticists, draws an analogy which seems to me little short of fantastic. According to NATURE of August 21, Lysenko treats Darwin's words as dogmas by which to judge and condemn, without examination, the work of modern experimenters. I accused Prof. Milne of imitating the practice of the Aristotelians who treated Aristotle's

words as dogmas by which to judge and condemn, without examination, the work of their contemporary experimenters. If there is any analogy to be drawn, it is surely between Lysenko and the Aristotelians (ancient or modern).

However, I am less concerned with that than with the possible implication that I wish forcibly to restrict Prof. Milne's work. On the contrary, I would place freedom of thought and expression second only to complete dedication to truth (or truthfulness, for those who think they can dispense with the shorter word) in the list of essential conditions for research. While I wish with all my heart that Prof. Milne would stop inventing systems and telling us what God cannot do, and would return to those problems in astrophysics which he is so peculiarly gifted to solve, I would fight to the last ditch for his right to waste his talents if he so wishes. My complaint is that he does not satisfy the first condition. He deduces systems from pure fancy, but instead of consistently calling them products of the imagination and presenting them as works of art, he tacitly identifies them with the world of experience and calls them scientific. Mathematics, according to the phrase which has been repeated and disregarded *ad nauseam*, is a subject in which we do not know what we are talking about. If Prof. Milne would eliminate such words as time, nebula, universe . . . from his

papers, and substitute x, y, z throughout I would no more seek to restrain his activities than I would those of the surrealists.

HERBERT DINGLE.

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Sept. 15.

Tritium or Triterium?

I HOPE it is not too late to protest against the use of the name 'triterium' for the isotope of hydrogen of mass 3. The name appears in the very interesting article by Lord Rutherford in NATURE of p. 303, and has apparently been used elsewhere, to judge by the quotations in that article.

The word 'deuterium' is correctly formed from the Greek δευτερος (*deuteros*), 'second', but the Greek for 'third' is τρίτος (*tritios*), not *triteros*. The name which corresponds properly with 'deuterium' is clearly 'tritium', and this word is already in use; for example, papers dealing with this isotope are indexed under 'tritium', and not 'triterium', in the indexes to the British Chemical Abstracts for 1935 and 1936.

Trinity College,
Dublin.
Sept. 1.

KENNETH C. BAILEY.

Points from Foregoing Letters

COMMENTING on a recent remark by Mann and Wells on the production of gold films by heat decomposition of volatile gold compounds, Prof. C. S. Gibson refers to previous experiments of the same type. Also, he points out that in aurous compounds gold is always 2-covalent and that aurous ions, like auric ions, are apparently incapable of existence.

A table with details of the structure of quinhydrone and related compounds, as determined by X-ray analysis, is given by Dr. J. S. Anderson. The position of the quinone and quinol groupings, the relation of compounds of chloranil and bromanil to hexamethylbenzene and other structural characteristics are discussed.

A photomicrograph of coproporphyrin III, obtained from a bovine suffering from congenital porphyria, is submitted by Dr. C. Rimington and G. C. S. Roets, showing that, as in the case of the related uroporphyrins, compounds belonging to both isomeric types (series I and series III) occur in certain pathological states.

Long-range ionization tracks, starting from a common focus in the emulsion of a photographic plate which had been exposed to cosmic radiation for five months at an altitude of 2,300 m., are considered by M. Blau and H. Wambacher to have been produced by disintegration of an atom in the emulsion by a cosmic ray.

Photographs of the solar corona, taken during the total solar eclipse of 1936 by means of a polarigraph with reflecting analyser, show, according to K. G. Zakharin, that the degree of polarization varies in different parts of the corona and also with the wavelength, and that the direction of polarization undergoes a change in the 'streams'.

Prof. S. K. Mitra and K. K. Roy point out that the complete formula for ionospheric dispersion yields

values for the dielectric constant which are greater than, equal to or less than unity, depending on degree of ionization, pressure and the exciting wave-length. The use of a simplified approximate formula has wrongly led to the opinion that theoretical considerations preclude values greater than unity, but such values were found experimentally.

Some characteristic fluctuations noticed in the declination magnetograms obtained at Alibag, near Bombay, are explained by Dr. K. R. Ramanathan as being due to the magnetic field of near lightning discharges. He points out that the magnetometer behaves as the needle of a ballistic galvanometer for these impulsive discharges, and suggests that this may be made the basis of an instrument for measuring the discharges of individual lightning flashes.

Implantations of the anterior pituitary of the front into immature female white mice are found by Dr. H. Zwarenstein to activate the reproductive apparatus (opening the vagina, increase in weight of ovaries and uterus, and follicular growth).

Dr. S. S. Zilva observed no vitamin P activity on administering a daily dose of either 'citrin', hesperidin or a mixture of hesperidin and eriodictyol to guinea-pigs on a scorbutic diet. He obtained, however, a biological response similar to that observed by Prof. A. Szent-Györgyi on administering sub-optimal doses of ascorbic acid. The bearing of these observations on Bentsáth and Szent-Györgyi's latest view concerning the action of vitamin P is pointed out.

ERRATUM.—In the note in NATURE of September 1, p. 509, referring to Dr. A. L. Reimann's communication, the statement: "the linear rate of decay of the phosphorescence of zinc-blende" should read "the linear rate of decay of the inverse of the square root ($p^{-\frac{1}{2}}$) of the phosphorescence of zinc-blende".

Research Items

Eastern Himalayan Blood-Groups

IN view of the high percentage of Group *AB* found among Tibetans at Gyantse, Miss Eileen W. E. Macfarlane has obtained samples from Tibetans, Nepalis and Lepchas (*Man*, No. 159, August). The Tibetans were hospital patients and others at Kalimpong, North Bengal. The subjects either called themselves Bhutias or were Bhutanese. There are Bhutias in Sikkim State, who resemble the Tibetans physically and wear similar dress and ornaments. The Bhutanese were nearly all from Ha, Bhutan, and also belong to the Tibetan race. The sample in all numbered fifty-six. The proportion of the blood-groups differs considerably from the blood-groups observed by Tennant at Gyantse. The percentage of *B* is of the same order, and considerably lower than in the neighbourhood of Nepal. The percentage of *O* is much higher and of *A* lower than at Gyantse, the latter possibly being due to inbreeding, while the high proportion of *AB* may be a result of the Chinese garrison stationed there from the beginning of the century until 1912. The proportions found at Kalimpong suggest either that blood-group relationships differ markedly in different parts of Tibet, or that conditions in Gyantse are exceptional. One eighth of the Bhutias belong to Group *B*, more than a third to Group *A*, and almost one half to Group *O*, *AB* being rare. The preponderance of *O*, the characteristic group among American Indians, recalls the fact that the physical resemblances and similarities of artistic design between Tibetans and American Indians, especially the Navajos, has been noted as striking. The nearest Mongoloid neighbours of Tibet in China and Nepal are fairly high in *B* and it is remarkable that the Tibetans have absorbed relatively little of this group. They have evidently been isolated from the main stream of Mongolian migration since very early times.

Early Chinese Bronzes

AMONG a number of early Chinese bronzes from the Eumorfopoulos Collection, now in the British Museum (Bloomsbury), which are figured and described in the *Brit. Mus. Quarterly*, 11, 3, by Mr. R. S. Jenyns, is the famous ram-handled *tsun* which belongs either to the Shang-Yin, or early Chou Dynasty. This piece should convince sceptics that the Chinese bronzes of the classic period are equal, if not superior, to those of any other civilization. It is modelled in the form of two rams standing back to back, and is supported on four legs represented by their forefeet. From between their heads rises the funnel, which forms the mouth. The body is covered with scales, which may, or may not, have been engraved after casting. The conquest of Shang-Yin by the Chou princes about 1100 B.C. does not seem to have altered the Shang-Yin style. This *tsun* shows only one of the four innovations regarded by Karlgren as making their appearance at that period. It must, therefore, be very closely related to the Shang-Yin bronzes. It is difficult to account for the sudden appearance of the Shang-Yin culture, which produced highly complicated and distinctive bronzes without apparent effort. The mastery of technique and the conventionalized motives argue a long process of

evolution, and their inscriptions are far from primitive. Yet there is an enormous hiatus of time to be accounted for between the neolithic pottery from Western Kansu and Honan and these highly sophisticated vessels. The immediate ancestors of these are lacking. The Hsia culture, in which bronze casting and early forms of bronze must have made their appearance, remains a mystery. Even if it be admitted that bronze casting was introduced from the West in its finished form immediately before the Shang-Yin, the existence in Shang-Yin of forms evidently of great antiquity, which betray no affinity to known Western forms, is difficult to explain, without admitting a long process of internal evolution. We are compelled to believe that Shang-Yin culture had its roots in a distant past, but why almost no traces of that past have survived is a puzzle for which archæology has yet to supply a happy solution.

Passerine Birds of Ethiopia and Kenya

DURING the months of its sojourn in Africa in 1911 and 1912, the Frick Expedition collected about 5,200 birds, besides a number of eggs and nests, and copious field observations, all due to the energy and collecting ability of the late Dr. Edgar Alexander Mearns. The description of the passerine birds by Herbert Friedmann adds to the faunal knowledge of an area remarkable for the wide range of its conditions, from desert to tropical rain-forest, from a rainfall of 0-11 inches to 70-80 inches, and from sea-level to 15,000 feet (*U.S. Nat. Mus., Bull.* 153, 479; 1937). Among the general features described is the marked tendency of far more lowland birds to range high up the mountain slopes in Ethiopia (to an altitude of 7,000-8,000 feet) than reach to about half that altitude (4,500 feet) in more equatorial portions of the continent. The authors regard the birds of these regions as having been derived from the steppes of south-eastern Asia by way of Asia Minor and Arabia during Pliocene times. In the course of this extensive movement many birds moved southwards through the area, such as the ancestors of *Francolinus sephaena*, *F. africanus*, *Streptopelia capicola*, *Lophoceros melanoleucus*; others remained and formed a centre in which new species developed, and from which westward migration probably contributed to the fauna of the western savannahs the ancestors of such forms as the gound hornbill (*Buceros abyssinicus*), the parakeet (*Psittacula krameri*), the roller (*Coracias abyssinicus*) and the chat (*Oenanthe bottae*).

Self-fertilization in Japanese Slugs

THAT a pulmonate mollusc may possess the power of laying fertile eggs when kept in strict isolation has been known since Oken's experiments on *Lymnæa auricularis* more than a century ago. A number of other species have since been shown to behave in similar manner. K. Ikeda (*J. Sci. Hiroshima University*, March 1937) has conducted extensive and carefully controlled investigations into this phenomenon in the slug, *Philomycus bilineatus*. The young hatched in spring do not become mature until autumn, so need not be isolated until then; they mate in autumn but the eggs are not laid until after awaking

from hibernation in spring. The discovery of albino forms allowed a certain amount of genetical analysis. The fertility of the egg results from self-fertilization and not from parthenogenesis, and the power of self-fertility does not diminish with age. The individual spermatozoa descend the genital duct to attain fertilizing power in the receptaculum seminis, and the varying degrees of self-fertility exhibited by different species possibly result from differences in the ability of the spermatozoa to migrate through the duct.

Larvæ of Indian Coleoptera

IN *Indian Forest Records*, 11, No. 9, Mr. J. C. M. Gardner, of the Forest Research Institute, Dehra Dun, continues his series of articles on the immature stages of Indian Coleoptera. The present contribution deals with various Carabidæ, or ground beetles, and includes descriptions of the larvæ of species belonging to eighteen genera of these insects. As a number of these genera are European, and the structural characters of their larvæ are figured, the paper is of interest to workers other than those studying the Indian fauna. Very little has been published previously on larvæ of the Indian members of the family, and the present article, it is hoped, will be followed by others of a like character.

Aquatic and Marsh Plants of India and Burma

MR. K. P. BISWAS described some aquatic and marsh plants of India and Burma in a paper read before Section K (Botany) at the meeting of the British Association on September 7. India and Burma contain an enormous stock of aquatic and marsh plants in their many stationary and flowing waters. The hill streams in the Himalayas have their beds often covered with *Batrachospermum* and *Sirodotia* sp. The coastline, both the Malabar and the Coromandal, harbour large quantities of different species of marine alga. But there is still a vast field for the investigation of the marine flora of the coastline of India and Burma. The Andaman Islands, the Mergui Archipelago have also a rich vegetation of marine alga, chiefly composed of *Caulerpa*, *Sargassum* and *Halimeda*. The estuarine areas are marked by dense mangrove vegetation exposed to tidal action. On the west coast *Ceriops Roxburghiana*, *Avecinnia alba* are predominant. In the east, *A. officinalis*, *A. alba*, *Bruguiera gymnorhiza*, *Rhizophora mucronata*, *Acanthus illicifolius*, *Agcerus majus*, *Ceriops Roxburghiana* are dominant species. In the Sundribun down to Mergui Archipelago and farther south the two palms, *Phoenix paludosa* and *Nipa fruticans* form quite a striking feature along the shore and deltaic areas. The larger rivers do not as a rule support much aquatic vegetation; but during hot months some portions of the beds of the rivers partially dry up, forming shallow pools separated from the main body of water. These pools form good culture beds of alga. Stationary water in the form of natural or artificial lakes, jhils, bils, tanks, pools, puddles and swampy areas (ricefield swamps) occupy a considerable area of the lower plains of the two countries. These, due to favourable edaphic and climatic conditions, are full of aquatic and marsh vegetation. In this mass of crowded vegetation, four zones can be distinguished: (1) the bottom layer, which may be called the zone of the vital layer; (2) the zone of rooted aquatics; (3) the zone of suspended vegetation, and (4) the zone of surface vegetation.

The inland brackish water plants are interesting, too. Such plants are often found in the plains of the cities near the sea, such as Bombay, Calcutta and Madras. The salt lakes of Calcutta retain a mixture of salt-water and freshwater vegetation in their swamps.

Polyporaceous Fungi

THE behaviour of nuclei in the developing basidium of the higher fungi has only been studied intensively during comparatively recent years. It has been generally established for one or two agaricaceous fungi that two nuclei fuse in the young basidium; the fusion nucleus divides, first by reduction division, and later by ordinary mitosis, to form the basidiospores. Dr. S. R. Bose adds welcome confirmation to this view, by showing that the Polyporaceæ possess a similar mechanism (*J. Ind. Bot. Soc.*, 16, No. 3, 119-128; 1937). Eleven species of Polyporaceæ have been studied, and results are given in detail for each species. Basidia are very small in the pore-bearing fungi, but a sufficient number of stages has been found to establish similarity of behaviour with other previously described Basidiomycetes. The mechanism of nuclear division is essentially similar to that of higher plants, though the chromosomes are too small to be counted satisfactorily. Dr. Bose has recently published a paper on "Polyporaceæ from Lokra Hills (Assam)" (*Ann. Mycologici*, 35, No. 2, 1937), in which he describes a number of species from an elevation of 5,000-10,000 feet. Many cosmopolitan fungi are included, and the accounts show that several polypores of temperate Europe and North America are found at this elevation in Assam, but are absent from the plains of Bengal. *Fomes fomentarius* is a typical example of such distribution.

A Dune Drainage System

MR. V. J. CHAPMAN has described an investigation made in 1933 to determine the nature of the water-table movements in the salt marshes of Scolt Head Island on the Norfolk coast (*Mem. and Proc. Manchester Lit. and Phil. Soc.*, Session 1936-37). The area selected was especially convenient for the experiment as there is a small artificial pond near the centre, and it was the rise and fall of the water in this pond that prompted the investigation. The information obtained showed that while the diurnal tidal movements did not sensibly affect the level of the pond, it rose appreciably and rapidly about 48 hours after every maximum spring tide which reached a height of 27 ft. above Hull datum and then fell slowly. Particulars were also obtained showing the direction of the drainage flow. These water-table movements have a profound bearing on the plants which grow in the dunes and which, in order to tap the supply of fresh water known to float on top of the salt water, develop long roots. Without these periodic fluctuations of the water-table many of the dune plants would not be able to exist in summer when their need of water is great. To this extent, it is suggested the flora of dune hollows may be associated with and dependent upon the subterranean water supply, assisted possibly by some capillary action in the sand. The conclusions reached as a result of this short investigation agree with those of earlier research carried out at Blakeney Point, and are therefore thought to be representative of the conditions in dunes in this part of Norfolk. These are that no flow takes place until the high spring tide reaches a

certain minimum level, that then a rapid rise takes place after a lag of 48 hours and that, except at these very high tides, the water drains out along the line of least resistance following a shingle path to the shore.

Meteorological Connexions between Greenland and Europe

At a meeting of the Royal Meteorological Society held on June 16, Dr. F. Loewe read a paper entitled "A Period of Warm Winters in Western Greenland and the Temperature See-Saw between Western Greenland and Central Europe". He referred to the studies of Grosse, Wagner and Scherhag on the marked change that has taken place in the climate of Greenland since about the beginning of the present century in the direction of milder winters and slightly warmer summers, resulting in a decrease of the mean annual range and therefore in a more oceanic climate. For example, the average difference between the extreme seasons from 1923-34 at Jakobshavn was 19.5°C . compared with 24°C . for the period 1876-1934. A striking individual instance of winter warmth is that of the period January-March 1929 when Jakobshavn temperature was 12.7°C . above the 1876-1935 mean, and the coldness of the same period in northern Germany (it was the coldest winter probably since 1830 and certainly since 1838) illustrates the see-saw of temperature with which the second part of the paper deals. This see-saw effect was pointed out by Hann so long ago as 1890, who observed that in the winter months the anomalies of temperature at Vienna and Jakobshavn were of opposite sign, but Dr. Loewe finds that the contrast with west Greenland is greater for the region around the Baltic than for Vienna. He gives a table of temperature anomalies for the nine warmest and nine coldest winters at each of the three stations, Jakobshavn, Breslau and Uppsala, for the period 1876-1930, and the corresponding anomalies at the other two stations, which illustrates the effect very well. The 54 sets of figures contain only two years, 1916 and 1930, with big simultaneous positive anomalies on both sides of the North Atlantic. The main reason for the see-saw is clearly to be found in pressure conditions between Greenland and Norway, high pressure tending to bring polar air down to the Baltic and tropical air up to West Greenland, and low pressure in the same area a reversed exchange of tropical and polar air.

Fluoroform

A MINUTE amount of a substance which was probably fluoroform, CHF_3 , was obtained by Meslans in 1894 by the interaction of iodoform and silver fluoride. It was prepared in a pure state by Ruff in 1936 by the interaction of iodoform with a mixture of mercurous and calcium fluorides. A. L. Henne (*J. Amer. Chem. Soc.*, 59, 1200; 1937) has now described a method suitable for larger scale preparation. In this, bromoform is heated in a closed steel vessel with antimony fluoride (SbF_3) and some bromine. This gives the substance CHF_2Br , b.p. -14.5° . This is carefully purified and is then treated with mercuric fluoride in a similar apparatus, with special temperature control. The gaseous CHF_3 evolved is collected over water, condensed by liquid air and distilled through a condenser cooled at -80° ; CHF_3 (b.p. -88.2°) passes on. The substance is very inert chemically and physiologically. Alkalis and acids are unaffected by it, bromine does not react in

bright sunlight, but fluorine reacts vigorously with formation of CF_4 and HF . The atomic distance between the carbon and fluorine atoms (as measured by L. O. Brockway) is 1.35 Å. By the action of chlorine in bright sunlight, hydrogen is replaced and CClF_3 formed. This boils at -81.1° and, as CHF_3 boils at -82.2° , it is seen that in these compounds a replacement of hydrogen by chlorine has caused a rise in boiling point of only 1° .

Effect of Pressure on Phosphors

It is well known that powdering a phosphor results in a diminution of the intensity of the light emitted, but that uniform pressure produces no change in the intensity. Smekal's theory gives a satisfactory explanation of the effect of powdering. A comprehensive investigation of the effect has now been made (N. Riehl and H. Ortmann, *Ann. Physik.*, [v], 29, 556; 1937). It was first shown that powdering does not affect the specific gravity of either zinc sulphide or alkaline earth sulphide phosphors. An attempt was then made to determine the percentage of active centres which are rendered inactive by the effect of pressure, the work being confined to the zinc, calcium and strontium sulphide phosphors. The opinion is expressed that the absolute effect of pressure was widely overstated in the earlier work, the reason being that the transparency of the phosphorescent layer was greatly decreased by powdering. For a medium-powdered phosphor it is estimated that the effect is only to reduce the intensity of the emission by 10 per cent, and this is near the limit of accuracy of the experiment. For an extremely finely powdered phosphor the diminution was only about 36 per cent. A rough estimation of the number of centres which come to the surface on account of the powdering agrees well with the experimentally determined decrease in intensity.

Spectrum of Nova Herculis

A LARGE number of papers on the spectrum of Nova Herculis has appeared since the discovery of this star in 1934, but one of the most complete and detailed accounts is that published recently by D. B. McLaughlin (*Pub., Obs. of Univ. of Michigan*, 6, No. 12). The method of presenting the observational material is worthy of note, since the author discards "that most deadly of methods of discussion: the day-to-day journal of observations" and divides the history of the nova into typical stages, with separate treatment of each stage as a unit. Day-to-day changes of more important characters are, however, to be found in the numerous tables or diagrams. Wave-lengths, identifications, intensities and radial velocities are given for each group of absorption or emission lines which occurred in the various stages considered, together with critical accounts of the main features typifying each stage. It is impossible to summarize the many interesting results obtained, but special mention might be made of the anomalous behaviour of the Mg II line at 4481 Å., which showed radial velocity changes at variance with those of all the other absorption lines. It is described as "one of the most remarkable enigmas of the Nova spectrum". Some correlations are found between spectral changes and luminosity, and a tentative hypothesis is offered in which an interesting variant of the expanding shells hypothesis appears to give a satisfactory physical interpretation of the principal features observed.

The Relation of Growth Substances to Horticultural Practice*

By Dr. M. A. H. Tincker, Royal Horticultural Society, Wisley

MUCH of our recent knowledge of plant hormones we owe to the Utrecht botanists, whose investigations led to the recognition of the nature and function of these substances. Earlier experiments carried out with seedling oats showed that the shoot apex produced substances capable of regulating growth. When cut off and placed on gelatin, quantities exuded from the tips of the active substances proportional to the number of seedlings used for a fixed period of exudation. These substances could be transferred to other seedlings. A wide search was made for a ready source of these compounds, found to be present in small quantity in grain, pollen and leaves. Higher concentrations are available in urine.

At the Leicester meeting of the British Association Prof. F. Kogl described the isolation and chemical recognition of auxin *a* and *b*. Their structure is complicated; but with these two compounds a third active compound, hetero-auxin, was found. It is a simpler chemical, β -indolyl acetic acid, previously well known to chemists.

Small quantities (5 mgm.) of indolyl acetic acid when applied in lanolin, a convenient solvent, to the young stems of tomato plants growing vigorously, cause within 24 hours twisting and bending of the petioles and stems, as unequal growth takes place on the two sides. This is a quick ready means of testing closely related and other chemicals. In a few days, roots appear from the stem, root initials also develop inside, clearly seen by cutting the stem longitudinally. Similarly, the production of roots may be induced in severed portions of plants, and this is the practical point, for vegetative reproduction is thus facilitated.

The paste method has been largely superseded by dilute solutions. Herbaceous or woody cuttings are taken with expanded leaves, their basal ends placed in the solution to a depth of an inch; owing to the loss of water in transpiration from the leaves, sufficient solution is taken up to induce subsequent root production when the cuttings are placed, after washing in water, in sand in propagating frames.

The list of active chemicals includes the related indolyl butyric and indolyl propionic acids. The organic salts or esters of these acids are active, so are some of their metallic salts such as sodium indolyl-acetate. Scatole has recently been proved active. Alpha and beta naphthalene acetic acid are very highly active, phenyl acetic and anthracene acetic acid are less active.

Although fairly closely related, iso-indolinone is inactive. The substitution of sulphur for the nitrogen and hydrogen group in indolyl acetic acid very greatly reduces the activity. Although closely related to indolyl propionic acid, tryptophan is inactive; it may be a stage in the formation of the growth substance in Nature.

The treatment causes: (a) more cuttings to form roots; (b) more roots to be formed on each cutting;

(c) the active process (including *a* and *b*) to be accelerated.

Amongst herbaceous plants, cuttings of lupins, delphiniums, pelargoniums, violas and alpine phlox have shown accelerated rooting by treatment with pastes in lanolin and with very weak solutions. There is a tendency to damage delicate tissue by the use of solutions of too high a concentration; 1 part in 30,000 or 40,000 parts of water is recommended for such cuttings.

With holly, taken at the end of June and treated with indolyl acetic acid, 1 part in 10,000 of water for 24 hours, half the cuttings rooted in 6 weeks whilst none of the controls, placed in water for 24 hours, rooted in this time. With *Viburnum Carlesii*, cuttings taken at the end of July and treated with alpha naphthalene acetic and others with indolyl acetic, 1 part in 10,000 of water for 24 hours, rooting took place rapidly. In ten days, the active growth taking place inside the stem split the outer layers. Cuttings of *Ceanothus dentatus* taken in late November produced roots in January, and *Myrtus communis* cuttings taken in January rooted in a month. Stimulation may occur at a season of normal quiescence.

Species and varieties of heather (*Erica*) responded quickly to alpha naphthalene acetic acid, *Pieris formosa* taken in late August and *Gaultheria procumbens* have given favourable results. With *Rhododendron rubiginosum*, 85 per cent of the cuttings treated in alpha naphthalene acetic acid and indolyl acetic acid, 1 in 20,000 for 48 hours, rooted in three months, whilst only 5 per cent of the controls form roots. Other plants tested include species of *Buddleia*, *Camellia*, *Deutzia*, *Escallonia*, *Hydrangea*, *Pernettya*, all of which showed favourable results by these methods. Even with the more recalcitrant genera and species some encouraging results have already been obtained. Further results are reported in tests made by horticultural and chemical firms, and at other research stations and laboratories. These greatly extend the list of species in which root formation has been accelerated. Certain species may yet prove quite unresponsive but the indications are to the contrary, provided the time of year and concentration of solution can be correctly selected.

The concentrations are surprisingly low, for frequently 1 in 40,000 of water is effective. It appears from certain *ad hoc* tests that there is a critical concentration below which little or no activity is induced. Twice the length of time for uptake from a solution half as concentrated may not be so effective as a stronger solution used for the given time.

Pouring solution on to the sand before inserting cuttings is not recommended, as bacteria interfere. Freshly made solutions should be used as moulds and bacteria may contaminate them if kept. Since the solutions are not stable in light, storage in coloured and opaque vessels at higher concentration is recommended.

The success obtained has been quickly appreciated

* Substance of a lecture to Section K (Botany) of the British Association, delivered at Nottingham on September 3.

by chemical manufacturers and by horticulturalists. There are now a number of solutions readily available on the market in many countries.

Thus it is seen that investigations, primarily of botanical interest, dealing with fundamental problems

of plant development, have quickly led to results of much interest and value to the practical man; showing once more the relationship of science and its discoveries to everyday life, to industry and to recreational pursuits.

The Teaching of Geology in Schools

JUST over two years ago, at the Norwich meeting of the British Association, Section C (Geology) appointed a committee to report on questions affecting the teaching of geology in schools. A short report was presented at the 1936 meeting of the Association, and, at the suggestion of members of Section L (Education), an extended report giving detailed proposals was prepared for the Nottingham meeting. These reports were discussed in a joint meeting of Sections C and L, at which Mr. H. G. Wells presided, on September 7.

The views of the geologists were explained by Prof. A. E. Trueman, who opened the discussion, Prof. G. Hickling, Prof. W. W. Watts, Prof. L. J. Wills, Sir Lewis Fermor and Prof. P. G. H. Boswell. It was pointed out that, while geology has never figured very prominently in school curricula, many pupils were formerly introduced to it, for example, on field excursions, by teachers who had received some training in the subject, but that few intending teachers at present are encouraged to include it in their university or college courses. While appreciating something of the difficulties of the overcrowded curriculum, it was felt that geology should be more widely included in school courses. The Committee did not press its claims in competition with any other subject; in general, while it wished to secure the inclusion of some outlines of geological knowledge in all science courses in secondary schools (for example, as a part of schemes of 'general science'), it only asked, in addition, that geology should be included as an optional subject at more advanced stages. The inclusion of some geology in the scheme of informative education outlined by Mr. Wells in his address to the Education Section was noted with keen satisfaction.

Both the cultural and utilitarian aspects of geology were emphasized. It is one of the richest of cultures, stimulating a broader interest in the outside world and increasing the appreciation of scenery. On the other hand, it is an eminently useful science with numerous and obvious applications in mining, engineering and agriculture. It was suggested that geology should form an essential part of the school curriculum in mining and industrial areas, partly on account of its economic importance, partly for the wider interest it would give to later life.

The syllabuses proposed by the Committee are intended only as suggestions, and great elasticity of treatment appears to be desirable in the case of geology even more than in other sciences, the bias and the arrangement of the various topics depending largely on the location of the school.

In the senior elementary schools there is more opportunity for variety of treatment, and a rather practical bias is suggested. Dr. W. K. Spencer described some of the work carried out in such schools.

The lack of any courses in geology in most schools was held responsible for the present dearth of trained

geologists; Prof. Hickling and Prof. Watts pointed out that while the supply is thus restricted the demand for geologists is increasing. It was emphasized that there are attractive careers in this field for a number of men of ability and good physique.

Two teachers who took part in the discussion expressed rather different points of view. First, Mr. James Davies, one of the few teachers who are actually teaching geology in secondary schools, indicated the nature of his courses. In pleading for a wider adoption of geology he spoke of the attractiveness of the subject and said that there is nothing more inspiring than leading a party of young people over hill and dale (his school is in South Wales). As an example of the chance of a beginner in geology making new discoveries, he mentioned the first recognition of a marine band in the Coal Measures by one of his pupils. In his school, both geology and geography appear in the curriculum. On the other hand, Mr. V. C. Spary, speaking as a teacher of geography, expressed fears that the introduction of geology into the time-table could only mean the displacement of geography. He agreed, however, that a well-balanced course of geography must include many lessons of a geological nature, for "geography teachers must borrow a great deal", and he thought it a great advantage for teachers of that subject to have some geological training.

Mr. Wells agreed with Mr. Spary that the teaching of geology as a specific subject is not highly desirable until an advanced stage in education is reached, but thought that reference would nevertheless be made at earlier stages to the geological record when teaching biology, and to physiography in teaching geography. He went on to inquire what constitutes geological training when the biological and physiological sides are taken away. In reply to these questions it was insisted that palæontology and physiography are branches of geology, and while it may be convenient to treat them in relation to other subjects in the curriculum, it is desirable that the pupils should know that they are then learning geology. Anxious as they are to see their subject taught in schools, geologists would much prefer to have it taught under its own name.

In the course of the discussion, there was no real criticism of the view that geology should be taught in schools; there was, however, this difference of opinion as to whether it should appear as a separate subject except at more advanced stages (for example, at the Higher School Certificate stage). The inclusion of the subject as a part of a course in 'general science' would possibly be the most satisfactory solution in many schools, up to the stage of the School Certificate, as the Committee had recommended.

In connexion with the discussion, Prof. H. H. Swinnerton arranged an interesting exhibit to show a course of simple experimental work in geology suitable for schools.

Fossil Man in Minnesota*

IT is probable that there is no skeleton of ancient man of which the circumstances and conditions of discovery have been more carefully documented than that of the skeleton found in the ancient glacial lake deposits, now known as "Lake Pelican", beneath Minnesota Highway No. 30, near Pelican Rapids, on June 18, 1931 (see NATURE, Feb. 27, p. 365). Prof. A. E. Jenks, in his detailed account of the skeleton, has been careful to secure statements from all who were concerned in the discovery of this skeleton; and the facts were further checked by a re-excavation on the site, in which the circumstances received further confirmation by the occurrence of more fragments of the skeleton.

The skeleton was unearthed at a depth of some twelve feet in the course of repairs to a recently made road, when a mechanical excavator was noticed by the workmen to have crushed a clam shell. A closer examination revealed the existence of a skeleton, which on removal proved to be virtually complete. One tooth, lost after discovery, is missing, as are the nasal and some of the smaller bones, such as those of one hand and the feet.

Minnesota is the centre of an area of some thousand miles in extent which, as a zone of terminal moraines and a 'driftless area,' would have been peculiarly favourable for the existence of glacial man. The ancient glacial lake system to which belong the deposits in which the skeletal remains were found is of late Pleistocene date. This area would have been readily accessible to early man entering America by either the Arctic coast or the Yukon valley, and thence coming south-eastward along the Mackenzie River and on the east of the Rocky Mountains, and thereafter in a generally eastward direction along the Missouri River. Hence access could readily be gained to the various centres in America in which forms of aboriginal culture developed later.

The skeleton as a whole, as already mentioned, is very complete. It is that of a sub-adult female of about fifteen years. The bones are mineralized, and little affected by the silt in which they lay. There can be no question of a modern burial, and the supposition is that the young woman was drowned in glacial Lake Pelican about half a mile from the foot of the glacier, possibly having fallen through the ice.

The characteristics of the cranium are not distinctively primitive in type, except in the backward extension of the skull and the 'houseboat' shape, which is also characteristic of the Australian and Eskimo. The cephalic index, 77.09, distinctly mesocephalic, and therefore higher than in the Mousterian and Aurignacian types, and the head-height indices are not very distinctive of race, falling in the median categories, which may be found in all the great groupings of mankind. The cranial vault shows a number of primitive characters, of which the more noteworthy are the prominent glabella, the absolutely and relatively long temporal margin of the parietal bone, the low index of the squamous portion of the temporal bone, the high position of theinion above

the Frankfort plane, and the flatness of the nuchal area. A number of unique or unusual features are shown, such as the U-shaped grooves of the occipital condyles and the columnar form of the bases of the pterygoid processes.

The face as a whole shows an important primitive characteristic in the marked alveolar prognathism combined with mid-facial orthognathism. In this respect it most closely resembles neanthropic palæolithic Europeans. In other measurements and indices the resemblance is nearest to the Mongoloid and White groups. As contrasting with certain Amerindian groups, it is both higher and narrower; yet it falls within the group means of Algonkians, and in breadth within the range of the Siouan group. In orbital index the specimen falls with the Mongoloids; while the interorbital breadth and index are Mongoloid. The nasal index is closest to the White, yet certain of the Mongoloid groups have similar indices. The forward thrust of the malars is Mongoloid; while the mandibular index is closer to that of the Australian than of any other living race.

The teeth exhibit important primitive characteristics. They are absolutely large in every respect. In the relative length of the lower molars the third is the greatest, which gives them a unique formula. The cusps of none of the molars show any reduction in number, and they retain the primitive crown pattern. The shovel-shaped upper incisors, though characteristic of the modern Mongoloids, seem to be of primitive character.

The stature as computed from the long bones is 1,582 mm. (Manouvrier) or 1,540 mm. (Pearson). This, on Manouvrier's method, is slightly above the average for females generally, which is 1,530-1,535 mm. (Martin). The figure is above the Mongoloid average, which is generally lower than European and Negro.

Artefacts were found with the remains. The clam shell crushed by the grader has been identified as *Lampsilis siliquoides*. As this lay above the frontal bone it may have been part of the headdress. An antler dagger, broken at the time of discovery, lay to the right of the right humerus, and has been identified as part of the tine on the main beam of an elk antler. It is 196 mm. in length and had been fashioned by a coarse cutting implement. Its butt end is perforated. A conch shell pendant was found among the ribs and vertebræ in the abdominal area. At the second re-digging of the site sixty fragments of turtle carapace were recovered, also fragments of antler, metatarsal of a loon, toe bones of a bird foot, a wolf's tooth, and the calcaneum of a rodent. The whole possibly was a 'medicine' outfit.

The general deductions are that the skeleton named 'Minnesota man' has been found geologically documented in undisturbed sediment of late Pleistocene origin in the area immediately east of the Big Stone Moraine of the Wisconsin glacier; and that the measured and observed morphological characteristics of this skeleton proclaim it to be a primitive *Homo sapiens* of an early type of evolving Mongoloid, already prophetically suggesting American aborigine, especially the Eskimo, more than the present Asian Mongoloids, and living in west central Minnesota about twenty thousand years ago in late Pleistocene times.

* Pleistocene Man in Minnesota: a Fossil Homo Sapiens. By Dr. Albert Ernest Jenks. With a Chapter on the Pleistocene Geology of the Prairie Lake Region, by Dr. George A. Thiel. Pp. xiv+197. (Minneapolis, Minn.: University of Minnesota Press; London: Oxford University Press, 1936.) 34s. net.

Naval Architecture and Engineering

A SAILING yacht, being designed to attain the highest speed without the usual restrictive commercial considerations, provides an opportunity for the development of the ideal form of hull. If this is nicely balanced, the yacht keeps her course when heeled over, whereas if, on heeling, she tends to change course, she becomes a difficult boat to steer and can be described as unbalanced. In "A Law of Hydrostatics and its Influence on the Shapes of Sailing Yachts"—a paper read at the spring meeting of the Institution of Naval Architects held in March—Engineer Rear-Admiral Alfred Turner dealt with this question of balance. On heeling, the hull displaces an unsymmetrical volume of water, and may be considered as resting on the line of centres of buoyancy described as the metacentric shelf. This line does not form a plane curve; it may be very irregular, and from its irregularities there may arise a variable tendency to alter course according to angle of heel. The author investigates this by poising transparent paper patterns of a set of cross-sections and, after setting out Bouguer's law of balance with slight modifications, explains, by reference to the characteristics of some thirty-six vessels of which diagrams are given, the rules he has formulated.

In another paper, "The Development of the Two-stroke Cycle Oil Engine", read at this session, Mr. W. S. Burn, treating the subject from the marine point of view, explained its advantages over the four-stroke type in offering a cheaper, smaller, lighter and more efficient unit. The feature of first importance in its design is the evolution of a satisfactory method of scavenging, a process which has to be completed during the small movement of the piston and the small interval of time in which the exhaust ports are open. By means of a set of diagrams illustrating successful systems in use, the author explained their merits and classified them as uniflow or double-flow types. Scavenging being satisfactorily provided for, the two-stroke engine is shown to present, in other respects, a simpler problem for the designer owing to the greater freedom in arranging the combustion chamber, the cylinder head and piston crown, on each of which useful comment was made.

Marine steam boilers have, in the past, been regarded as immune from what is known as 'caustic embrittlement', but as in recent years a few cases have occurred in which the shells were found to be seriously affected and were condemned as unfit for further service, the problem has demanded the attention of marine engineers. The term is more picturesque than accurate, but the nature of the attack is characteristic and well defined, taking the form of intercrystalline fracture due to chemical action occurring only at the seams where two surfaces are in contact, and when the water is strongly alkaline and low in sulphates. The cracks follow the grain boundaries and are not transcrystalline as in the case of fatigue fractures. These points were illustrated by photomicrographs in a paper entitled "Note on the Chemical Intercrystalline Fracture of Riveted Joints in Boilers" read by Dr. S. F. Dorey, in which also he showed how the cracks in several joints examined were found to extend along the lines of rivet holes and along radial lines from these holes, invariably on the faces in contact.

While these results have always occurred in cases in which caustic soda was present, recent investigations suggest that the actual cause is the presence of sodium silicate in the soda or other chemicals used in the boilers. As soda was used in boilers long before caustic embrittlement was spoken of, the author thinks that possibly some difference in the method of manufacture of soda during the last thirty years may account for it and suggests that particulars of the analysis of the earlier supplies of soda may give some hint. He advises that care should be taken that nothing containing sodium silicate should be used in the treatment of boiler water and that, where soda is necessary, no more should be used than will maintain a neutral condition.

Science News a Century Ago

The Morse Recording Electric Telegraph

ON October 3, 1837, Samuel Finley Breese Morse, the American artist and professor of the "Arts of Design" at the New York City University, filed in the United States Patent Office a "Caveat" comprising: "1st, a system of signs by which numbers and consequently words and sentences are signified; 2nd, a set of type adapted to regulate and communicate the signs, with cases for convenient keeping of the type, and rules in which to set up the type; 3rd, an apparatus called a port-rule for regulating the movement of the type-rules, which rules by means of the type in their turn regulate the times and intervals of the passage of electricity; 4th, a register which records the signs permanently; 5th, a dictionary or vocabulary of words numbered and adapted to this system of telegraph; 6th, modes of laying the conductors to preserve them from injury."

Morse was born in 1791. He was the eldest son of Jedidiah Morse (1761-1826), "the first American geographer". Educated at Yale College, he determined to be a painter, and at the Royal Academy in London in 1813 exhibited his picture "The Dying Hereules". During 1829-32 he paid his second visit to Europe, studying art in France and Italy, and it was on his passage home in the sailing ship *Sully* that, after a conversation on the possibility of sending electric currents along wires, he conceived the "Morse code". He had little scientific knowledge, but at the New York City University was assisted by Leonard W. Gale, professor of chemistry, who was acquainted with the work of Henry.

On September 4, 1837, with an apparatus made by Morse, a continuous dispatch was effected in the form of V-shaped lines inscribed on a paper fillet, consisting of the numbers "215-36-2-58-112-04-01837" which, interpreted by a numbered vocabulary, made the phrase "successful experiment with electric telegraph, September 4, 1837". Early in 1838, Morse discarded the numerals and employed an alphabet of 'dots and dashes'.

The Thermo-electric Light

IN the *London and Edinburgh Philosophical Magazine* of October 1837 is a communication from Francis Watkins, a partner in the firm of Watkins and Hill, opticians and philosophical instrument makers, of 5 Charing Cross, in which he says: "I

hope you will allow me to make known in your forthcoming publication a fact in thermo-electricity which I have observed since my last communication to you, and which I believe has not been noticed in print in this or any other country.

"With a pair of metallic elements, consisting of one bismuth and one antimony, weighing each five grains and measuring 0.5 of an inch long and 0.12 diameter, when their extremities were unevenly heated, I have obtained with a Henry's flat ribbon coil, a very perceptible and brilliant spark.

"I have had the pleasure of showing the experiment to MM. De la Rive, Plateau and Netschayef, and I need not add that these distinguished philosophers were much delighted on seeing the thermo-electric light developed by a single pair of metallic elements."

Medical Mission to China

THE following announcement is contained in the *British and Foreign Medical Review* of October, 1837: "The London Missionary Society is desirous of finding medical men adapted to execute its benevolent designs for the improvement of the vast and interesting population of China. To candidates properly qualified such an undertaking must be highly attractive. In a scientific point of view China presents a field of observation of great variety and extent. With slight exceptions the state of medical knowledge is extremely low and defective, and notwithstanding their inordinate national vanity, many of the inhabitants are beginning to recognize the superiority of Europeans in this as in many other departments. A competent endowment of medical science and more especially a talent for operative and ophthalmic surgery, would be a sure passport of popularity and reputation under such circumstances; and we can hardly imagine a situation more calculated to excite and gratify the honourable ambition and philanthropic feelings of generous and adventurous work."

The Medical Literature of Norway

THE following extract is taken from a paper in the *British and Foreign Medical Review* of October, 1837, by Prof. Frederick Holst, professor of medicine at the Royal Frederick's University at Christiania: "The medical literature of Norway is but of small extent, and will probably always continue such in proportion to the population; as the latter is not great, the medical practitioners are but few, and the language of the country is understood by very few out of Scandinavia. Consequently, neither the medical man who might feel inclined to come forward as an author, nor the bookseller who is able to undertake the cost of printing the work, has the same encouragement as in other countries. It would therefore be unjust to consider the paucity of literary productions in that country as a proof of the incompetence of its medical men. The facilities of communication with other countries makes them pretty soon acquainted with foreign publications on subjects in their department; and in Norway there is no well-informed practitioner who does not take one or more of the best foreign medical journals, and procure the more important works by foreign medical writers. The medical works that have appeared in Norway have, in almost every instance, been called forth by particular occasions, or possess merely a private or local interest."

Societies and Academies

Paris

Academy of Sciences, July 26 (*C.R.*, 205, 265-300)

NIKOLA OBRECHKOFF: The solutions of a system of linear finite difference equations of the first order with constant coefficients.

JEAN LERAY: Discussion of the problem of Dirichlet. FOLKE ODQVIST: Complete equations of equilibrium of thin elastic skew layers.

GEORGES CARPÉNI: The dissociation constants of *d*-glucoascorbic acid and of its product of oxidation by iodine. The absorption ultra-violet spectra of *d*-glucoascorbic acid.

HENRI MOUREU, MICHEL MAGAT and GEORGES WÉTROFF: The Raman spectra of the two forms of phosphorus pentachloride. From the study of the Raman spectra of phosphorus pentachloride in the solid and liquid states, it is found that this substance has two distinct molecular forms, changing from one to the other on fusion. The partially fused substance shows the two spectra superposed. In liquid form the molecule possesses the symmetry of a trigonal bipyramid; the Raman spectrum of the solid form can be interpreted in more than one way. The Langmuir formula $(\text{PCl}_4)^+\text{Cl}^-$ is consistent with the results.

MOÏSE NEUMANN and PAUL TOUTAKIN: The dissociation of peroxides and the cold flame of hydrocarbons. Experiments confirming the theory of Aivazov and Neumann on the formation of cold flames during the oxidation of hydrocarbons, the intermediate oxidation product being a peroxide.

Mlle. ALICE LACOURT: The volumetric micrometric estimation of oxygen (ter Meulen method).

FÉLIX FRANÇOIS and Mlle. MARIE LOUISE DE WAULLE: The isothermal decomposition of the nickel peroxides.

DINAH ABRAGAM and YVES DEUX: The fixation of hypochlorous acid on phenylbutadiene and isomerization of the corresponding epoxide in phenylcrotonaldehyde.

MIGUEL POCTIVAS and Mlle. BIANCA TCHOUBA: The action of $\text{C}_2\text{H}_5\text{MgBr}$ and of MgBr_2 on the oxidation of dimethylstyrolene.

EDOUARD ROCH: The Oligo-Miocene of the southern slope of the Moroccan Haut-Atlas.

RENÉ ABRAR and EDGAR AUBERT DE LA RIVIERE: The presence of the Pliocene at the island of Malek (New Hebrides)

DANIEL AUGER: Complex pulsations of the actin current produced in *Nitella* by the action of certain buffer substances.

ROBERT ECHEVIN and ARTHUR BRUNEL: Ureolysis and free urea, the degradation of the purins in *Sarcosphaera hispida*.

YVES LE GRAND and EUGÈNE GEBLEWITZ: Fluttering in lateral vision.

ERNEST FOURNEAU, M. and MME. JACQUETTE TRÉFOUËL, FEDERICO NITTI and DANIEL BOVINI: The chemotherapy of pneumococcal infection with di(*p*-acetylaminophenyl) sulphone (1399F).

Calcutta

National Institute of Sciences of India, August 27-28

R. N. CHOPRA: Therapeutics of antimalarial drugs.

A. C. BANERJEE: Urban malaria in the United Provinces.

R. B. LAL: Methods of forecasting malaria epidemics.

- FROILANO DE MELLO: Malaria in Portuguese India.
 R. SENIOR WHITE: Physical factors in mosquito ecology.
 W. C. SWEET: Irrigation and malaria.
 T. A. CURRY: Flood and flush schemes in Bengal.
 F. C. GRIFFEN: Surface and subsoil drainage.
 S. G. MASILLAMANI: Irrigation and malaria in the Madras Presidency.
 M. O. T. IYENGAR: Topography of land in relation to malaria.
 P. SEN: *Anopheles ludlowii* survey in and around Calcutta.
 G. C. CHATTERJEE: Malaria and its relation to agriculture in India.
 M. K. AFRIDI: Antimalarial operations in Delhi.
 B. A. RAO: Control of anopheline breeding in irrigation channels by Paris green.
 J. D. SINHA: Drug prophylaxis in malaria by the use of quinine and plasmoquine in the field.
 K. V. KRISHNAN: The spleen and resistance to malaria and hæmoglobinuria.
 K. L. CHOWDHURY: Mosquito control in Calcutta.
 G. C. CHATTERJEE: Larvivorous fish.
 S. L. HORA: Larvicidal fish.
 R. N. CHOPRA: Experimental studies on ape malaria with reference to its use in therapy for nervous conditions.
 B. B. DIKSHIT: Pharmacology of plasmochin with special reference to its action in pregnancy.
 K. V. KRISHNAN: Biochemical changes in the blood of monkeys developing malarial hæmoglobinuria and their significance in the etiology and treatment of blackwater fever in man.
 B. M. DAS GUPTA: Transmission of *P. inui* to man.
 M. O. T. IYENGAR: Natural parasites of mosquitos in India.
 S. L. HORA and K. K. NAIR: Observations on the nutrition of *Panchax panchax*.
 A. G. FRASER: Observations on the bionomics of *Panchax panchax*.
 H. N. RAY: The development of bird malaria parasites in endothelial cells.
 D. N. ROY: Salt water *rossi* as a malaria carrier.
 M. N. DE: The pathology of malarial spleen.
- Moscow
- Academy of Sciences (C.R., 15, No. 6-7; 1937).
 I. M. VINOGRADOV: Representation of an odd number as a sum of three primes.
 D. MENŠOV: The series of orthogonal functions limited in their totality.
 A. A. IVANOV: The most probable orbit of the small planet (122) Gerda, from observations at thirty-four oppositions from 1872 to 1934.
 M. KURENSKIJ: Fundamental formulæ for the calculation of elements of a trajectory of the centre of gravity of a projectile.
 V. FURDUJEV: A method of acoustical design of rooms equipped with loud speakers.
 S. LIFSHITZ: Experimental investigations of reverberation optimum for different frequencies.
 W. W. ŠHOLEJKIN: The principles of the monsoon theory.
 L. A. TUMERMANN and V. ŠYMANOVSKIJ: A fluorometer based on the effect of Debye and Sears.
 K. S. LJALIKOV: Experimental verification of the Thomson formula.
 N. S. KURNAKOV, G. B. BOKIJ and I. N. LEPEŠKOV: Kainite and polyhalite in salt deposits of the Soviet Union.
- V. I. NIKOLAJEV, O. K. JANATJEVA and V. D. POLJAKOV: The potassium deposits on the right side of the Volga and in Kalmykia.
 I. I. CERNIAJEV and V. I. GOREMYKIN: (1) Hydroxylamine-pyridine compounds of bivalent platinum. (2) Oxidation of hydroxylamine compounds of platinum.
 F. M. ŠEMIAKIN: The reactions of rare earths and allied elements with pyrogallol, gallic acid and morphine (5).
 A. I. ZUJTIŇ: Influence of temperature contrasts on the frequency of lethal mutations in *Drosophila melanogaster*.
 A. M. GROSSMAN: The elimination of supernumerary chromosomes in *Zea mays*.
 I. SOKOLOV: The chromosomes in the spermatogenesis of the domestic ass.
 V. I. TOVARNITSKIJ and T. L. RIVKIND: Hormonization of seeds. Treatment of seeds with a solution of equine urine, known to contain substances of hormone nature, resulted in an increase in the yield of grain up to 60 per cent.
 B. S. ZAKHAROV: The problem of vernalization of *Perilla*.
 T. T. DEMIDENKO and N. P. MARTYNOV: The effect of the osmotic pressure of soil solution on the yield and composition of sugar-beet.
 T. T. DEMIDENKO and V. P. GOLLE: The influence of light on the inflow of nutrient substances in plants.
 N. V. NASSONOV: The effect of the subcutaneous insertion of epithelial, osseous and muscular tissues on the surrounding tissues in axolotls.
 L. V. POLEŽAEV: The determination of a regenerating extremity in axolotl.
 A. M. VASJUTOČKIN: Some derivatives of the epithelial framework of the thymus gland of an amphibian.
 A. A. VOITKEVIČ: Morphogenetic activity of different parts of the hypophysis. (3) The influence of different zones of the anterior lobes of hypophysis on the thyroid gland of Amphibia. (4) Inhibition of metamorphosis of tadpoles by the substance of the "eosinophilous zone" of the anterior lobes of the hypophysis.
 S. M. ANDRONOV: *Gigantella* Sars and its stratigraphic importance in the Lower Carboniferous deposits of the middle course of the Ishim River.
- Rome
- National Academy of the Lincei (*Atti*, 25, 149-196; 1793).
 E. BOMPIANI: Construction of surface elements starting from curvilinear elements.
 G. GIORGI: A method for calculating distortion effects in telegraph and telephone wires.
 W. BLASCHKE: Invariants of complexes.
 E. BORTOLOTTI: Moutard's quadratics and the canonic bundle.
 R. CALAPSO: Some surfaces of the third and fourth order.
 W. DOEBLIN: Continuous case of chain probabilities.
 G. ARRIGHI: Observations on the Newtonian motion of any two masses.
 L. MARTINELLI: Luminosity of the images which appear in a telescope.
 G. OCCHIALINI: Gamma radiations of polonium-beryllium.
 A. BARONI: Non-existence of bismuthous bromide, BiBr₃.

Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

ASSISTANT WATER ENGINEER in the County Borough of Croydon—Town Clerk, application forms from Borough Engineer (October 5).

JUNIOR ASSISTANT in the Development Department, British Non-Ferrous Metals Research Association, Regnart Buildings, Euston Street, N.W.1—Secretary (October 8).

LECTURER IN BACTERIOLOGY in the FACULTY OF MEDICINE, University of Birmingham—Secretary (October 9).

LECTURER IN CIVIL ENGINEERING at University College, Nottingham—Registrar (October 15).

SECOND ASSISTANT ENGINEER to the Rivers Mersey and Irwell Catchment Board—Engineer to the Board, Carrington Lane, Sale, Cheshire (October 16).

ASSISTANT (biology) in the Museum and Art Galleries, Paisley—The Clerks to the Committee, Young, Martin and Sauers, 4 St. Mirren Street, Paisley (October 20).

ASSISTANT DIRECTOR OF FISHERIES in the Straits Settlements—The Director of Recruitment (Colonial Service), 2 Richmond Terrace, S.W.1 (October 31).

SIR HENRY ROYCE RESEARCH FELLOWSHIP for work on the common cold or on influenza—Registrar, The University, Manchester, 13 (October 31).

PROFESSOR OF SOCIAL SCIENCE in the University of Liverpool—The Registrar (November 15).

JUNIOR LECTURER and a LECTURER in ZOOLOGY in the University of Cape Town—Secretary to the High Commissioner for the Union of South Africa, Trafalgar Square, London, W.C.2 (November 15).

TWO RESEARCH FELLOWSHIPS relative to the causation and pathology of rheumatic disease—Secretary, Empire Rheumatism Council, 1 Mitre Court Buildings, Temple, E.C.4 (November 15).

TWO SENIOR ELECTRICAL ENGINEERS (temporary) at the Headquarters of the Air Ministry, Adastral House, Kingsway, W.C.2—Secretary (W.9).

ELECTRICAL ENGINEERS (temporary) in the Directorate of Works, Air Ministry, Adastral House, Kingsway, W.C.2—Secretary (W.9).

ASSISTANT MECHANICAL ENGINEER in the Locomotive, Carriage and Wagon Workshops of the South Indian Railway Co., Ltd.—Messrs. Robert White and Partners, 3 Victoria Street, S.W.1.

Official Publications Received

Great Britain and Ireland

Saorstát Éireann: Roinn Talmhaíochta (Department of Agriculture): *Brainse Iascaigh* (Fisheries Branch). Statistics of Salmon, Sea Trout and Eels captured during the Years 1935, 1933, 1931, 1929 and 1927. (P. No. 2627.) Pp. 16. (Dublin: Stationery Office.) 3d. [109]

Britain's New Forests. Pp. 12. (London: Forestry Commission.) [109]

Chelsea Polytechnic. Prospectus, Session 1937-38. Pp. 61. Chelsea School of Art: Prospectus, Session 1937-38. Pp. 16. Chelsea College of Physical Education: Session 1937-38. Pp. 14. Chelsea School of Pharmacy: Prospectus, Session 1937-38. Pp. 19. Chelsea School of Cookery, Housecraft, Dressmaking and Millinery: Prospectus, Session 1937-38. Pp. 10. Chelsea School of Chiropody: Prospectus, Session 1937-38. Pp. 14. Chelsea School of Metallurgy: Prospectus, Session 1937-38. Pp. 18. (London: Chelsea Polytechnic.) [109]

British Film Institute. Science Teaching Films: a Report presented to the Governing Body of the British Film Institute by the Science Committee of the Education Panel. Pp. 44. (London: British Film Institute.) 6d. [159]

Queen Mary College (University of London). Calendar, Session 1937-1938. Pp. 283. (London: Queen Mary College.) [159]

Amgueddfa Genedlaethol Cymru: National Museum of Wales. Humphrey Lluyd's Maps of England and of Wales. By Dr. P. J. North. Pp. 59+5 plates. (Cardiff: National Museum of Wales.) 1s. [159]

Medical Research Council. Seventeenth Annual Report of the Industrial Health Research Board to 30th June 1937. Pp. iii+30. (London: H.M. Stationery Office.) 9d. net. [159]

Bacon Development Board. Bulletin No. 2: Substitutes for Cereals in Pig Keeping. Pp. 62. (London: Bacon Development Board.) 2s. [159]

Transactions of the Royal Society of Edinburgh. Vol. 59, Part 1, No. 6: Metamorphic Correlation in the Polymetamorphic Rocks of the Valla Field Block, Unst, Shetland Islands, By Dr. H. H. Read. Pp. 195-221+2 plates. (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) 4s. [159]

Vitamin D in Cacao Shell (Commercial Cocoa Bean Shell): Reports on Recent Researches, including Investigations into its Use as an Accessory Fodder. Reprinted from various publications and edited by A. W. Knapp. (Technical Series, No. 23.) Pp. 64. (Bournville: Publication Department.) 1s. [179]

Technical Publications of the International Tin Research and Development Council. Series B, No. 5: Fusible Alloys containing Tin. By E. J. Daniels. Pp. 24. (London: International Tin Research and Development Council.) Free. [179]

Royal Technical College, Glasgow. Calendar for the One Hundred and Forty-second Session, 1937-1938. Pp. 522. (Glasgow: Royal Technical College.) [189]

Other Countries

Instituto Nacional de Tecnologia. Estudos sobre conforto termico no Brasil: O termometro resultante de Misenand. Pelo Paulo Pp. 24. Estudos sobre o conforto termico e o conforto visual Brasil. Pelo Paulo Sá. Pp. 43. (Rio de Janeiro: Instituto Nacional de Tecnologia.)

British East African Meteorological Service. Annual Report for Year 1936. Pp. 8+4+2+2. (Nairobi: B.E.A. Meteorological Service.)

Expédition Antarctique Belge. Résultats du voyage de la *Belgica* en 1897-99. Rapports scientifiques. Zoology—Crinoidea. By Dilwyn John. Pp. 11. (Anvers: J.-E. Buschmann.)

Ceylon. Part 4: Education, Science and Art (F). Administration Report of the Director of the Colombo Museum for 1936. By A. Malpas. Pp. F19. 20 cents. Part 4: Education, Science and (G). Administration Report of the Marine Biologist for the Year 1936. By A. H. Malpas. Pp. G12. 15 cents. (Colombo: Government Printing Office.)

Scientific Publications of the Cleveland Museum of Natural History. Vol. 7: The Birds and Mammals of the Western Slope of the Azuero Peninsula (Republic of Panama). By John Warren Aldrich Benjamin Patterson Bole, Jr. Pp. 196. (Cleveland, Ohio: Cleveland Museum of Natural History.)

U.S. Department of the Interior: Office of Education. Bulletin 1937, No. 5: Insurance and Annuity Plans for College Staffs. Sherman E. Flanagan. Pp. v+83. (Washington, D.C.: Government Printing Office.) 10 cents.

Cornell University: Agricultural Experiment Station. Bulletin 665: A Study of Price Differences in Retail Grocery Stores in New York State. By Leila Doman. Pp. 52. Bulletin 666: Body of Butter and Cream. By E. S. Guthrie. Pp. 12. Bulletin 667: Soil relation to Fruit Growing in New York. Part 10: Susceptibility of various New York Orchard Soils in reduction upon water-logs. By Michael Peech and Damon Boynton. Pp. 20. Bulletin 668: Economic Study of Land Utilization in Genesee County, New York. By J. N. Efferson. Pp. 42. Bulletin 669: Marketing Apples in Champlain Valley. By G. P. Scoville. Pp. 41. Bulletin 670: Economic Study of Grape Farms in Schuyler and Yates Counties, New York 1935. By E. G. Misner. Pp. 27. Bulletin 671: Economic Study of Vegetable Farming in New York. 1: Market-Garden Farms in Greenhouses, Rochester Area. By G. A. M. Baptist and E. G. Misner. Pp. 51. Bulletin 672: Soils in relation to Fruit Growing in New York Part 11: The Organic-matter Content of New York Orchard Soils in relation to Orchard Performance. By Ralph W. Cummings. Pp. 17. (Ithaca, N.Y.: Cornell University.)

University of California Publications in American Archaeology and Ethnology. Vol. 37, No. 4: Culture Element Distributions. 4: Part 4. By E. W. Gifford and A. L. Kröber. Pp. 117-254. (Berkeley, California: University of California Press; London: Cambridge University Press.) 1.50 dollars.

Department of Agriculture: New South Wales. Science Bulletin No. 56: Plant Breeding in New South Wales—Tenth Year of Progress 1935-36. Pp. 56. (Sydney: Government Printer.)

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 107: A Soil Survey of the Coomealla, W. W. worth (Curlwaa), and Pomona Irrigation Settlements, N.S.W. T. J. Marshall and Dr. Allan Walkley. Pp. 48+3 plates. Pamphlet No. 70: Further Observations on Soil Erosion and Sand Drift, with Special Reference to South-Western Queensland. By F. N. Ratcliffe. Pp. 28+6 plates. (Melbourne: Government Printer.)

The Carlsberg Foundation's Oceanographical Expedition round the World, 1928-30, and previous *Dana*-Expeditions. *Dana*-Report No. 9: Contributions to the Life Histories of the Deep Sea Lophothoracidae, by Anton Fr. Bruun; *Dana*-Report No. 10: poissons abyssaux du genre *Cyema* Günther (Anatomic, embryology, bionomic), par Dr. Léon Bertin; *Dana*-Report No. 11: Les octopodes de la croisière du *Dana*, 1921-22, par Prof. Louis Joublin. (Published by the Carlsberg Foundation.) Pp. 32+30+50. (Copenhagen: C. A. Reitzels Forlag; London: Oxford University Press.) 1 kr.; 11s.

The Rockefeller Foundation. Annual Report, 1936. Pp. iv+100. (New York: The Rockefeller Foundation.)

Bulletin of the Experiment Station of the Hawaiian Sugar Planters' Association. Agricultural and Chemical Series, No. 52: Scientific Irrigation Management; a Review of Investigations on Plant Water Relations, the Waialua Irrigation Investigations, the Administration of Plantation Irrigation Water. By H. R. Shaw and J. M. Swezey. Pp. 199-279. (Honolulu: Hawaiian Sugar Planters' Association.)

U.S. Department of Agriculture, Farmer's Bulletin No. 1715: Diseases of Fur Animals. By J. E. Shillinger. Pp. ii+22. 5 cents. Miscellaneous Publication No. 258: Annotated List of the Insects and Mites associated with Stored Grain and Cereal Products, and their Arthropod Parasites and Predators. By R. T. Cotton and N. Good. Pp. 81. 10 cents. (Washington, D.C.: Government Printing Office.)

Malta. Annual Report on the Working of the Museum Department during 1936-37. Pp. xxvii. (Malta: Government Printing Office.)

Rutgers University Bulletin. Vol. 14, No. 2A (Studies in Educational Psychology). Pp. 14. (New Brunswick, N.J.: Rutgers University.) 75 cents.

Smithsonian Institution: Bureau of American Ethnology. Bulletin 115: Journal of Rudolph Friederich Kurz; an Account of his Experiences among Fur Traders and American Indians on the Mississippi and the Upper Missouri Rivers during the Years 1846 to 1852. Translated by Myrta Jarrrell. Edited by J. N. B. Hewitt. Pp. ix+300. 48 plates. (Washington, D.C.: Government Printing Office.) 48 cents.