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War, Science and Citizenship

FIELD-MARSHAL LORD ALLENBY, in his rectorial address delivered at the University of Edinburgh on April 28, when he was installed as Lord Rector of the University, gave the students a noble message for the future of humanity. He condemned war between nations in unmeasured terms as futile in itself and perilous to the highest needs of civilisation. "Wars," he said, "have been usually waged for the spoils of victory, increase of territory, acquisition of wealth, even glory to the victor. The lust for expansion is not yet dead, but the glory of conquest is departing, its gains are Dead Sea fruit, its legacy bitter memories alone. We find the cleverest brains everywhere busily experimenting with new inventions for facilitating slaughter, building more horrible engines of destruction, brewing more atrocious poisons, designing more monstrous methods of murdering their fellow-men and women. . . . Governments, distrusting treaty makers, no longer hold treaties in respect, regarding them as merely temporary makeshifts."

The use of poison gas in Abyssinia, and the unprovoked attack upon the country, are examples of a breach of covenant and disregard of international obligations which have been condemned by all civilised peoples. These outrages on humanity have raised again the question of the association of science with war and the prostitution of scientific effort to war purposes. No scientific worker will underestimate the difficulties which confront the Italian chemists who reprobate the abuse of scientific knowledge and work in this manner in a State where freedom of scientific thought and effort have long been proscribed. The danger and the problem are, however, far from being confined to Italy. We need look no further than the preparations for national defence stimulated by the British Government in pursuance of the policies outlined in the White Paper on Defence, and the activities in respect of aerial defence which are outlined in the handbooks on Air Raid Precautions being published by H.M. Stationery Office.

Individual manufacturers and local councils are participating in these preparations, if only through the fear of incurring the anger of those who did survive if no precautions had been attempted. Besides this, however, professional and other associations of scientific workers are being led to participate in various ways; and the responsibility which lies on such associations is far greater than that which rests on the non-technical or non-scientific municipal or district council or manufacturer. Despite the action of individual scientific workers, it is disheartening to find that no association of scientific men has yet had the courage to express a frank opinion on the exact value of this effort and the security it can confer.

There is no more disturbing sign in the present situation than the absence of such an authoritative pronouncement, with the social outlook and acceptance of civic responsibility which it implies. While most scientific workers would not wish to avoid participating in the task of national defence, and in so doing to see that the highest possible efficiency is secured, they would be disloyal to their trust if they do nothing to prevent the creation of a sense of false security, or to make known the extent to which authoritative and expert opinion regards defence against aerial bombardment, whether by incendiary, high explosive or gas bombs, separately or simultaneously, as practicable.

To neglect all precautions would be foolish, but scarcely more foolish than allowing the population to believe that effective defence is possible, or to remain ignorant of the acute dangers which would attend the severing of, for example, the Great London sewer at Barking or the new Mersey tunnel, and the extreme vulnerability of such points to high explosive or gas bombs. Moreover, since complete defence is impossible, authorities have recognised that victory in the next war will go to the country whose population and industrial organisation show the greatest degree of staying power and endurance. Accordingly, populations are being trained and organised to develop staying power and endurance, and the scattering of individuals and industries to enhance staying power has already begun in some of the threatened countries, with consequences to social amenities and the preservation of natural beauty which may be irreparable, as they are for the present disregarded.

The misdirection of scientific effort and national resources in this way is in itself a threat to the continuance of civilisation almost as serious as the outlook of the very warfare against which the precautions are being developed. It is not merely the appropriation in this way, for defence purposes which are largely futile, of large sums of money which might otherwise enable the mass of the population to enjoy that measure of plenty with which science could well endow them. At a recent meeting held in London, Sir John Orr and a group of engineers and other scientific workers assessed the unfulfilled needs of the people of Great Britain with regard to prime human necessities such as food, housing, clothing, health and recreation, at about £3,000,000,000 a year, including a sum for essential foods of £200,000,000, which is roughly the cost in goods and services of the activities now being organised with immense care and skill to meet the artificially created danger of aerial bombardment.

Much more serious is the steady deterioration of life which always occurs under a military regime, and to which Lewis Mumford directed attention in a brilliant chapter in his "Technics and Civilisation". Under such a regime, the reorientation of civilisation so that the creative forces of society are fully utilised, and mechanisation is the agent and not the master of mankind, becomes more than ever impossible of attainment. Nor can we hope either that technical developments will be made to conform to the elementary spiritual needs of mankind or for the successful elimination of the causes of cultural decay which to-day present an evergrowing menace to the spiritual and æsthetic elements still left to our civilisation.

Whether anything worth preserving can long remain in our civilisation under its present conditions and leadership may well be open to doubt. In a speech at Worcester on April 18, the Prime Minister spoke of the probability of the outraged peoples turning against Governments which allowed the use of poison gas in a European war, after hostilities had ceased. That rising against wickedness in high places may well be much nearer. The ordinary citizen has much to lose by mere acquiescence to the drift of present conditions, in which a dangerous premium is put on revolution and violence. Only constructive statesmanship can avert either revolution or disaster, and in that statesmanship men of science must play their part.

Even the dullest cannot fail to see what is involved in the cynical disregard of international conventions shown by Italy's use of poison gas against a nation utterly unprovided with any means either of defence or reprisal in kind. This shattering of faith in international pledges is accentuated by the evident reluctance of powerful members of the League of Nations to resort to effective means of restraining the aggressor, and the consequences of such default may be far-reaching. The alternative to collective security resolutely enforced is so terrible that it would be rash to predict that any intelligent people will indefinitely allow their rulers to repudiate or disregard their international obligations and plunge all alike in a catastrophe from which there may be no recovery.

Scientific workers should pause to consider whether even yet there is not some decisive contribution which collectively they might make to remedy this condition of our so-called civilisation. It is deplorable that so much effort continues to be expended on destructive purposes while the great constructive enterprises, which might enable mankind to enjoy more fully the great resources with which science has endowed us, remain crippled or uncommenced for lack of funds.

The choice before us could scarcely be better expressed than has been done by Mr. H. A. L. Fisher in his recent "History of Europe": "The developing miracle of science is at our disposal to use or to abuse, to make or to mar. With science we may

lay civilisation in ruins or enter into a period of plenty and well-being, the like of which has never been experienced by mankind".

To acquiesce tamely in the present situation is a policy of despair and will assuredly involve scientific workers in the destruction to which civilisation is steadily drifting. To ally themselves boldly with constructive political forces, to apply the spirit and method of science to the elaboration in the political and social spheres of ways and means of control, of relating power to knowledge, may yet avert disaster and enable the world to reap the advantages which are still within its reach. To do so, however, demands courage, and vision, resource and pertinacity the equal of any which has yet been shown in pioneering investigations in those fields of knowledge within which science has hitherto been largely content to limit its activities.

Modern Methods in the Antarctic

Antarctic Discovery:
the Story of the Second Byrd Antarctic Expedition. By Rear Admiral Richard Evelyn Byrd. Pp. xxii + 421 + 47 plates. (London: Putnam and Co., Ltd., 1936.) 18*s*. net.

THANKS to the restraint on publicity imposed by the practice of exclusive copyright in news, most English newspaper readers have been kept nearly as ignorant of Admiral Byrd's second expedition to Little America as of the financing of Irish hospitals or evidence in the divorce courts. As a result there has been a vague impression that the expedition was a lavishly equipped pleasure trip intent on photographing films of sensational stunts and making exaggerated claims to amazing discoveries. It is for this reason that I welcome the opportunity of reviewing Admiral Byrd's book and endeavouring as far as I can stretch the allotted space to direct attention to the solid achievements of the expedition.

It must be acknowledged that the book presents some initial difficulties to the reader accustomed only to English books of travel, but these are soon overcome. The chapter headings give little idea of the subjects dealt with; but a good index goes far to remedy the deficiency. The book is a straightforward narrative vividly and tersely written. The meaning of certain American neologisms can be divined from the context, and even such a cryptic phrase as "commuting to work back home" glimmers into comprehensions as a simile for the monotonous repetition of daily drudgery.

We learn that, like most of our own explorers, Byrd had a hard and distasteful struggle to raise funds and collect stores. He had to be content with two indifferent ships, an old wooden whaler, the *Bear of Oakland*, and a common steel tramp, the *Jacob Ruppert*. On the way out, the latter vessel escorted by a scouting seaplane reached higher latitudes in the South Pacific than had been attained before. This enables the cartographer to push nearly the whole Pacific coast-line of Antarctica south of 73° S. We notice that the name Marie Byrd Land, given in Admiral Byrd's earlier book "Little America" to a modest area south of King Edward VII Land, is now stretched across the whole great lobe between the Pacific Ocean and the Ross and Weddell Seas.

At the Bay of Whales 400 tons of stores were landed and transported several miles to Little America. The old buildings were found intact, deeply buried in snow on which the new buildings were erected, soon to be drifted over in their turn. The two levels were connected by steep tunnels and a population of 55 men, twice as many dogs and several cows was settled for the winter entirely underground. The extent of this catacomb 'city' was so great that Dog-town alone consisted of eight parallel tunnels, each 100 feet long, 6 feet high and 3 feet wide, with each dog tethered to a crate let into the walls on either side out of reach of its neighbours. The whole was burrowed in a cake of ice probably about 300 feet thick and floating on 600 fathoms of water. In fact, it was a potential iceberg, and a system of crevasses made its permanence very questionable until winter moored it fast.

An advanced base 120 miles to the south (in 80° S.) was occupied for the winter by the leader alone, a somewhat surprising arrangement. It was Admiral Byrd's expedition; he was entitled to conduct it as he thought best, and as it was a success the event justified the plan.

"The truth of the matter is," Byrd writes, "I really wanted to go and keenly looked forward to the experience. . . . I sincerely believed I was as interested in the experience for its own sake as I was in the meteorological work for which the Base was designed. Therefore I cannot say that I was making a sacrifice for science. That did not

enter my head. As for leaving the camp without a leader, well, I had confidence in the officers and men at Little America."

Communication by wireless telegraphy was kept up with the leader, and every unit in the field with dogs, tractors or by air were always "contacted" with the Base. Although nearly poisoned by fumes from his stove, Byrd survived the ordeal. Dr. Poulter, his second in command at the Main Base, fell ill with acute appendicitis. He was operated on and his life saved by Dr. Potaka, the clever Maori doctor who had been brought by the *Discovery II* in a dramatic feat of seamanship when the American surgeon resigned immediately after landing.

Exploring work was carried out before and after the winter of 1934 by all three means of transport. The dogs worked well, especially on the great three months' journey of the geological party due south to an elevation of 8,000 feet in the Queen Maud Mountains in 87° S., a total distance of 1,400 miles out and home. Fossils were obtained in great numbers and beds of coal located on the huge rock faces of the mountains. Living lichens were found in the crevices of the rock at the farthest point. Dogs did their full share in the transport of loads between the ships and Little America, but they could not face the extreme cold of winter when temperature fell to − 70° F. or lower.

The tractors bore the brunt of the transport service, and although it was a tremendous task to start the engines, they made the journey to the advance base to the relief of Admiral Byrd in the mid-winter darkness of July. The distance run by tractor amounted to 11,000 miles, which included long journeys along the eastern margin of the Barrier partly on the Ross Ice Shelf and partly along the western slope of the Rockefeller Plateau, often in heavily crevassed country. They were demonstrated to be the most effective of all the forms of polar transport when a sufficient force of skilled mechanics and ample supplies of fuel were available. The troubles of camping were enormously reduced by using the cabins instead of pitching tents to sleep in.

For speed and range, however, the aeroplane easily took the first place. There was a strong fleet of aircraft, from a small auto-giro used for taking meteorological observations at high levels, to the great Condor weighing 8 tons with a wing-spread of 82 feet. The handling of these machines was one of the chief triumphs of the expedition. They had to be housed for the winter in pits dug in the snow where they were soon drifted over. This work, together with the delicate task of digging them out unhurt in the spring, was scarcely less remarkable than the 16,000 miles of flying which they accomplished when in the air. The aeroplanes were often used to lay out depots in advance and to replenish the supplies of the surface parties. The principal exploring journeys by air were into the mass of Marie Byrd land for distances up to 500 miles in straight flights to south-east, east and north-east respectively, the last bearing being along the coast.

In his popular narrative, Admiral Byrd speaks lightly of surveying hundreds of thousands of square miles, but he uses the word as Cowper made Alexander Selkirk say, "I am monarch of all I survey". In the note on maps, the claims are set forth with scientific moderation, and it is explained that there has not yet been time for all the cartographic material to be tested and worked out. The preliminary maps, however, show in an impressive way how greatly this and the earlier expedition have added to the knowledge of the eastern borders of the Ross Ice Shelf. The eastern coast of the ice-filled gulf has been roughly mapped for the first time. It is less mountainous than the western and southern margins, but is clearly marked by the rising slope to the Rockefeller Plateau.

Much new light was thrown on the nature of the Ice Shelf itself by seismic echo-sounding. Although the northern edge of the Barrier was afloat in deep water, the ice proved to be aground at many points in the interior, separated by crevassed belts from the floating portions. The probability of a sea connexion between the Ross and the Weddell Seas has been much diminished. If there is any, it can only be by a comparatively narrow and winding strait.

Apart from the important geographical discoveries and the geological collections, substantial scientific researches were undertaken in biology and physics, which, if fully discussed, should prove valuable. Plankton, for example, was collected from various depths in the Bay of Whales in winter until the sea ice had thickened to more than five feet, and at air temperatures of − 40° or less the contents of the tow-net were transferred to vacuum flasks and carried unfrozen to the laboratory. Regular photographic magnetic records and meteorological observations were made on the surface and in the upper air at the main base and for several months at the advance base also. Cosmic radiation was studied, and a novel feature of the scientific programme was the continuous record of meteors during the winter night at Little America and for some time at the advance base.

Admiral Byrd is to be congratulated on the success of a great venture in which foresight and good management overcame all the risks and hardships of the very severe conditions encountered.

HUGH ROBERT MILL.

Mr. Keynes and the Rate of Investment

The General Theory of Employment, Interest and Money

By John Maynard Keynes. Pp. xii +403. (London : Macmillan and Co., Ltd., 1936.) 5*s*. net.

FOR more than a century the problem of unused resources has occupied a conspicuous place in economic investigation, yet much remains to be done in a field of great intellectual difficulty. A large part of Mr. Keynes's own previous work, not least his important two-volume "Treatise on Money" published in 1930, has been occupied with this and allied topics. His present rather startling volume tears to pieces some portions (not always the weakest) of his earlier work, amends other portions and supplies much new analysis. In dealing with short run changes in the level of activity, the most important factors to consider are, of course, those which determine the rate of new investment—factors already analysed at some length in the author's "Treatise". He now believes, however, that the main weakness of his earlier analysis was that it relegated changes in aggregate output and employment to a secondary position, and involved a definition of income which was not the most convenient one. These defects it is the purpose of the present book to remedy.

Nevertheless, it should not be thought that the "General Theory" is in any sense a mere revision of the "Treatise" ; for cyclical movements of activity now occupy a much smaller part of the picture. Instead of an alternate excess and deficiency of 'effective demand' (aggregate money demand for total output), Mr. Keynes now believes in the existence of a chronic tendency for it to become deficient. His analysis differs from that of the cruder underconsumptionists in that the trouble is imputed not to excessive, but to continuously insufficient investment. The failure of investment to come up to a level which would secure full employment is due, he explains, to the unwillingness, owing to institutional frictions, of the rate of interest to decline adequately. Each level of interest rates represents a perfectly stable equilibrium, and is correlated with a volume of unemployment, which is larger, the higher is the level of interest rates above a critical minimum. This critical minimum corresponds to full employment ; if the rate of interest is forced down below this minimum the resulting increase of investment results merely in rising prices, and a state of 'true inflation' develops. Only after full employment is reached is there any danger of the situation becoming unstable. Certain obvious practical conclusions emerge : the proper way to attack unemployment is not by lowering money wages (which is anyway impracticable) but by governmental measures to expand investment, or (better still) by direct measures (central banking or otherwise) to lower the prevailing level of interest rates. The argument also leads to an unreserved condemnation of the gold, or any other international, standard, since such a standard destroys national autonomy in interest rate policy.

It may be that many readers will think there is more to be said in favour of classical economics than Mr. Keynes allows : he seldom takes Ricardo and his followers on their own ground. It may be, too, that some readers will think the writings of several of the author's contemporaries scarcely deserve the asperity which is accorded them. But it is plain that the book will stand or fall by the relevance to real life of its central (and it should be realised highly unconventional) thesis outlined above. Mr. Keynes's main difference from other writers has to do with his judgments concerning the stability of the rate of investment. The crucial question may be put as follows : Is it possible by lowering interest rates to raise the current rate of investment by some defined amount, without releasing a tendency for investment to go on expanding ? Or if this is possible, but only possible within certain limits, what are these limits ? According to the "General Theory", these limits are set by that rate of investment which yields full employment. But many readers will undoubtedly feel that no sufficient grounds are advanced for believing that expansions of investment are non-cumulative on one side, and cumulative on the other side, of full employment. In effect, Mr. Keynes relies on the short run inelasticity of the supply of capital goods, coupled with the decline in their physical marginal product as they become less scarce, to save him from instability in the rate of investment. But the decline in the supply price of capital goods, as the resources for producing them are increased, will further stimulate investment. To argue that this tendency will be neutralised (within relevant periods of time) by a fall in the physical marginal product of these goods, is surely to lose all contact with reality.

The problem can also be posed in another way. Mr. Keynes develops 'multipliers' to relate the total increments of investment and employment, respectively, to the initial increments in these

quantities induced (say) by a dose of governmental loan expenditure. The multiplier is obtained in each case by summing the secondary, tertiary and other increments which follow as a result of the primary increment. In order that the multiplier shall be finite, or (put otherwise) in order that any tendency to *cumulative* expansion in the rate of investment and danger of ensuing crisis shall be absent, these increments must form a convergent series. But do they ? This is a point that Mr. Keynes has scarcely argued ; and that he should not have done so is all the more curious since most writers in the past have urged, both a priori and from experience, that, at any rate outside narrow limits by no means necessarily coincident with full employment, the series in question do *not* converge.

The practical question remains whether 'full employment' can be secured in a system of private enterprise merely by operating upon the rate of interest. As Mr. Keynes justly remarks in his preface, "the matters at issue are of an importance which can not be exaggerated". He writes for a technical audience, and since his conclusions disagree with the results of most recent thinking on the subject, the sooner other economists decide whether it is they who are on the wrong side of the looking-glass or he, the better it will be. It scarcely needs saying that the book is written with charm and insight, and like everything from the author's pen has a frankness and an aptness of expression which are often disarming. Much of the book is highly original, and all of it is stimulating ; especially penetrating and fruitful are the chapters on the long-term expectation and on the properties of interest and money. But on the fundamental problem, those readers may perhaps be pardoned who decide that the "Treatise" remains a safer, if a less ambitious, guide.

HAROLD BARGER.

Fuels and Fuel Economy

Fuel:
Solid, Liquid and Gaseous. By J. S. S. Brame and Dr. J. G. King. Fourth edition. Pp. xvi+422. (London : Edward Arnold and Co., 1935.) 25*s*. net.

THE subject of fuel grows in political, economic, technical and scientific importance. Though wood is no longer in the picture in competition with coal, oil is very much so. Raw coal is being displaced by coke, by low-temperature fuel and particularly by gas—either coal gas, or coke oven, producer, blast furnace, or water gas—and indeed should never be burnt as such. Liquid fuels are extending in every field of use ; they include fuel oil, Diesel oil, petrol, tar, benzol and alcohol.

There is a large volume of technical and scientific knowledge available about these fuels, their properties and the methods of testing them, which is increasing every day, though it is far from being as widely spread as is desirable, particularly among engineers and fuel users in general.

Such books as the one before us are calculated to help greatly in developing the economic use of the most suitable type of fuel for any particular purpose. It is well to emphasise that fuel costs enter into the cost of every manufactured article, sometimes, as in the heavy industries, in transportation, and in certain chemicals to a very large extent. If manufactured articles are to be competitive, the fuel costs must be kept low, with the result that as the prime cost of a fuel increases, there is every incentive to burn it more economically and therefore to a less extent. Those connected with the coal trade remain obstinately blind to this fact.

Fuel efficiency as a science is as yet in its infancy, and relatively few firms have whole-time fuel officers. In many industries this officer should be one of the most important of the staff, and it behoves our training centres to produce an adequate supply of them. Raw coal has had its day ; the open grate fire is only useful to inspire poets and to counteract depression. Coal should be first distilled for its valuable products and ultimately burnt in forms which keep the tar and smoke and sulphur out of the atmosphere.

The actual loss of combustible matter in the smoke even of a domestic fire is far smaller than is supposed, and by far the greatest saving in an industrial boiler is effected by reducing the amount of air so that the flue gases contain a maximum of carbon dioxide. It is the escaping sulphur which is the real problem, which now requires dealing with drastically in our cities.

This is a fourth edition, a testimony that the authors know their subject, though it has needed a good deal of bringing up to date since progress is so rapid. This is particularly true in connexion with the poorer gaseous fuels. The book is

conveniently divided into four sections dealing with solid, liquid and gaseous fuels respectively and with their analysis and calorimetry.

It is clearly printed and well illustrated with drawings, graphs and tables, and contains a deal of practical information on every section of the subject set out in a manner which should be readily intelligible to the practical engineer and works officer. Its possession and the application of the information it contains should help to advance the cause of fuel economy: in this connexion we would again emphasise the desirability of the employment of full-time fuel economy experts by large firms. E. F. A.

Some Aspects of Eugenics

(1) Constructive Eugenics and Rational Marriage
By Dr. Morris Siegel. Pp. xiii+196. (Toronto: McClelland and Stewart, Ltd., 1934.) 2.50 dollars.

(2) The Chemical Control of Conception
By Dr. John R. Baker. With a Chapter by Dr. H. M. Carleton. Pp. x+173. (London: Chapman and Hall, Ltd., 1935.) 15*s*. net.

(1) DR. SIEGEL'S small volume has been written for the average reader who may wish to learn something about the science of eugenics. Following a short chapter on the laws of heredity, the author opens his main theme, which is that the number of defectives in proportion to sound stock in a population is steadily increasing, owing to the prevalence of what may be called faulty mating; and it is the author's object to indicate how it should be possible to ensure proper and suitable unions.

For the preservation of the race, it is essential in the author's opinion that steps be taken by society to prevent breeding from unhealthy stock. As it happens, in certain instances great men and great women have arisen from a bad stock, so that it is impossible to insist upon a wide programme of sterilisation as a general method of improving the human stock. Dr. Siegel therefore advocates an extensive educational programme which would involve the compulsory teaching of eugenics in higher schools, more extensive instruction in heredity and eugenics for medical students, post-graduate courses for the training of specialists and widespread propaganda. The author emphasises that good stock is not synonymous with the so-called upper classes, and quotes many instances of famous men and women who have risen from the masses.

Dr. Siegel's book is written in a popular manner, but suffers from the disadvantage that the political outlook is not always applicable to conditions in Great Britain.

(2) Touching on this subject from a different angle is the question of birth control, which may play an extremely important part in the future in regulating over-population and so the pressure of peoples outwards, beyond their frontiers. Moreover, in modern civilisation it is often considered essential to control the frequency of births in families, or even to prevent them altogether. Chemical methods of contraception are frequently practised, but little scientific work has been carried out on the subject, so that Dr. Baker's book fills a distinct gap.

Dr. Baker uses the spermatozoa of the guinea pig on which to test the effect of contraceptives. The spermatozoa can be maintained alive in different fluids, such as phosphate or acetate glucose-saline, or a solution of egg white in saline or phosphate. The author has found that it is best to determine the lowest concentration in which a substance under test kills all the spermatozoa in a standard time rather than to find out how long the spermatozoa take to die in a standard concentration. Most substances have little or no effect upon spermatozoa in one-eighth of the concentration at which they immobilise every time. The most potent compounds found were certain quinones, which immobilise in a concentration of 1/512 per cent. At the end of the scale come resorcinol and chloral, which only immobilise in a concentration of 1 per cent. The alkaloids harmine and ethylharmol are weakly active: quinine salts are less potent. Human spermatozoa react in almost the same way as those of guinea pigs, but germicidal power is not a reliable indicator of spermicidal activities.

Unfortunately, however, the most active compounds are irritant to the vaginal wall. In fact, it appears that a really potent chemical contraceptive which is also devoid of any pathological effects has yet to be found. In the course of the experiments, it was noticed that certain of the compounds at certain concentrations stimulated the activity of the spermatozoa, and it is suggested that strychnine in dilute solution should be used in human beings where sterility is due to feeble motility of the spermatozoa. The book gives a detailed account of the experiments carried out and should be of the greatest value to all those engaged in investigating the usefulness of contraceptives.

Confessions of a Ghost-Hunter

By Harry Price. Pp. 396+16 plates. (London: Putnam and Co., Ltd., 1936.) 10*s*. 6*d*. net.

THIS volume is a further series of accounts by Mr. Price of his experiences when investigating alleged supernormal phenomena. In the course of his remarks he ranges over a wide field, and thus the records are somewhat unequal in value. Thus, on one hand, space is given to accounts of the performances of palpable frauds; and on the other, we find interesting chapters which contain records of experiments with persons well worth serious attention, like the vaudeville telepathist, Fred Marion. From the scientific point of view one of the most interesting chapters is that dealing with 'spirit' photography, in which Mr. Price details a number of ingenious methods for producing these fraudulent results. From this account it will be seen how valueless reports by untrained and uncritical persons must be, and how difficult is any serious investigation of such claims.

Apart from accounts of these rather dubious manifestations, the book contains a good deal of topical material of importance to psychical researchers, including a résumé of the forthcoming report of the University of London Council for Psychical Investigation on experiments with a subject who exhibited unusual hyperæsthesia; and a summary of the recently staged fire-walk by Mr. Kuda Bux. In this latter case, where the same performer claims to be able to read blindfolded, Mr. Price is of the opinion that this exhibition of eyeless sight is "extremely interesting, entertaining and puzzling", a somewhat startling conclusion, seeing that he himself admits that Bux will not allow the investigators to prevent him seeing down the sides of his nose.

For and Against Doctors:

an Anthology. Compiled by Robert Hutchison and G. M. Wauchope. Pp. 168. (London: Edward Arnold and Co., 1935.) 7*s*. 6*d*. net.

DRS. ROBERT HUTCHISON and G. M. Wauchope have fished in all the waters of literature for evidence of the world's opinion of its medical advisers. The feast which they have prepared from their catch is salted with wit and strongly spiced with mustard and pepper. The dishes vary in length from simple statements like "I abhor physicians" to a quotation from Molière occupying three pages. The material is divided chronologically into chapters, and each chapter is prefaced with a summary of its contents. The authors believe that the praise and the dispraise pretty well cancel out. Gravimetrically this may be true, but volumetrically there is more abuse than homage. There is evidence that increase in medical skill has been accompanied by an increase in the reputation of doctors. The first quotation from the "Ancients" states that "the best of doctors is ripe for Hell". The last word of the "Moderns" is that "If a doctor's life may not be a divine vocation, then no life is a vocation, and nothing is divine".

Abraham:

Recent Discoveries and Hebrew Origins. By Sir Leonard Woolley. Pp. 299. (London: Faber and Faber, Ltd., 1936.) 7*s*. 6*d*. net.

IN writing this study of Abraham, Sir Leonard Woolley evidently had in mind the class of readers who seek in archæology evidence which will confirm Bible narrative. As he is careful to explain at the outset, his work of excavation in Mesopotamia has produced no concrete evidence of the presence of Abraham at "Ur of the Chaldees"—in any event the epithet is an anachronism. He maintains, however, that the knowledge of the civilisation of Ur, which has been acquired by excavation in the years in which the joint expedition, of which he was leader, was engaged on the site, both explains and expands the Biblical narrative. If Abraham as a young man, and the people of whom he was the leader came from Ur, the patriarch may fairly be regarded as something more than the leader of a nomad bedouin tribe. He and his people had been in contact with the civilisation of a Sumerian city; and to this contact may be ascribed certain peculiarities in the behaviour of Abraham, such as his treatment of Hagar and Ishmael, and certain distinctive characteristics in Hebrew law and religion, which appear with a clearly perceptible change in the character of the historical narrative when Abraham comes on the scene. The Biblical narrative, therefore, Sir Leonard concludes, is substantially accurate. The argument is stated with much force, and the clear and succinct account of the civilisation of Ur brings into due prominence the resemblances which the author finds in the two cultures.

Einführung in die deutsche Bodenkunde

Von Prof. Johannes Walther. (Verständliche Wissenschaft, Band 26.) Pp. viii+172. (Berlin: Julius Springer, 1935.) 4.80 gold marks.

THIS book, by a well-known German geographer, is a popular account of the author's views on the geomorphological history of German soils. He sets out to describe the varying climates that have prevailed in Germany since post-Cretaceous times, and their effect on the deposition of soil material and on the plant and animal life. The greater part of the book is naturally concerned with a description of the conditions that prevailed during the Ice Age and their effects on the present-day landscape. He is barely concerned with the details of the chemical weathering of the soil material that has taken place since it was laid down in its present position. Thus the book should be complementary to the usual books on soil formation.

Unfortunately, the usefulness of this book for English readers is limited, for the author justifies very few of the statements made, as it is primarily a popular account of his views. It is thus difficult to distinguish between those statements that are generally true and those that are only applicable to parts of Germany, or between the ideas held by the author and those that are generally accepted.

E. W. R.

The Cavendish Laboratory, Cambridge

Benefaction by Sir Herbert Austin, K.B.E.

THE benefaction of approximately £250,000 by Sir Herbert Austin for the future work of the Cavendish Laboratory satisfies in a most handsome way one of the urgent needs of the University of Cambridge.

In recent years, developments in physics have changed the requirements of experimental physicists from the glass tube and electrometer of an earlier generation to apparatus such as the two million volt generator, the 50-ton magnet or the cryogenic laboratory. The initiation in Cambridge of new fields of work involving such apparatus has been made possible by the support of the Department of Scientific and Industrial Research, by generous help from the Royal Society and by special grants from the University. Inevitably, however, it would have been difficult for the University to provide from its limited resources for a continuation of such developments in the future, and for some time the need of research endowment has been strongly felt.

Not only have funds been required for research purposes, but also far-reaching reconstructions of the buildings of the Laboratory have also become necessary. The oldest wing of the Cavendish Laboratory was built under the close personal supervision of Clerk Maxwell between 1871 and 1874, the cost being defrayed by the seventh Duke of Devonshire, then Chancellor of the University. The Laboratory, built in a restrained Gothic manner, consisted of a large lecture room, ground floor research rooms and workshop, and class rooms above. In this building Maxwell, Rayleigh and J. J. Thomson built up the Cambridge school of experimental physics. Between the years 1877 and 1893, the number of students rose from 22 to 150, and in 1893 the first extension of the Laboratory was made, houses in Free School Lane being converted into a large class room for elementary teaching with a small lecture room and offices above. In 1896, with the admission of graduates of other universities to carry out research work with J. J. Thomson, the number of research workers gradually increased, and by 1906 further extensions became necessary. For this Lord Rayleigh generously handed over the sum of £5,000, being the greater part of his Nobel Prize, and by 1908 the ground floor research rooms known as the 'Garage', the lecture room above and the small block of research rooms on the second floor had been completed.

During the directorship of Lord Rutherford, the number of research workers in the Laboratory increased further to between forty and fifty, and to provide for this and for the increasing scale of the work, further accommodation became urgently necessary. Fortunately for the development of the work, the great Rockefeller benefaction of 1930 enabled the University to provide new accommodation for the biological departments, and to hand over some of the old buildings adjoining the Cavendish Laboratory until such time as they could be reconstructed.

Plans were then prepared showing how the site could best be used, and the organisation of an appeal for the sum of £250,000 was commenced. Much interest has been shown by many friends of the Cavendish. They will be delighted to hear of this splendid gift by Sir Herbert Austin.

The University, in the confident expectation that the appeal would succeed, had already authorised the construction of a new high-voltage laboratory. It will now be possible to prepare a more far-reaching scheme including a new research block on the site of the old Zoological Laboratory, and some reorganisation of the teaching wing. It should also be possible to meet many long-felt needs of the Laboratory, and to provide substantially increased facilities for research.

We have received the following appreciative notice of the work of the Cavendish Laboratory from Sir Ambrose Fleming:

IN common with all other Cambridge men, I am enormously gratified to hear of the splendid munificence of Sir Herbert Austin in giving a quarter of a million sterling to the University of Cambridge for the special benefit of the Cavendish Laboratory.

That Laboratory and chair of physics was founded in 1870 by the generosity of the seventh Duke of Devonshire, then Chancellor of the University, and the first occupant of the chair was James Clerk Maxwell whose contributions to science had made him then of world-wide fame. Under him the Laboratory was designed and equipped. Among a small number of his first students I had the privilege of being numbered. This group included the late Principal W. M. Hicks, Sir Richard Glazebrook, Mr. J. E. H. Gordon, Prof. G. Chrystal, Sir Arthur Schuster and Prof. J. H. Poynting, with William Garnett as

demonstrator. My own work there consisted, at Maxwell's suggestion, in comparing the existing B.A. standards of resistance with the object of ascertaining the most probable value of the B.A. unit, the absolute value of which was afterwards determined by the work of Lord Rayleigh and Sir Arthur Schuster. For this purpose a special form of resistance balance was designed which was in use for many years afterwards at the Cavendish Laboratory.

After the lamented decease of Prof. Clerk Maxwell in 1879, Lord Rayleigh consented to hold the chair for a time in response to a universal request, and made in a few years most notable contributions to exact electrical measurement.

Then on Lord Rayleigh's retirement, Sir J. J. Thomson, now Master of Trinity College, was appointed, and began his epoch-making researches on the constitution of the atom. Under him a large number of research workers were gathered whose discoveries made the Cavendish Laboratory world-famous.

On Thomson's retirement, Lord Rutherford succeeded to the chair, and his great discoveries in radioactive matter and the structure of the atom have opened new chapters in the history of science. With him have been associated other workers whose researches have given them fame. The work of Dr. Aston on isotopes and the discovery of the neutron by Prof. James Chadwick, and more recent work by others, such as Drs. J. D. Cockcroft and E. T. S. Walton, have made departures of an importance not easily overstated.

This donation of Sir Herbert Austin will, I believe, be devoted to the erection and equipment of a new high-voltage laboratory, where electromotive forces of a million or more volts will be employed to hurl the hardest particles in nature, namely the alpha particle, at other atoms, and so break up their nuclei. It is possible by some such process that an artificial radium may be produced with all the valuable properties of the natural radium in therapeutic work. It is impossible yet to foresee all the supreme importance of the outcome of such a new laboratory. We know already that enormous stores of atomic energy are awaiting discovery and utilisation, and this great benefaction of Sir Herbert Austin when utilised by the resourceful and able research workers in physics at Cambridge will unquestionably bring in due course not only greater knowledge but also greater benefits to mankind.

Blackpool Meeting of the British Association

THE visits of the British Association to Lancashire have not been infrequent—they began with the Liverpool visit of 1837—and its members know, and appreciate, the traditions of Lancashire hospitality. In its history of a hundred and five years the Association has visited Liverpool six times, Manchester thrice and Southport twice. Now the Association will enlarge its experiences, having accepted for this year (September 9–16) the invitation extended by the Mayor and Corporation of the Borough of Blackpool.

Each of the great cities of the North has its special characteristics, but their civic and industrial activities may be matched in other regions. Blackpool may fairly be said to be unique. It has devoted itself to the problems of the systematisation of mass-amusements with a spaciousness which is all its own. In these, and in its municipal activities, it has preserved a pioneering energy and ability to take the long view given to it by the far-sightedness of its first Mayor, the late Dr. W. H. Cocker—an ability which has made Blackpool's remarkable experiments in town lighting and traction models for other communities for more than fifty years past. The Blackpool meeting also affords special opportunities for the study of what is, in its integrity, a little-known corner of the kingdom. The Fylde is a division of England the natural features of which will well repay investigation, a division which still has its own peculiarities of thought and diction and the villages of which preserve something of the atmosphere of those days when the Industrial Revolution was not.

Sir Josiah Stamp will deliver his presidential address in the Empress Hall of the Winter Gardens. The exact title of the address is not announced, but it will deal with the impact of science on society—a subject at once arresting and topical. The spirit of the age is less and less in sympathy with the view that science may be pursued regardless of its repercussions on the community; nor, in these times, may we be quite so complacent concerning the benefits conferred by science on society as was the fashion in the days of Samuel Smiles. Eugenic and dysgenic effects must be considered, and those who look to Sir Josiah Stamp for an analysis of these repercussions which shall be critical, far-reaching and provocative, are not likely to be disappointed.

The sectional presidential addresses cover a wide field, and in many instances deal directly with the bearing of scientific investigation on the

life of the community. The list of the addresses is as follows :

Section A (Mathematical and Physical Sciences) : Prof. Allan Ferguson, "Trends in Modern Physics"* ; Section B (Chemistry) : Prof. J. C. Philip, "The Training of the Chemist for the Service of the Community"* ; Section C (Geology) : Prof. H. L. Hawkins, "Palæontology and Humanity" ; Section D (Zoology) : Dr. Julian Huxley, "Natural Selection and Evolutionary Progress" ; Section E (Geography) : Brigadier H. S. L. Winterbotham, "Mapping of the Colonial Empire"* ; Section F (Economic Science and Statistics) : Dr. C. R. Fay, "Some Aspects of Commercial Agriculture" ; Section G (Engineering) : Prof. W. Cramp, "The Engineer and the Nation"* ; Section H (Anthropology) : Miss D. A. E. Garrod, "The Upper Palæolithic in the Light of Recent Discovery" ; Section I (Physiology) : Prof. R. J. S. McDowall, "Integration of the Circulation" ; Section J (Psychology) : Mr. A. W. Wolters, "Patterns of Experience" ; Section K (Botany) : Mr. J. Ramsbottom, "The Uses of Fungi"* ; Section L (Education) : Sir R. Livingstone, "The Future in Education" ; Section M (Agriculture) : Prof. J. Hendrick, "Soil Science in the Twentieth Century"*.

The Council of the Association has evidently been studying its statutes, and has wisely interpreted the phrase, "to obtain more general attention for the objects of Science and the removal of any disadvantages of a public kind which impede its progress", as one of encouragement to the Council in its response to the growing public demand for a discussion of the more immediate bearing of advances in science on the life and well-being of the community. With the exception of the mathematical theorem which its discoverer announced as—"Thank Heaven, of no possible use to anyone, at any time, or in any circumstances", there are no advances in science which may not, potentially, influence the life of the community ; but some discoveries are more remote in their influence than others. Moreover, titles are misleading ; and the new policy of indicating by an asterisk those subjects of more immediate public interest is one which should commend itself alike to the members of the Association and to the Press.

The programmes of the sections, even in their present brief form, illustrate in a very interesting fashion the tendency to move from isolated papers to discussions. Discussions, either within a section, or jointly between two sections, are likely to bulk largely in the Blackpool programme ; and of these discussions quite a large fraction is concerned with topics of community interest. Thus, discussions on high voltages and on textiles, on chemistry and the community, on scientific problems of the poultry industry, on Abyssinia, on economic problems affecting Lancashire, on engineering problems of mass-amusement, on climate and health, on botany and gardening, on the social and cultural value of science, on the strain of modern civilisation, and on national nutrition and British agriculture, are examples, taken from the sectional programmes, of topics which have been starred as of immediate communal interest. And there is no lack of variety in the unstarred subjects for discussion. Genetics and the race concept, education for rural life, motor-car headlights, sea defences, the teaching of economics in schools, the agricultural geography of the Fylde, earth movements in north-east England, and the physical basis of living matter—these are but a selection from topics of general and of local interest.

The discussion, staged by Section A, on the evolution of the solar system, brings back memories of that wider discussion on the evolution of the universe which was such a prominent feature of the London meeting of 1931. It is specially appropriate that this related, if rather more modest, topic should come to the front at the Blackpool meeting. For Sir Oliver Lodge, the doyen of the Association, whose memories of its meetings reach back to those remote days when John Tyndall's Belfast address raised such a storm, has, after two years' absence, announced his attention to attend the Blackpool meeting. It was at the London discussion that Sir Oliver made his latest formal contribution to the proceedings of Section A. Is it too much to hope that the Section will again have the privilege of hearing its old friend and whilom president on one of the many topics which have engaged his interest ?

The evening discourses will be delivered by Capt. F. Kingdon-Ward, who will speak on plant-hunting and exploration in Tibet, and by Mr. C. C. Paterson, who will deal with a subject of special interest to Blackpool—science and electric lighting.

A couple of generations ago, the Association was wont to arrange at its meetings popular addresses which were known as "Lectures to the Operative Classes". We have left such titles far behind to-day, but the practice survives, and public lectures of a popular type will be given during the week of the meeting in many of the neighbouring towns.

A number of most interesting sectional and general excursions have been arranged which should afford to members ample opportunity for making acquaintance with the beauty-spots and antiquities of Lancashire. The Lakes are well known, and an outstanding feature of the week will be a whole-day excursion to the Lakes on Saturday, September 12. A shorter Saturday

excursion may be arranged which will give an opportunity to explore the Ribble valley and to see something of the work which has recently been carried out at Whalley Abbey. Sectional excursions and visits will include the Metropolitan-Vickers Works at Manchester, Stonyhurst and Rossall, the freshwater biological station at Wray Castle, and the laboratories of Imperial Chemical Industries Ltd. at Blackley.

A four-days' excursion in the Furness district is being arranged in collaboration with the Yorkshire Geological Society immediately preceding the meeting, and a four-days' excursion to the Isle of Man after the meeting is under consideration.

The Mayor and Mayoress of Blackpool (Alderman Walter Newman, J.P., and Miss Newman) will hold a reception in the Winter Gardens on Thursday evening, September 10.

Scenic Geography at the Royal Academy

"WHAT will this year's Academy teach us about the scenery of the world ?" was the question uppermost in my mind as I entered Burlington House. It was with particular satisfaction that I noted several instructive studies of the scenery of cities. The sky-line of the city is bolder than any which Nature can produce, but in the strong light of day the scene is generally confusing in its multiplicity of form, and in colour often drab and dull. But Mr. C. R. W. Nevinson's two studies of London in twilight illustrate the advantages of civic scenery without its drawbacks. "Hail and Fairwell" (730) gives us a last view of the round arches of Waterloo Bridge with the harmonious curves of the dome of St. Paul's in the background, with the grey of twilight changed to a deep and tender shade of blue by the amber glow of the street lighting. In his second study, "Battersea Twilight" (727), the sky-line beyond a foreground of the Embankment and river is dominated not by a Cathedral but an industrial building, the Battersea Power House with its two great chimneys. There is a story that Whistler replied to a friend who complained of the prominence of factory chimneys, "Call them campaniles". It is to be hoped that in a future exhibition Mr. Nevinson's study may be followed by one taken from a nearer stand-point where the details of Sir Giles Gilbert Scott's design can be seen, particularly the fluting of the chimneys which so greatly enhances the columnar effect. This is the artistic touch that campaniles share but which the older factory chimneys lack. It is a hopeful sign of the times that the architect of Liverpool Cathedral has been entrusted with the design of this great industrial building. If the practice becomes general of obtaining the best architectural advice for factory building, the social benefit will be great, for if these huge erections were made beautiful the community would realise better the romance of industrial achievement.

Among the studies of purely natural scenery none has more poetic appeal than Mr. Julius Olsson's large painting of "Land's End and Longships Light" (151). Below the dark cliff a broad band of foaming surf is lit by the moon, which shines through a rift in the sombre clouds. Two studies of the Cornish coast (246 and 541), by Mr. Charles Simpson, remind us of the importance of taking steps to preserve this wild shore as a sanctuary of scenery. Mr. Borlase Smart's "Along our North-West Coast" (540) is one of the few studies of the shore viewed from the sea, which when the land is mountainous is one of the most attractive aspects of natural scenery. The recent extension of the programme of pleasure cruises, now much better organised than heretofore, would provide the sea painter with a travelling studio for such studies. Thus, passing west of Teneriffe on the outward and to the east on the homeward voyage of the *Almanzora*, I recently saw the whole circumference of the wonderful Peak from an advantageous distance with exquisite effects of cloud and sky.

Of mountain scenery there is a fine example in Mr. Harry Van der Weyden's "From the Path to Castellar" (121), in which the nobility of height is associated with the solemnity of shadowed valleys where the sun's declining rays can no longer penetrate.

The quiet charm of the fields, woods and rural architecture of the English countryside is the welcome theme of many works. Mr. Oliver Hall's "Leckhampton Court from the Lawn" (22) possesses in full measure the restful dignity characteristic of this artist's work. Mr. Alfred J. Munnings's "A Farm in Suffolk" (60) illustrates the advantageous setting which the small undulations of the Suffolk landscape provide for the picturesque old farm houses. The suave lines of the rolling chalk downs are the subject of pleasant water-colours by the Very Rev. W. Foxley Norris, "Chanctonbury Ring" (777) and by Mr. Charles H. Larkin, "The Downs, Poynings, Sussex" (956).

In Mr. Karl Hagedorn's "Spanish Fishing Boats" (702) we have a study of the captivating curves of sailing craft which it is now so urgent to record.

Sir John Lavery's impressive portrait "Grey Owl" (553) is of special interest to the scientific world. This man, a Red Indian, by a self-denying life in the company of beavers, has carried our knowledge of an animal species to a point which it is only possible to attain when intellect is reinforced by loving-kindness.

VAUGHAN CORNISH.

Among the portraits of men of science are Catherine Dodgson's chalk drawing, "Sir Thomas Barlow, Bt., M.D., F.R.S." (1236); a white metal bust "Dr. Alexander Scott, F.R.S." (1518) by Sir W. Reynolds-Stephens; a charcoal drawing of Sir Almroth Wright, K.B.E., C.B., M.D., F.R.S. (1212) by Francis Dodd and also a bronze bust of Sir Almroth (1503) by Donald Gilbert; oil paintings of "Dr. J. Vargas Eyre, Ph.D., M.A." (375) by Algernon Talmage, and "A. E. Morgan, Esq., M.A., Principal and Vice-Chancellor of McGill University, Montreal, formerly Principal of University College, Hull" (409) by Frederick W. Elwell; miniatures of "Emeritus Professor R. W. Reid, M.D., LL.D., F.R.C.S.", emeritus regius professor of anatomy, University of Aberdeen (1055) by Isabella E. Reid, and "Bernard Dyer, Esq., D.Sc." (1133) by Inés Johnson; mezzotints of "Thomas Telford, after Sir Henry Raeburn, R.A." (1311) and "The Viscount Wakefield of Hythe, C.B.E." (1335) by H. Macbeth-Raeburn.

In addition, mention may be made of two architectural drawings by Charles Holden, "London University: Bird's-eye View from South-West" (1368) and "London University" (1451).

Hofmann and his Influence on Chemistry in Great Britain

IN his Hofmann Memorial Lecture, delivered at the Imperial College of Science and Technology on May 4, Prof. G. T. Morgan dealt with A. W. von Hofmann's career as chemist and teacher, and vividly recalled the extraordinary influence which he had on contemporary chemistry and chemical technology in Great Britain.

The main facts of Hofmann's life and work are well known through the original lectures delivered before the Chemical Society in 1893 by Lord Playfair, Sir Frederick Abel, Sir William Perkin and Prof. H. E. Armstrong. Hofmann came to England from Bonn in 1845 as a young man of twenty-seven, and spent the best years of his life in this country. Most chemical discoveries had until that time been the work of brilliant individuals, and it was left for Hofmann and for Graham to found the first schools for the training of chemical investigators. The times were peculiarly propitious for the new developments: Liebig's tour of the country in 1842 had awakened a general interest in chemistry, and, under the leadership of the Prince Consort, Sir James Clerk and Playfair, the Royal School of Mines and Royal College of Chemistry were founded. Hofmann became the first director of the latter, which rapidly developed as a centre for both instruction and original research. The early account books of the College show that chemistry became a popular and even fashionable study, owing no doubt to Hofmann's close associations with the Royal family. When he left England, twenty years later, to use Prof. Morgan's words, "Hofmann had established a school of research in organic chemistry such as had never existed before in this country."

Organic chemistry was then beginning the rapid development which was one of the main features of the science of the second half of the nineteenth century, and Hofmann was one of the first great chemists to specialise in this particular branch. His name is particularly associated with that of aniline, the compound which he described as his first love. In 1843, he investigated the "cyanol" of coal tar and suggested that this was identical with the bases "aniline" and "crystallin" prepared by the degradation of indigo and with the "benzidam" obtained by reducing nitrobenzene, a view which was afterwards shown to be correct. In later investigations he dealt with a wide range of derivatives of aniline, including the chloranilines and the phenyl carbamides. The early experiments were greatly hampered by scarcity of material; aniline was made from indigo and "the production of a few ounces was a proud achievement".

Hofmann was greatly attracted by Wurtz's contemporary discovery of monomethylamine and monoethylamine. This led him to investigate whether the remaining two hydrogen atoms attached to nitrogen in aniline and the alkylamines could be substituted by alkyl radicals without affecting the general nature of the bases. This led to the discovery of the alkyl anilines and of the quaternary ammonium compounds. Hofmann at once correctly interpreted the nature of these substances and their theoretical significance. Prof.

Morgan pointed out that the work foreshadowed the discovery that the four radicals surrounding the nitrogen atom in the tetra-alkyl ammonium salts are in equivalent positions. Another example of Hofmann's acumen in theoretical matters was shown in his work with Cahours on the corresponding compounds derived from phosphorus, in which the analogies between nitrogen, phosphorus, arsenic and antimony were clearly recognised. This was some twelve years before the development of the periodic law by Mendeléeff and Lothar Meyer. For the preparation of the trialkyl phosphines, Hofmann and Cahours used the corresponding zinc alkyls, which had recently been discovered by Frankland. With these classical investigations, the name of Hofmann will always be associated.

Prof. Morgan's lecture recalled many less known facts, for example, that Hofmann was responsible for the discovery of allyl alcohol, the first unsaturated alcohol (with Cahours), and of formaldehyde.

A brilliant group of pupils and assistants worked under Hofmann's direction during the prosecution of these researches. They included Abel, de la Rue, Merck, Crookes, Divers, Clowes and Newlands and the founders of the synthetic dyestuff industry in Perkin, Nicholson, Mansfield, Griess, Martius, Medlock and Greville Williams. The record of these men in science and technology is a testimony to Hofmann's extraordinary power of kindling enthusiasm among those with whom he came into contact.

Hofmann was the midwife at the birth of the organic dyestuff and fine-chemical industry. His pupils founded the first factories, and his researches on the aromatic bases acted as the scientific foundation of the technical processes. Prof. Morgan gave a very interesting picture of the influence which Hofmann and his school had on the early growth of the industry. Perkin's original discovery of mauve was made at a time when he was Hofmann's assistant, and the connexion was maintained by Mansfield's collaboration with the firm of Read Holliday of Huddersfield, and with the scientific investigations of Hofmann himself and of Nicholson on the rosaniline bases. The name of Perkin is deservedly honoured. Nicholson and Mansfield have perhaps not received the recognition which their pioneer work merits.

It is well known that Perkin's second great success was the synthesis from anthracene of alizarine, the natural colouring matter of the madder root, used in the production of 'Turkey Red'. The first research assigned to Perkin by Hofmann was a study of "paranaphthalene", as anthracene was then called. The experience gained by Perkin, then sixteen years of age, must have been invaluable to him later.

Although the heroic period of the colour-making industry in Great Britain has passed, it is satisfactory to realise that it has completely recovered from its pre-War decline, and that, in Prof. Morgan's opinion, four of the six outstanding discoveries in tinctorial chemistry of recent times have been made by British chemists.

Obituary

Sir Archibald Garrod, K.C.M.G., F.R.S.

ARCHIBALD GARROD, who died at the age of seventy-eight years on March 28 last, was a physician to whom the chemical aspects of pathology and clinical medicine made a special appeal. His father, Sir Alfred Garrod, M.D., F.R.S., had the same tastes. He was deeply interested in chemistry as a science, and though professional calls left little leisure for these pursuits, delighted in laboratory experiments. As many will remember, Alfred Garrod was the first to give a convincing demonstration of the presence of uric acid in the blood of gouty patients. This was in 1848, and his son was able to claim with pride that it involved the first biochemical observation of the kind made on the living human body. These paternal interests may have awakened those of the son, though in the latter love of chemistry seems to have been innate.

Archibald Garrod went from Marlborough to Christ Church, Oxford, and took a first class in natural science in 1884. For his medical training he joined St. Bartholomew's Hospital and became distinguished as a student. He was marked out for the visiting staff, but promotion at Bart's. was at that time very slow, and it was not until 1903 that he became assistant physician. In the intervening years, however, he held other clinical posts, of which the most important was that of honorary physician to the Great Ormond Street Hospital for Sick Children. It was during these years that he found leisure for personal research.

Garrod was led to take a special interest in urinary pigments, and between 1892 and the end of the century he published a series of papers dealing with these. Each of the best known among the excretory pigments received his attention in turn; hæmatoporphyrin, urochrome, uroerythrin and urobilin. His publications on these were mainly descriptive, and the spectroscope played a chief part in the studies; but all the observations were

made with meticulous care, and the results very carefully recorded.

It was just before the end of the century that Garrod's interests turned to the subject of alkaptonuria. It was his contact with this anomaly which led him to think so deeply, and to write so brilliantly, concerning what he came to call "chemical malformations", or "inborn errors of metabolism". In 1899 he published an important paper on this anomaly in which the data recorded in all known cases were assembled, and which described two cases studied by himself. Emphasis was laid on the circumstance that the condition was not a disease but an individual variation from the normal; and, moreover, that its distribution is familial. It was later pointed out by Bateson and Punnett that its mode of incidence finds a ready explanation if it be regarded as a recessive character in the Mendelian sense.

This increased Garrod's interest in the subject. His own further studies of cystinuria, and the efforts he made to gather and study all the data from the literature bearing upon these and analogous conditions, such as albinism and pentosuria, led to the publication in 1909 of his book "Inborn Errors of Metabolism". A second edition appeared in 1923 in which new chapters dealt with instances of inborn metabolic defects unrecognised as such when the first edition was published. This book, so ably written and so full of interest, has stimulated the thought of many, and has to my knowledge led not a few students to seek a career in biochemistry. Its author's interest in the subject of the book never weakened. Among his later publications was one in which, conjointly with L. G. J. Mackey, he described a case of congenital hæmatoporphyrinuria, and another (with W. H. Hurtley) on congenital family steatorrhœa.

It is sure that had he chosen a career in science, Garrod would have taken high rank as an investigator. Professional calls, especially in later years, left him little leisure for personal research, but his interest in science and especially in the progress of biochemistry was abiding. During the seven years of his tenure of the regius chair of medicine at Oxford (1920–27) he held the needs of the scientific departments always in mind, and did much to promote their interests.

Garrod's instinctive scientific attitude of mind was inherited, and is, it would seem, familial. His father, given opportunities, would have been an experimentalist of high rank, and his eldest brother, Alfred Henry Garrod, unquestionably attained to that rank. At Cambridge, the latter was an investigator when still an undergraduate. It must have been rare indeed in the history of the Royal Society for a father and two of his sons to be received into its fellowship. The spirit of the investigator has again shown itself in the third generation, though in another field of research. Sir Archibald's daughter, Dr. Dorothy Garrod, has acquired a world-wide reputation as an archæologist of high accomplishment.

F. G. HOPKINS.

Mrs. R. E. Mortimer Wheeler

WE regret to record the death of Mrs. Tessa Verney Wheeler, wife of Dr. R. E. Mortimer Wheeler, Keeper of the London Museum, which took place after an operation on April 15. Mrs. Wheeler, who herself was on the staff of the London Museum, was a fellow of the Society of Antiquaries of London, and a field archæologist of much experience and ability. She took an active part in the excavations on prehistoric and Roman sites in Wales and England, with which her husband has been associated.

At Verulamium and on the later excavation of Maiden Castle, Dorchester, where voluntary assistants, some of whom were in process of being trained, made skilled supervision and leadership essential, Mrs. Wheeler's work was of the greatest value, especially when, in the absence of Dr. Wheeler, she herself took charge of the excavations. She took her full share in the recording and conservation of the finds, as well as in working up the results for report and publication. Mrs. Wheeler was also extremely active and helpful in the promotion and organisation of the Institute of Archæology in the University of London. Her death will be, in a very real sense, a great loss to British Archæology.

A wide circle will welcome the proposal that there should be some permanent memorial of Mrs. Wheeler's life and archæological work. Those who were closely associated with her in the promotion of archæological studies will agree that such a memorial could take no more appropriate form than some integral part in the working organisation of the Institute of Archæology of the University of London, as is suggested by Sir Frederic Kenyon and his fellow signatories in a letter to *The Times* of May 2. They indicate as possibilities the dedication of a room in the Institute, the provision of a working archæological library or a fund for the assistance of students, according as response to the suggestion allows. In view of Mrs. Wheeler's activities in connexion with the Institute and her interest in the training of students in the field, any one of these would be fitting. Communications relating to the proposed memorial and contributions may be sent to the secretary of the Institute, Miss Kathleen Kenyon, Kirkstead, Godstone, Surrey.

WE regret to announce the following deaths:

Mr. Harold Cox, a well-known economist and journalist, who served in 1919 on the Royal Commission on Decimal Currency, on May 1, aged seventy-six years.

Prof. A. C. Dixon, F.R.S., emeritus professor of mathematics in Queen's University, Belfast, on May 4, aged seventy years.

Mr. L. W. Hinxman, district geologist in H.M. Geological Survey (Scotland) from 1905 until 1919, on April 29, aged eighty-one years.

Prof. D. Morrison, professor of moral philosophy in the University of St. Andrews, who was associated with Prof. G. F. Stout in the editorship of *Mind*, on April 8, aged sixty-nine years.

News and Views

Royal Society: New Fellows

AT a meeting of the Royal Society of London on May 7, the following fellows were elected: Dr. A. C. Aitken, lecturer in mathematical statistics and actuarial mathematics, University of Edinburgh; Dr. J. D. Cockcroft, demonstrator in physics, University of Cambridge; Prof. H. J. Fleure, professor of geography and anthropology, University of Manchester; Mr. C. Forster-Cooper, director of the University Museum of Zoology and reader in zoology, University of Cambridge; Sir Alexander Gibb, consulting engineer; Mr. H. L. Guy, chief engineer, Mechanical Engineering Department, Metropolitan Vickers, Ltd.; Prof. H. G. A. Hickling, professor of geology, Armstrong College, Newcastle-on-Tyne; Prof. Lancelot Hogben, professor of social biology, University of London; Dr. J. Kenyon, head of the Chemistry Department, Battersea Polytechnic; Prof. E. H. Kettle, professor of pathology, University of London; Prof. N. F. Mott, professor of theoretical physics, University of Bristol; Dr. R. G. W. Norrish, lecturer in physical chemistry, University of Cambridge; Prof. H. H. Plaskett, Savilian professor of astronomy, University of Oxford; Mr. E. F. Relf, superintendent, Aerodynamics Department, National Physical Laboratory; Dr. F. J. W. Roughton, lecturer in physiology, University of Cambridge; Prof. Birbal Sahni, professor of botany, University of Lucknow; Prof. E. B. Verney, Shields reader in pharmacology, University of Cambridge.

Transmutation of Matter

DR. J. D. COCKROFT gave the twenty-seventh Annual Kelvin Lecture to the Institution of Electrical Engineers on April 23. He chose as his subject the transmutation of matter by high energy particles and radiations. In 1919, Rutherford's discovery that the central nuclei of atoms could be penetrated and permanently changed by a bombardment of very high speed atomic projectiles, such as those given off by radioactive bodies, proved that the ordinary elements are not immutable. It took some years before the importance of his experimental results was fully recognised. He observed that nitrogen gas, penetrated by helium nuclei, ejected hydrogen nuclei. It has been shown since that boron, fluorine, sodium, magnesium, aluminium, phosphorus and sulphur can be similarly transmuted. In the case of nuclear transmutations, it seems that the loss of mass is precisely equal to the increase in the kinetic energy that has taken place. This gives a striking proof of the modern physical law that mass and energy are equivalent. In 1932, Chadwick discovered the neutron, a new type of atomic particle which has no electric charge. It does not therefore interact with other electrons and produces no ionisation when passing through a gas. It is of outstanding importance because of its power to produce transmutations. There is little hope that this process can be used on an engineering scale to convert mass into energy. So far, our laboratory experiments produce the converse result. Theory indicates that at temperatures equal to those of the interior of the sun or stars, it might be possible to convert the inexpensive simple elements to the more valuable heavier combinations, but practically, there is no method of producing the effects formerly attributed to the 'philosopher's stone'.

The Hofmann Memorial Lecture

THIS lecture, in memory of A. W. von Hofmann, was delivered by Prof. G. T. Morgan, director of the Chemical Research Laboratory, Teddington, at the Imperial College of Science and Technology on May 4, Lord Rayleigh, chairman of the Governing Body of the College, presiding. Hofmann was the first director of the Royal College of Chemistry, which was founded in 1845. He held this position for twenty years. The College was eventually renamed the Royal College of Science, and became a constituent part of the Imperial College at South Kensington. In previous years, Huxley Memorial Lectures have been given at the College during the first week of May; in future, these will be alternated with lectures commemorating other distinguished men who have been associated with the Imperial College or its forerunners. The Hofmann Memorial Lecture was the first of the new series, and Prof. Morgan, from his early associations with the College and his work in organic chemistry, was an appropriate choice as lecturer. A brief account, giving the substance of the lecture, appears elsewhere in this issue (p. 769), and the complete lecture is also available (London: Macmillan and Co., Ltd., 1*s*. net).

Native Lands in South Africa

IN recent discussion in the Union of South Africa relating to the Cape franchise and native representation in Parliament, it was generally understood that, when once this question had been settled, consideration would be given to the problem of native lands, in accordance with an undertaking outstanding for many years. At present the lands held as native reserves comprise some 20,000,000 acres, which in part owing to native custom, in part owing to increase in population, is admittedly quite insufficient for tribal needs. In order to remedy a situation which is the cause of considerable unrest, and as General Hertzog, the Prime Minister, stated in Parliament, as an earnest of the Government's sincerity in dealing sympathetically with native needs, a Bill has been introduced, of which the second reading was moved by Mr. Grobler, Minister for Native Affairs, on April 30. Under its provisions, a South African Native Trust is to be established, which will be administered by the Governor General. In this Trust will be vested all lands reserved for

native occupation; and further land is to be purchased out of moneys to be provided by Parliament. Purchase will be spread over a period of five years, the total amount of the expenditure being £10,000,000. This will admit, it is expected, of an addition of 14,000,000 acres to the reserves. Among the provisions of the Bill it is proposed to include the gradual abolition of native squatting on European-owned lands and the registration of native labour tenants. Of these the former will in all probability arouse some opposition on the part of various interests; but the practice has given rise to friction and abuse on occasion, and on the whole its abolition is probably well advised.

Control of Australian Aborigines

AN innovation of no little importance in the method of controlling the Australian aborigines, who come under the jurisdiction of the Commonwealth Government, is announced from Canberra. The Cabinet has decided, it is reported by *The Times* correspondent in the issue of April 29, that in future the work of the police patrol in the south-west of the Northern Territory will be entrusted to an anthropologist who is familiar with the language and customs of the tribes. The district under the new officer will thus include the country of the Arunta, made famous in the annals of anthropology by the investigations of Sir Baldwin Spencer and F. J. Gillen. This change in administrative machinery is, no doubt, in large measure due to the protests made, especially by anthropologists, when recently certain aborigines were tried for murder on account of killings in accordance with tribal custom. It is, at any rate, regarded as marking an advance in the method of dealing with native offences against the law of the white man, as the officer will have magisterial powers to deal with the great majority of cases, and will take only the more important to the court at Alice Springs. Mr. Paterson, the Minister for the Interior, has announced that Dr. Strehlow of the University of Adelaide, now conducting investigations on behalf of that University in North Australia, has been appointed to the post.

Scientific Research in Australia and New Zealand

AT the instance of the Governments of Australia and New Zealand, steps are being taken to effect close collaboration between their respective Councils for Scientific and Industrial Research. The two Dominions have in common many problems in primary industry, and united action to solve them is obviously desirable. It is proposed to attach New Zealand officers to the Australian teams working on (*a*) mammitis in dairy cattle, (*b*) bovine contagious abortion, (*c*) sterility in sheep and (*d*) preservation and transport of foodstuffs. Australia will probably second an officer to the staff of the Dairy Research Institute of New Zealand, and will send the leaders of its Soils and Forest Products Divisions to consult with their corresponding numbers there about future co-operative organisation. This move for closer association between the research councils of the Dominions is overdue and its development will be watched with much interest.

The Parliamentary Science Committee

DURING the past twelve months several institutions have affiliated with the Parliamentary Science Committee; and the approximate aggregate membership of all the bodies affiliated is now 100,000. Two of the latest bodies to enrol themselves are the Institution of Gas Engineers and the British Association of Zoologists. The last-named accession affords peculiar satisfaction to the Committee, inasmuch as it is the first enrolment of a body devoted to pure—as distinct from applied—science; and it is hoped that it is the harbinger of others to come. Many societies devoted to natural history were perturbed last year at the prospect of a bombing centre being established near Chesil Beach. Letters of protest were published in the daily Press, but more effective action might have been taken by bringing the matter before Parliament through such a medium as the Parliamentary Science Committee, which actually meets at the House of Commons. By so doing, naturalists would have had the advantage of common action on their behalf by a Committee entitled to speak for an aggregate of 100,000 people interested in scientific matters—a body not to be lightly disregarded by a House of Commons the individual members of which owe their presence in that assembly to the votes cast in their favour.

Physics of the Divining Rod

THE April number of *Discovery* contains an article on the divining rod by E. Christie which gives a detailed account of methods adopted by the author in searching for water and certain metals. It claims to show that there is nothing mysterious about the power of divining, and that it is subject to definite natural laws. The great difficulty which impedes the progress of scientific investigation is that the statements of dowsers regarding their methods in the field and manner of inference vary considerably, and the article mentioned only adds yet another to the many already published. That there is a basic similarity cannot be denied by anyone who has taken the trouble to study them, but the elucidation of the fundamental facts from what are necessarily very subjective accounts has so far not been achieved. The author, however, is right in stressing the point that without examining the details, in such accounts as he has written, no man of science is likely to arrange a reliable test for dowsers. Experiments in which the underlying physical process is unknown are always difficult to interpret, and it is very doubtful whether a conclusive proof of the claims of dowsers will be obtained unless much more attention is given to their writings, vitiated as they nearly always are, by the incorrect use of the terminology of physics.

Royal Institution: Annual Meeting

THE annual meeting of the members of the Royal Institution was held on Friday, May 1. In the unavoidable absence of the president, Lord Eustace Percy, the chair was taken by the treasurer, Sir Robert Robertson. The Committee of Visitors, in a preface to its annual report, which was presented at

the meeting, referred to the loss the Institution had sustained by the lamented death of its patron, His Majesty King George V. At a recent general monthly meeting it was announced that His Majesty King Edward VIII had been graciously pleased to grant his patronage to the Institution. The Visitors' Report referred to the increased attendance at the lectures of late. The recent course of Christmas Juvenile Lectures, given by Dr. Kenneth Mees on Photography, had an average audience of 515, and a Friday Evening Discourse given by Sir James Jeans on November 29 had an attendance of 640, the largest at the Institution for many years. The Dewar research fellowship, set up under the will of the late Lady Dewar, has been filled by the appointment of Mr. A. R. Ubbelohde, lately senior scholar of Christ Church, Oxford, as the first Dewar fellow. Mr. Ubbelohde has begun investigations on the changes in the palladium lattice caused by the presence of hydrogen, as measured by X-rays, and on the latent heat of sublimation of chain compounds.

PART of the Brown legacy of between £25,000 and £30,000 has been invested by the Managers of the Royal Institution in the purchase of the freehold of No. 19, Albemarle Street, immediately adjoining the premises of the Institution. The purchase has been made in anticipation of future expansion of the research and other activities; but for the present, only the top two floors of the house have been occupied for Institution purposes. The remainder is being let on lease. The reconstruction of the principal library and the rooms below, which the Managers were compelled to undertake last year, is still in progress; and is expected to be completed during the summer. The large new research laboratory in the basement, the construction of which has been made possible by these alterations, promises to be a most valuable improvement. During the year, the publication by the Institution of "Faraday's Diary" has been completed by the issue of vol. 7 and a separate index volume. The Treasurer's report and accounts show a sound and satisfactory position, with substantial additions to the funds during the year despite the heavy cost of the library reconstruction scheme. This reconstruction has caused an interruption in the research work in progress with the large 50 kva. X-ray generator; but in other researches there has been considerable progress, as the report of the Committee of the Davy Faraday Research Laboratory shows. X-ray structure determinations, related chemical and magnetic problems, the optical study of methane, the construction of a hydrogen liquefier and the ether drift experiment are some of the experimental investigations referred to in the report. The following officers were elected for the year 1936–37: *President*, Lord Eustace Percy; *Treasurer*, Sir Robert Robertson; *Secretary*, Major Charles E. S. Phillips.

Salaries in the Civil Service

AT the annual general meeting of the Institution of Professional Civil Servants held on April 30, the president, Sir Richard Redmayne, referred to the inadequacy of the remuneration of the highest posts in the specialist departments of the Civil Service. He directed attention to the recommendations made by the Royal Commission in 1931 that a salary of £2,500 should be paid to the Engineer-in-Chief in the Post Office, and that there should be "a certain number of posts carrying an inclusive salary of £2,000 a year", and to the fact that these recommendations have not yet been carried into effect. He also pointed out that the Committee on the Staffs of Government Scientific Establishments in 1930 commented on the inadequacy of the prospects offered for the higher posts in the scientific establishments, and recommended that a small *ad hoc* committee should be appointed to consider these posts. In spite of this recommendation no action has been taken. Sir Richard claimed that the placing of the directing posts in the professional, scientific and technical departments on some degree of equality of status and remuneration with those obtaining on the non-technical side of the Service would conduce to that greater efficiency of the Service, which it is the primary aim of the Institution to promote. Sir Richard referred to the recent vote in the House of Commons on the question of equal pay for equal work as between men and women. He stated that the Institution is an unqualified supporter of the principle of equality.

Rockefeller Foundation and International Health

THE annual report for 1934 of the International Health Division of the Rockefeller Foundation, recently issued, gives an account of the world-wide activities of the Foundation in the field of public health. The projects in operation for which grants are made are broadly speaking of three types: (1) the control of specific diseases, (2) aid to Governments to establish public health on a permanent basis, and (3) public health education. Under the first-named, investigations upon the control of yellow fever have resulted in the discovery in South America of a type of rural or jungle yellow fever, which differs from the usual form in that it is not conveyed by the yellow fever mosquito, which is completely absent in such districts. How this form of yellow fever is conveyed to man is at present unknown. Malaria, hookworm disease, yaws, diphtheria and tuberculosis are some of the other diseases that are the subject of investigation. Foundation aid has been granted to the Bureau of Hygiene and Tropical Diseases of the British Colonial Office, to the Irish Free State and to the United Provinces, India, for local health services, and to the Calcutta school of public health. The total expenditure for the year amounted to 2,433,535 dollars. The volume is illustrated with a number of interesting plates.

Recent Acquisitions at the Geological Survey and Museum

THE gemstone collections of the Geological Survey and Museum have been recently enriched by a number of valuable presentations by H.M. Queen Mary. These include a large polished and carved block of yellow amber weighing 26 ounces, probably from the Prussian coast of the Baltic Sea; an exceptionally

large nodule of pyrope garnet from the Premier diamond mine of South Africa, and a fine rounded water-worn crystal of parti-coloured tourmaline, sectioned to show the colour. The Museum has acquired a large water-worn crystal of topaz of gem-stone quality, about eight inches in diameter, with a cleavage plate of the same mineral, from Brazil. The weight of the larger specimen is 29½ lb. Other important acquisitions include the late Dr. H. Bolton's valuable collection of Carboniferous insect wings, presented recently to the Department of Palæontology.

Thunder Census Organisation

THE survey of thunderstorms in the British Isles during the coming summer is to be continued and again the co-operation of readers of NATURE in the observational work is requested. Fuller details can be obtained from Mr. S. Morris Bower, Langley Terrace, Oakes, Huddersfield. The census has recently been extended into the winter months in order to bring the winter data, collected between 1925 and 1929, more nearly up to the standard of the summer survey, and also to make special reports on individual storms available for insurance and other purposes throughout the year. The lightning damage survey has been commenced in some parts of the country, and it is intended to build up this work gradually: sections of maps, on the scale of two miles to the inch, are issued to observers, who are invited to record local positions of damage.

Awards for Aeronautical Research

AT a meeting of the Council of the Royal Aeronautical Society held on April 21, the following awards were made: *Silver Medal of the Society* to Mr. B. N. Wallis, for his work on geodetic construction; *Simms Gold Medal* to Mr. W. S. Farren, for his inventions of new methods of the measurement of drag and his designs of scientific apparatus for aeronautical research; *Taylor Gold Medal* to Mr. E. F. Relf, for his paper read before the Society on the compressed air tunnel; *Sir Charles Wakefield Gold Medal* to Mr. C. R. Fairey, for his work on the development of flaps; *Busk Memorial Prize* to Mr. R. P. Alston, for his paper read before the Society on wing flaps and other devices as aids to landing. At a meeting of the Amulree Committee held on April 27, the following awards were made on the recommendation of the Council of the Royal Aeronautical Society: *British Gold Medal for Aeronautics* to Dr. Hugo Eckener for his technical achievements in lighter-than-air craft; *British Silver Medal for Aeronautics* to Mr. A. J. Rowledge, for his scientific achievements in the development of aircraft engines.

Announcements

THE Council of the Royal Society of Edinburgh has awarded the Keith Prize for the period 1933–35 to Prof. Lancelot T. Hogben, for his papers on genetical subjects published alone and in collaboration, which have appeared in the *Proceedings* of the Society during the period of the award; and the Neill Prize for the period 1933–35 to Dr. Samuel Williams, University of Glasgow, for his contributions to the anatomy and experimental morphology of the Pteridophyta.

DR. W. E. HARPER, of the Dominion Astrophysical Observatory, Victoria, B.C., who has been assistant director since 1923, has been appointed director in succession to Dr. J. S. Plaskett, who retired last year. Dr. J. A. Pearce, astronomer at the Observatory since 1924, has been made assistant director.

IN 1935 the directors of Teyler's Foundation and the members of Teyler's Second Society at Haarlem, Netherlands, announced a competition for a gold medal to be awarded for the best treatise on the interaction between atomic nuclei and electrons. Four essays were submitted, two from the United States and two from the Netherlands. The medal has now been awarded to Dr. H. B. G. Casimir, of Leyden. The prize essay will be published shortly in the *Transactions of Teyler's Second Society* and in the *Archives du Musée Teyler*.

THE twelfth Annual Norman Lockyer Lecture of the British Science Guild will be given by the Right Hon. Lord Rutherford on November 12. The lecture will be held in the Goldsmiths' Hall, Foster Lane, E.C.2 (by courtesy of the Goldsmiths' Company).

THE forty-seventh Annual Conference of the Museums Association will be held at Leeds on July 6–10, under the presidency of Sir Eric Maclagan. Further information can be obtained from Mr. E. W. Wignall, Chaucer House, Malet Place, London, W.C.1.

THE Medical Research Council will consider applications submitted by June 1 for a number of travelling fellowships in medical science (including clinical medicine and surgery) tenable abroad during the ensuing academic year. These will be awarded either by the Council or by other bodies on the Council's nomination, and will each be of the value of £400, with an additional allowance for travelling and special expenses. Applications will at the same time be received for other travelling fellowships restricted respectively to tuberculosis and to psychiatry or neurology. Further information can be obtained from the Secretary of the Medical Research Council, 38 Old Queen Street, Westminster, London, S.W.1.

SIR FREDERICK BANTING, Mr. Havelock Ellis and Dr. Robert Leiper were elected fellows of the Royal College of Physicians of London on April 30 by By-law XXXVIII (*b*).

PROF. SIGMUND FREUD, extraordinary professor of nervous pathology in the University of Vienna and well-known for his work on psychopathology and psychoanalysis, celebrated his eightieth birthday on May 6.

PROF. HUGO SPATZ, professor of psychiatry in the University of Munich and senior physician to the Psychiatric Clinic, has been nominated to succeed Prof. Oskar Vogt as director of the Kaiser Wilhelm Institut für Gehirnsforschung at Berlin-Buch.

A DISCUSSION on "The Present Status of the Theory of Natural Selection" will be held at the Royal Society on May 14 at 4.30. It will be opened by Prof. D. M. S. Watson.

THE annual Canadian Chemical Convention will be held at the Brock Hotel, Niagara Falls, Ontario, on June 9–11. British chemists who are likely to be in Canada at that time are advised to communicate with Dr. R. T. Elworthy, secretary of the Canadian Institute of Chemistry, 366 Adelaide Street West, Toronto, 2, Canada.

THE general meeting of the International Association for the Prevention of Blindness and of the International Organisation of the Campaign against Trachoma will be held at the Centre Marcelin Berthelot, 28 bis rue Saint-Dominique, Paris, on May 11 under the presidency of Prof. F. de Lapersonne. Further information can be obtained from the General Secretary, 66 Boulevard Saint-Michel.

AT the anniversary meeting of the Royal Society of South Africa held on March 18, the following officers were elected for 1936: *President*, Prof. L. Crawford; *Hon. Treasurer*, Prof. A. Brown; *Hon. General Secretary*, A. J. H. Goodwin; *Hon. Editor of Transactions*, Prof. R. S. Adamson; *Hon. Librarian* Prof. E. Newbery; *Council*, K. H. Barnard, H. G. Fourcade, J. Jackson, R. F. Lawrence, Dr. E. P. Phillips, Dr. A. W. Rogers, Dr. B. F. J. Schonland, Prof. R. B. Young.

THE March issue of *Film Progress* forms a Supplementary Bulletin to the "National Encyclopædia of Educational Films" (see NATURE, Dec. 28, 1935, p. 1007). It gives an account of the advance that has been made in the use of educational films in 1935, and brings the Encyclopædia of films up to date.

IT was stated in NATURE of May 2, p. 737, that the Royal Society possessed no bust of Faraday prior to Sir Robert Hadfield's recent gift. We are informed that this is incorrect. Dr. H. Bence Jones, F.R.S., presented to the Royal Society in 1873 a marble bust of Faraday by the sculptor, M. Noble; and in 1885 the Royal Society acquired a plaster bust which had been made by J. H. Foley, R.A.

IN reviewing Bodenheimer's "Animal Life in Palestine" in NATURE of January 4, p. 5, Prof. P. A. Buxton referred to the name 'scheltopusik'. Dr. B. N. Schwanwitsch, Entomological Laboratory, University of Leningrad, states that this is a native Russian name for the glass-snake (*Ophisaurus apus* Pall.), meaning literally 'yellow-bellied', which has been used in French and German zoological literature. This is, of course, no reason for its use in a work published in English, in which the reviewer also recognised German and Arabic names.

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

A lecturer in engineering or mining technology in the Clowne Mining and Technical Institute, Clowne, Chesterfield—The Clerk to the Governors (May 16).

A head of the Engineering Department and a head of the Domestic Science and Women's Department in the Stockton-on-Tees Technical School Evening Institute—The Director of Education, Shire Hall, Durham (May 16).

A lecturer in pharmacy in the Witwatersrand Technical College, Johannesburg—Messrs. Frank Ross and Co., 9 Fenchurch Avenue, London, E.C.3 (May 16).

A lecturer in pathology and bacteriology in the Veterinary College, Madras—The High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (May 16).

A head of the Engineering Department of the Cheltenham Technical College—The Secretary (May 16).

An assistant lecturer in zoology and chemistry in the City Technical College, Liverpool—The Director of Education, Education Offices, 14 Sir Thomas Street, Liverpool, 1 (May 19).

A demonstrator in physiology in the London (Royal Free Hospital) School of Medicine for Women, 8 Hunter Street, W.C.1—The Secretary (May 20).

A lecturer in bacteriology in the University of Liverpool—The Registrar (May 22).

A lecturer in physiology and a lecturer in zoology in the Brighton Technical College—The Education Officer, 54 Old Steine, Brighton (May 22).

An assistant in the Royal Observatory, Greenwich—The Secretary of the Admiralty (C.E. Branch), Whitehall, London, S.W.1 (quote C.E. 6235/35) (May 23).

A lecturer in engineering in the Leicester College of Technology—The Registrar (May 23).

A professor of mining and head of the Department of Mining and Fuels in University College, Nottingham—The Registrar (May 25).

A civilian education officer (Grade III) in the Royal Air Force Educational Service—The Secretary (A.E.), Air Ministry, Adastral House, Kingsway, London, W.C.2 (May 25).

A lecturer in mathematics at the Goldsmiths' College, New Cross, S.E.14—The Warden (May 25).

A temporary information officer in the library of the Research Association of British Flour-Millers—The Director of Research, Old London Road, St. Albans.

An assistant engineer (civil) in the Malayan Public Works Service—The Crown Agents for the Colonies, 4 Millbank, London, S.W.1 (quote M/4163).

Resident engineers for the construction of new aerodromes by the Air Ministry—The Secretary (W.B. 9), Air Ministry, Adastral House, Kingsway, London, W.C.2.

Structural engineering assistants in the Designs Branch of the Directorate of Fortifications and Works—The Under-Secretary of State (C. 5), The War Office, London, S.W.1.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 784.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Cause of 'Oil Patches' on Water Surfaces

WHEN water moving in a channel at constant velocity encounters an obstacle, say, a weir, retarding its motion, a stationary wave is formed called Bidone's wave after its first observer. The more gradual the change in velocity, the less conspicuous becomes the wave. I have found no reference in literature to the fact that at very low velocities the gravity wave is reduced to a capillary wave appearing like a very fine thread or hair floating on the surface. The phenomenon is strikingly revealed as a moving reflection or refraction image when bright sunshine falls on to the bottom of the channel (see Fig. 1, taken in 1932, at a point where a brook discharges into the Lake of Lunz, Lower Austria).

Minute floating particles crossing the thread are abruptly retarded and thus accumulate. With larger particles the effect is less conspicuous, indicating that only a very thin surface-layer (say, 1 mm. or less) is involved, at least close to the 'thread' on its downstream side, where coloured water if gently poured over the surface tends to remain. That capillary forces are largely responsible for the phenomenon is proved by pouring a liquid of lower surface tension like liquid paraffin over the surface, when the thread is at once displaced upstream by several metres.

The same phenomenon is observed along the leeward shore of a lake when a gentle wind is blowing (Fig. 2). Here the boundary (indicating a line of convergence) is formed 10–30 metres from the shore where the wind-driven surface-water dives below a thin layer of slowly moving water. Generally the thread itself is easily observed. Scattering aluminium powder over the surface brings out the circulation still more clearly. Where the convergence is bilateral, as is generally the case farther off from the shore, the 'oil patch' will assume the form of an oblong streak limited on each side by a 'thread'.

FIG. 1. The 'thread' image on the bottom of a stream, showing as a white line across the sheet of paper.

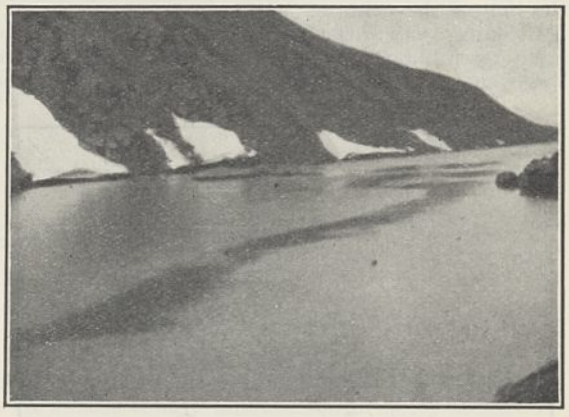

FIG. 2. 'Oil patches' on the Oberalp Lake, Switzerland, 1935.

These regions of retarded motion in a well-defined surface layer have mechanical effects analogous to those of real oil patches, that is, they have a damping effect on waves, especially those of short wavelengths, smoothing out their crests. When viewed obliquely, the surface is apparently quieter inside than outside the boundary, an effect which is most marked when capillary waves are generated by raindrops. It is, however, also quite distinct with the wavelets due to a rising wind. With stronger winds and increased eddies the thread becomes less continuous, but is still visible from time to time. The layer itself is not broken up very easily, the 'oil patch' and its effect on waves remaining visible.

This explanation seems to agree well with other observations on 'oil patches', which are known to contain more pollution, surface plankton and sometimes fatty substances than the rest of the water, obviously a *consequence* of the formation of the layer and not its *cause*.

'Oil patches' in the form of long streaks left behind a boat crossing the lake persist as long as there is any descending motion in the surface. I have never found the position of similar streaks incompatible with the explanation here advanced. They seem to afford important clues to the general circulation in the water. A detailed study may help to explain various surface phenomena, like the great differences in velocity often manifest between the surface itself and the water some centimetres below.

The conditions of the formation of these 'threads' and their associated phenomena will be a subject of further study.

WILH. SCHMIDT.

Zentralanstalt für Meteorologie
und Geodynamik,
Wien.
March 19.

The *Gegenschein* Observed at Sea

ON March 14, during a cruise on board R.M.S. *Almanzora*, I saw the Zodiacal Light strongly in the west when off the coast of Portugal in lat. 32° 30′ N. The season being favourable, I hoped to see the *Gegenschein*, or counterglow, which I had never observed. Realising the importance of unbiased vision in localising a faint luminosity, I was careful not to ascertain beforehand the distance of the sun below the horizon. Thus I did not know whether the sun's antipode was in Virgo or in Leo. I was also unaware which stars in these constellations lay upon the line of the ecliptic.

Looking eastwards, I saw a conspicuous band of light resembling the Milky Way which traversed Virgo and Leo and extended as far as the Praesepe

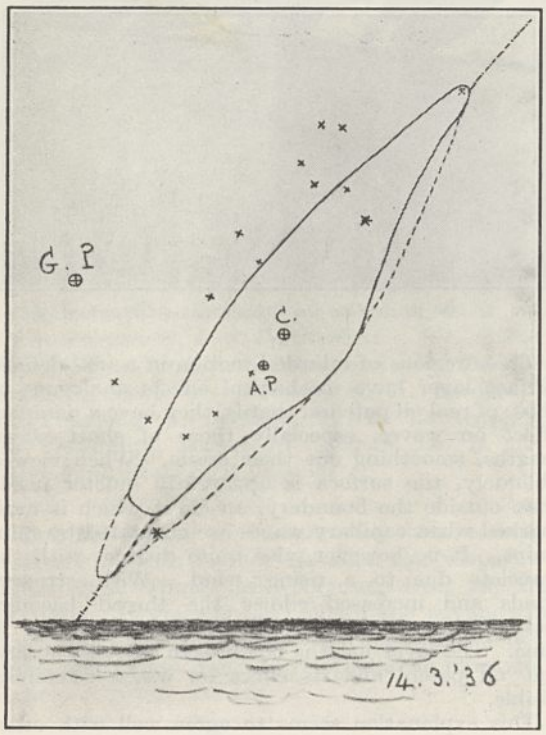

FIG. 1.

in Cancer. It rose steeply, slanting to the right, from about 15° above the horizon. Below this level the sky was pale.

I noticed also that at greater altitudes there was more illumination from the starry sky on the right hand than on the left, or north side of the band, where the interspaces were notably black. I was unaware at the time that the Galactic Pole (G.P.) was situated to the north of the luminous band, in the position shown in the accompanying drawing (Fig. 1).

After about an hour's observation, I marked the limits of the luminous band upon a star atlas, as shown by the continuous line in the drawing. The measurement of the drawing and the determination of the sun's antipode were done after the observations had been completed.

The length of the luminous band was 70°, the brightest part a nearly circular patch half way between Regulus and γ Virginis, extending 18° in this direction, the centre of brightness being in R.A. 170°, very slightly to the north of the ecliptic. This is 41° from the preceding, but only 29° from the following extremity of the luminous band. The latter was broader and blunter than the former. Marking a point upon the ecliptic (shown as a broken-and-dotted line) 41° following the centre of brightness, and prolonging the sides of the band from the lower end, the preceding extremity is seen to be repeated here with fair accuracy, and the form now becomes symmetrical about the transverse axis.

There remains a remarkable disparity of form on the two sides of the longer axis. If, however, the positions at 41° preceding and following the centre of brightness be joined to the right-hand bulge of the centre, the figure becomes perfectly symmetrical.

The distribution of brightness in the sky above, below, right and left to which I have referred was exactly such as to account for this encroachment upon the boundaries of an area the intrinsic luminosity of which was symmetrically disposed.

Having ascertained the position of the sun, I marked the antipode (A.P.) upon the drawing. This was 5° following the centre of brightness and 46° from the preceding extremity of the *Gegenschein*. It is conceivable that as the sun sank farther below the horizon, the centre of apparent brightness might have coincided with the antipode, but the matter could not have been tested on the evening of March 14 as the rising of the moon was due shortly.

My drawing shows the axis of the *Gegenschein* to be slightly north of the ecliptic, but the distribution of brightness in the sky deprives this fact of any significance in relation to the theory of the actual plane of symmetry.

On this evening when the counterglow reached a point 46° preceding the sun's antipode, the apex of the Zodiacal Light was at 53° following the sun.

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April 7.

Enhancement of Red Lines and Bands in the Auroral Spectrum from a Sunlit Atmosphere

IT is a well-established fact that the intensity distribution within the auroral spectrum is subject to considerable variations. In 1923 one of us (Vegard) found that the negative nitrogen bands as compared with the strong green line were considerably enhanced with increasing altitude.

In 1926 one of us (Vegard) showed that the red aurora of Type *A* owed its red colour to the enhancement of the red line or group of lines at 6300 A., which may probably be referred to the transitions $^1D_2 - {}^3P_{123}$ of oxygen. The red aurora of Type *B*, characterised by a red bottom edge, has been found to owe its red colour to the enhancement of some red bands belonging to the first positive group of nitrogen. Some diffuse auroral forms also show enhancement of the red bands and lines.

In 1929 Størmer obtained a spectrogram from rays which were still under the action of sunlight. His spectrogram, being taken on an orthochromatic plate, did not contain the red part, but only the green line and the negative nitrogen bands. It indicated a considerable enhancement of the latter bands as compared with the strong green line. It was, however, pointed out by one of us (Vegard), that this effect might be accounted for entirely by the altitude

effect mentioned, because the spectrogram corresponds to ray streamers with altitudes of several hundred kilometres. It was, however, a question of importance to make further investigations in order to see whether the auroral spectrum was changed in any way in an atmosphere exposed to sunlight.

During the past winter season a considerable number of spectrograms from auroral *arcs* exposed to sunlight were obtained at the Auroral Observatory at Tromsø, which showed some most important effects. All spectrograms were taken on panchromatic plates, and intensity scales were photographed on each plate in order to enable us to measure relative intensity changes within the spectrum. On the same plates were also taken spectrograms of normal auroras appearing later in the night.

A more complete account of our observational data will appear later. We propose to mention here the most striking facts only, and photometric curves are reproduced (Fig. 1) of two spectra of October 27, 1935, one corresponding to a sunlit atmosphere and the other corresponding to ordinary night conditions.

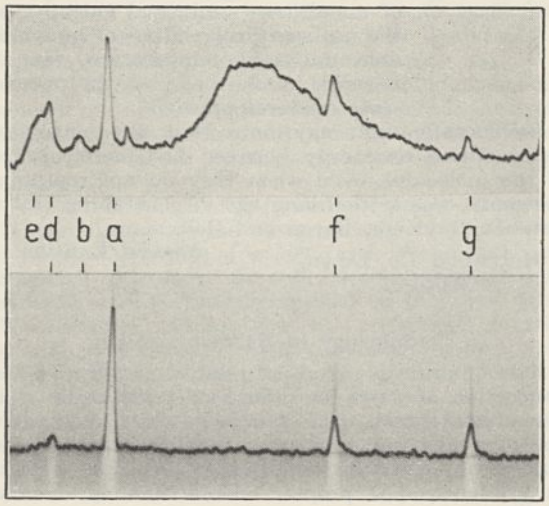

FIG. 1. Photograms of auroral spectra, October 27, 1935. Upper: Sunlit aurora. Lower: ordinary night aurora. a=5577 A.; d=6300 A.; b and e are bands of 1st positive group of nitrogen; f and g are the bands 4278 and 3914 of the negative nitrogen group.

First of all we notice that the enhancement of the negative bands due to sunlight is small. Comparing the band 4278 (f) and the green line (a), we find the ratio:

$$(I_f/I_a) \text{ sunlit} : (I_f/I_a) \text{ dark} = 1{\cdot}46.$$

Taking into account the probable error, this effect is not larger than may be accounted for by the altitude effect, because the altitude of the sunlit arcs according to Harangs' measurements is increased by about 25 per cent. Thus the enhancement of the negative bands due to sunlight scarcely exceeds 20 per cent.

From the photometric curves we notice *that the sunlight produces a most pronounced enhancement of certain bands of the* 1*st positive group* (*b*, *e*) *and of the red line* 6300, which is probably to be interpreted as the oxygen triplet ($^1D_2$–$^3P_{123}$). From the spectrograms here illustrated we find that the *red line* 6300 *relative to the green line is* 4–5 *times stronger from the sunlit atmosphere than from the dark one.*

The bands of the 1st positive group are in the present case enhanced to an even greater degree. So far as can be judged from our present material, the enhancement of 6300 seems to be more constant and to be always present in the light from a sunlit atmosphere, while the enhancement of the bands of the 1st positive group is more variable.

In a number of previous papers[1] one of us has suggested that the enhancement of the red line (6300), causing the red auroras of Type *A*, was due to the action on ozone (O_3) of an activated state of nitrogen, with the result that oxygen atoms were brought into the $^1D_2$ state. This explanation is now supported by our discovery of the enhancement of the red line 6300 in the sunlit atmosphere, for this effect is probably due to a change in the state of the atmosphere produced by sunlight, and the most conspicuous change consists in the production of ozone by the sun's radiation.

L. VEGARD.
E. TØNSBERG.

Oslo and Tromsø.
April 3.

[1] L. Vegard, *Geophys. Publ.*, **10**, No. 4, 48 (1933). L. Vegard and E. Tønsberg, *Z. Phys.*, **88**, 718 (1934).

Vitamins and Plants

IN general, vitamins are products of the vegetable kingdom. Their possible role in plants, however, has been almost totally unknown until quite recently.

Some years ago we followed the synthesis of carotene (the precursor of vitamin A) and vitamin C (ascorbic acid) in plants, and observed that the percentage content of these compounds in the plant is generally the higher the better the plant grows[1]. Their concentration thus reaches a maximum at an early stage of growth, either before or at the beginning of flowering. Similarly we found that an adequate fertilisation increases the percentage content of vitamin C and carotene. The view that artificial fertilisers would seriously affect the composition of plants is thus not tenable, at least where vitamins are concerned. This fact was clearly demonstrated by Scheunert's prolonged work on rats[2].

On the other hand, we found that all factors which have an unfavourable influence on the growth of plants, such as soil acidity, excessive concentrations of phosphate, potassium, sodium chloride, etc., lower the content of carotene and vitamin C in plants. In my opinion, these facts showed, although indirectly, that carotene and vitamin C are important growth factors of plants.

In the case of vitamin C, this assumption has now been conclusively proved by further work in this laboratory (S. v. Hausen[3]). Addition of crystalline vitamin C to the medium in sterile pea cultures led to an increase of 40–100 per cent in the dry weight of the treated plants. (At the same time it was noted that the roots of the plant protect vitamin C very effectively against autoxidation.) The effect of vitamin C on growth is a specific one, since, for example, glucose has no such effect. It was also shown that the peas actually took up with their roots vitamin C from the medium. Shortly after, L. Havas at Rothamsted made similar observations[4].

These results showed that an addition of vitamin C to the medium promotes markedly the growth of the plant, but they did not conclusively prove that vitamin C is essential for plants. Definite proof for the latter fact has, however, now been obtained through Miss v. Hausen's work on pea seedlings

which were deprived of their cotyledons at a suitable stage, when they contained about ninety per cent of the total vitamin C present in the seedling. Such seedlings generally die or remain completely dwarfed, whereas they will develop distinctly better, and even produce normal blossoms, when small amounts of pure ascorbic acid are added to the medium. Even the treated plants naturally suffer from the removal of cotyledons, which evidently contain also other necessary compounds besides vitamin C. The accompanying table will illustrate the effect of ascorbic acid on the development of cotyledon-less seedlings.

'Torstai' peas (cotyledons removed) in sterile Hiltner's solution with $(Ca(NO_3)_2$; initial *p*H 5·5. Time of growth 29 days.

	Average length of two plants, in cm.		Dry weight of two plants, in grams		Vitamin C in two plants, total (ml. of ind. solution)	
	Treated	Controls	Treated	Controls	Treated	Controls
Normal plants (cotyledons not removed; ascorbic acid not added)	83	35	0·431	0·070	22·8	2·7
	66	30	0·305	0·063	12·5	2·0
	75	30	0·461	0·075	22·5	2·8
	82	22	0·405	0·044	17·5	1·5
	—	85	—	1·850	—	48·0
	—	92	—	1·706	—	44·0

It is therefore reasonable to regard vitamin C as a phytohormone, which is indispensable to plants. The formation of vitamin C during germination is necessary for the early development of the plant. During later stages of growth, large quantities of vitamin C are produced in connexion with photosynthesis. So far, vitamin C is the only vitamin the indispensability of which to higher plants has been proved through *direct* experiments. Corresponding work on vitamin B_2 (lactoflavine) is at present in progress in this laboratory.

W. H. Schopfer[5] has recently shown that vitamin B_1 promotes greatly the growth of lower fungi (Phycomyces, etc.). According to his results, the effect is very delicate and specific, so that it can be used for the quantitative determination of B_1.

The fact that certain compounds, which act as vitamins in the animal organism, have important functions in plants, is additional evidence of the similarity of the metabolism of plant and animal cells.

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March 30.

[1] Virtanen, v. Hausen and Saastamoinen, *Ann. Acad. Scient. Fenn.*, A, **37**, No. 7 (1933).
[2] Scheunert, Sachse and Specht, *Biochem. Z.*, **274**, 373 (1934).
[3] v. Hausen, *Suomen Kemistilehti*, B, Nos. 5–6 (1935); No. 12 (1935); NATURE, **136**, 516 (1935).
[4] Havas, NATURE, **136**, 435 (1935).
[5] Schopfer, ref. Karrer, *Schweiz. Mediz. Wochenschr.*, **65**, No. 37 (1935).

Formal and Practical Thermodynamics

MAY I put in a word for the British way of looking at thermodynamics, now largely confined to engineers, as suggested by the critical remarks on the second edition of the treatise of Prof. Saha and Dr. Srivastava, contained in the brilliant and appreciative review in NATURE of April 4. Especially would I firmly support the Indian authors in passing over the preliminary abstractions of Prof. Carathéodory of Munich and his school. I remember when Prof. Planck, in a new edition of his book on thermodynamics, attracted attention by ultimately blessing them: which led to an invasion into Great Britain that I tried in my own way to counter by a critical commentary in my "Mathematical and Physical Papers" (vol. 2, pp. 603–7; 1928).

The fragmentary treatments by Kelvin and Rankine, even by Maxwell and Willard Gibbs, may be deficient as regards formal logic, but after all they are the efforts of constructive genius in this universal subject, after Carnot. Even the reviewer admits that it is hard to find English equivalents for the German technical terms. Indeed, the logical flavour comes largely from treating thermodynamics as a branch of the statistical mechanics as developed after Maxwell and Boltzmann: while on the other hand no biologist ought to admit that the vital activities to which he applies thermodynamic principles can be adequately described by the mere statistical play of atoms in the main unknown. It is here that the merit of Clausius' introduction of his concept of an abstract universal entropy, as the necessary correlative of unavoidable universal temperature, shines, however unfinished be its present state of development.

Incidentally one may note that the statistical equipartition of energy between the 'momentoids' of the molecules, even when they do not represent momenta, was settled long ago in general discussion between Rayleigh, Bryan and Boltzmann.

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April 5.

Terminology of Relative Growth

THE quantitative study of relative growth and the proportion of parts has in recent years made considerable progress, and is now beginning to find widespread application in such diverse fields as systematics, embryology, genetics and palæontology, as well as in growth-studies proper. Unfortunately, serious diversities of terminology and notation have sprung up[1,2,3,4,5,6]. We therefore wish to propose the following agreed terminology to avoid confusion.

(1) The terms *dysharmony*[7] and *heterogony*[8] should be dropped. *Dysharmony* was first used to denote the exaggerated proportions of certain organs, and a suggestion of abnormality remains attached to it. *Heterogony* has been widely used to denote a certain type of reproductive cycle[9,10,11], so that its employment in a new sense is not desirable. Accordingly, to denote growth of a part at a different rate from that of body as a whole or of a standard, we propose the term *allometry*, with *isometry* for the special case where the growth-rate of the part is identical with that of the standard or whole. Allometry has the advantage of recalling the allometrons of Osborn[12], those gradual changes in proportion observed in evolution, which according to the work of Hersch[13] and Robb[14] do proceed according to our fundamental law of allometric growth. The term has the further advantage that it can be applied equally legitimately to phenomena of growth (*dysharmonie de croissance*) or to those of proportionate size (*dysharmonie de taille*) as in holometabolous insects. *Positive* and *negative allometry* denote respectively growth-rates of the part above or below that of the standard.

(2) In all cases of allometry the part shows an absolute increase of size with time or with increase of size of the standard. For cases where, instead of this, a decrease of absolute size occurs, for example, in the abdominal limbs of crabs at and shortly after metamorphosis, we propose the new term *enantiometry* (equivalent to *negative growth*).

(3) The *elementary law of relative growth* or law of *simple allometry* can be expressed by a formula of the type

$$y = bx^{\alpha} \quad \text{(for notation see later)},$$

where y is the part, x the standard or whole, and b and α are constants. When $\alpha > 1$, we have positive allometry; when $\alpha < 1$, negative allometry; when $\alpha = 1$, isometry.

(4) The biologically important term in this formula is the exponent α. For this we propose the term *equilibrium constant* (in place of growth-coefficient, partition-coefficient, *constante de dysharmonie*, etc.). This general term covers both growth and final proportions. To distinguish the two where necessary, as, for example, in regard to deer antlers, we may use *growth-constant* (or *actual equilibrium constant*) as opposed to *limiting equilibrium constant*. *Growth-ratio* may also be properly used as equivalent of growth-constant in certain circumstances.

(5) The constant b merely represents the value of y when $x = 1$. However, since its value affects the initial size of an organ, we may call it the *initial growth-index*.

(6) The terms *growth-gradient* and *growth-centre*[1] remain.

(7) *Notation.* In the formula of simple allometry, Teissier[2] has employed the notation $y = kx^{\alpha}$, Huxley[1] $y = bx^{k}$, Nomura[3] $a = kb^{x}$, and Weymouth and Mackay[4] $p = aw^{k}$. It will be seen that different symbols are confusingly applied to the same term. We therefore propose that the recognised notation should be $y = bx^{\alpha}$. As is customary, x and y are used for the variables, y being the dependent variable. For the essential equilibrium constant, α is used, since Greek letters stand out against Latin. k is dropped since it has been widely used in two entirely distinct senses. For the initial index, the non-committal b is chosen.

We hope that other workers in this field will see fit to adopt these suggestions.

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G. TEISSIER.

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[1] J. S. Huxley, "Problems of Relative Growth". Methuen, London (1932).
[2] G. Teissier, 1934. "Dysharmonies et discontinuités dans la Croissance". *Act. Sci. et Industr.*, No. 95. (Exposés de Biometrie, 1) (1934). Hermann, Paris.
[3] E. Nomura. "An Application of $a = kb^{x}$ in expressing the Growth Relation in Molluscan Shells". *Sci. Rep. Tohoku Imp. Univ.* (4), **2**, 53 (1926).
[4] F. W. Weymouth and D. C. G. Mackay, "Relative Growth in the Pacific Edible Crab, *Cancer magister*". *Proc. Soc. Exp. Biol. Med.*, **31**, 113 (1934).
[5] W. J. Crozier and E. V. Enzmann, "On the Relation between Litter-Size, Birth-Weight, and Rate of Growth in Mice". *J. Gen. Physiol.*, **19**, 249 (1935).
[6] M. Raja, "Sull'accrescimento postembrionale del *Loligo vulgaris*". *Boll. Zool. Torino*, **5**, 1 (1934).
[7] C. Champy, "Sexualité et Hormones". G. Doin, Paris (1924).
[8] A. Pezard, "Le conditionnement physiologique des caractères sexuels secondaires chez les Oiseaux". *Bull. Biol. Fr. et Belg.*, **52**, 1 (1918).
[9] R. Leuckart, 1876. "Die Menschlichen Parasiten" (Bd. 2), Leipzig (1876).
[10] J. Meisenheimer, "Geschlecht und Geschlechter". Jena (1921).
[11] A. Weismann, "Beitr. zu. Naturgeschichte der Daphnoiden", Leipzig (1878).
[12] H. F. Osborn, "The Origin of Species". (2) "Distinctions between Rectigradations and Allometrons". *Proc. Nat. Ac. Sci.*, **11**, 749 (1925).
[13] A. H. Hersh, "Evolutionary Relative Growth in the *Titanotheres*". *Amer. Nat.*, **68**, 537 (1934).
[14] R. C. Robb, "Two Modes of Evolution in the Horse". *Proc. Sixth Internat. Congr. Genetics*, **2**, 166 (1932).

Structure of the Formate Ion

IN two recent letters to NATURE, B. C. Rây[1,2] and P. B. Sarkar[2] proposed a structure $\left[:C\begin{matrix}=O\\ -OH\end{matrix}\right]^{-}$ for the formate ion in solution, while retaining the normal structure for the acid, its esters and the formate ion in the crystal; they suppose that on solution the formate ion undergoes the prototropic change $\left[H-C\begin{matrix}=O\\ -O^{-}\end{matrix}\right] \rightarrow \left[:C\begin{matrix}=O\\ -OH\end{matrix}\right]^{-}$.

Such a prototropic change is usually pictured as an intermolecular process, and if the hypothesis of Sarkar and Rây is true it would be expected that the hydrogen of the formate ion would exchange very rapidly with deuterium in heavy water. The experiments of Wynne-Jones[3], Münzberg[4] and ourselves (unpublished) all go to show that the exchange process between formate ion and heavy water is extremely slow. We have found, for example, that 8 per cent exchange took place in 8 days at 100° with potassium formate in neutral solution, the exchange being accelerated by the presence of alkali. Münzberg was unable to detect any exchange in neutral solution after 300 hours at 50° C. It would seem, therefore, either that the prototropic change must be exclusively intra-molecular, which we regard as very unlikely, or that the postulated prototropy does not take place.

A second argument against the hypothesis of Sarkar and Rây, which is independent of the mechanism of the prototropic process, is to be found in the fact that an ion of the structure proposed would be expected to have an appreciable acid dissociation constant. Inasmuch as the hydroxyl group of phenol ($K_A = 10^{-10}$) and even those of the sugars exchange quite rapidly in heavy water, the slowness of the exchange of the formate ion seems to provide a second argument against the proposed structure of the formate ion. If the considerations we have put forward are valid, they constitute a further example of the application of deuterium to problems of molecular structure and mechanism.

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Balliol and Trinity Colleges,
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March 26.

[1] NATURE, **133**, 646 (1934).
[2] NATURE, **137**, 495 (1936).
[3] *Chem. Rev.*, **17**, 115 (1935).
[4] *Z. phys. Chem.*, **31**, B, 18 (1935).

Production of Electron Pairs

IN a recent paper[1] we discussed the creation of positive–negative electron pairs by a beam of γ-rays traversing lead, with atomic number $Z = 82$. Results have since been obtained with $Z = 50$ and $Z = 65$ for γ-rays of energy $h\nu = 3mc^2$. It is of interest to compare these with the values given by Bethe and Heitler[2], using the Born approximation. We give below the two sets of results, together with the corresponding values of $\overline{E}_+ - \overline{E}_-$, where $\overline{E}_+$ and $\overline{E}_-$ are the average energy of the positron and electron respectively.

Z	50	65	82
$\sigma \times 10^{24}$	0·17	0·34	0·67
$\sigma \times 10^{24}$(Born)	0·13	0·21	0·34
$(\overline{E}_+ - \overline{E}_-)/mc^2$	0·22	0·28	0·33

The accurate values have been calculated as described by Jaeger and Hulme (*loc. cit.*) using Dirac wave functions. The numerical work is tedious, and only the most important electronic transitions have been taken into account in calculating the absorption cross-section per atom (σ), which should be correct to within 5 per cent. Screening has been neglected, which is quite justifiable for low energies. It will be seen that σ approaches the value given by the Born approximation quite rapidly, the difference varying as Z^4. The three values calculated lie on the curve

$$\sigma \times 10^{24} = 0{\cdot}95(Z/137)^2 + 2{\cdot}54(Z/137)^4,$$

the first term giving the Born approximation. An empirical formula of this type could probably be used to fit results at higher energies. The increase in $\overline{E}_+ - \overline{E}_-$ is roughly linear, as we should expect (see Bethe and Heitler, *loc. cit.*, p. 108).

We may summarise by saying that the Born approximation always gives results which are too low, but the error decreases rapidly with decreasing atomic number and increasing energy of the γ-ray.

J. C. JAEGER.

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[1] Jaeger and Hulme, *Proc. Roy. Soc.*, A, **153**, 443 (1936).
[2] *Proc. Roy. Soc.*, A, **146**, 83 (1934).

The *D* Region of the Ionosphere

DURING the last ten years, investigations based upon the mathematical theories of Eccles and Larmor have given considerable information regarding the reflecting layers of the atmosphere. The most interesting discovery was that of Prof. E. V. Appleton, who showed that there is an upper reflecting region in addition to the Kennelly-Heaviside layer.

From experiments which we have conducted during the last year, we are led to believe that there is a third region at a height of 5–50 km. which strongly reflects radio waves. Such a layer has been postulated before as an absorption layer in the ozone region, but its reflecting powers have not been emphasised.

Our apparatus consists of a sending station which gives out sixty pulses per second, each pulse lasting ten microseconds. The signal is received upon a rotatable loop or a standard antenna located two hundred metres from the sending station. After passing through a special receiver having a wide band pass and short lag characteristics, the signal is observed visually upon a cathode ray oscilloscope. The rapid sweep of the oscilloscope separates the reflected and the ground rays.

From the many observations which have been made, the following important conclusions may be drawn :

(1) The lower part of the *D* region is well within the normal winds of the troposphere. It occasionally rises to a height of 50 km. in low-pressure areas and drops to 5 km. in high-pressure areas. It is the rise and fall of this region which causes the change in signal strength of nearby broadcasting stations such as *KDKA* (150 km. north of Morgantown).

(2) Generally there are reflections from two parts of the region at virtual heights of 5–30 km. and 40–55 km. During periods of low barometer these two reflections may combine.

(3) At times the region is very erratic. The polarisation and intensity change with great rapidity. This is especially true near the hours of sunrise and sunset.

(4) The *E* and *F* layers (Kennelly-Heaviside and Appleton layers) are shielded by the lower region. When the intensity of the *D* reflections increases, that of the two other layers decreases.

(5) The two waves employed were 1,614 kc. and 3,492·5 kc. The penetration and variations are greater on the higher frequency.

(6) Periodic fading has been observed on stations within 150 km. due to the change in the interference pattern when the *D* region is either rising or falling.

Messrs. N. I. Hall and L. R. Hill collaborated with us in making these measurements.

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Origin of the Term 'Solute'

IN 1894, at the instigation of Sir Henry A. Miers, my teacher in crystallography at the Central Technical College, London, I prepared a translation and enlargement of Fock's "Einleitung in die chemische Krystallographie" which was published by the Clarendon Press under the title of "An Introduction to Chemical Crystallography" in 1895.

The late Prof. N. Story-Maskelyne, who then held the chair of mineralogy in the University of Oxford, kindly wrote a preface, dated Nov. 18, 1894, to this little work. In this preface occurs the phrase "what for lack of a much-needed term I may call the *solute* (namely the substance or substances dissolved)". The word solute is italicised in the original.

Crystallographers have always been facile inventors of new words, and to Story-Maskelyne, a master of the art, must be ascribed the parentage of the term referred to in NATURE of April 25 (p. 698).

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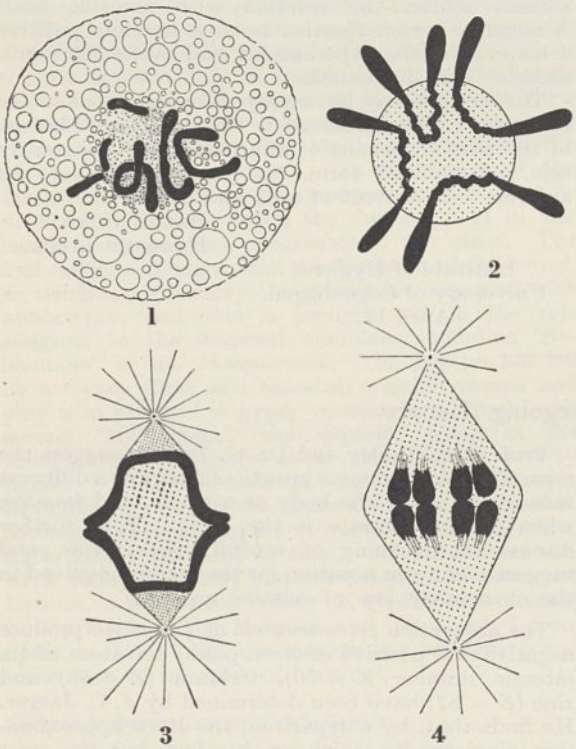
THE "Introduction to Chemical Crystallography", to which Sir William Pope refers, was reviewed in NATURE of August 1, 1895 (**52**, 315), and in the notice the word 'solute' occurs italicised as here shown : "the conditions of equilibrium in a solution containing various *solutes* (to employ a convenient word suggested by Prof. Maskelyne in his preface as a term for the substances dissolved)". Though the preface was dated November 18, 1894, the book containing it was not published until 1895. Before this date, Prof. F. G. Donnan had proposed the use of the word 'solute' in a letter from Leipzig published in NATURE of December 27, 1894. The letter is so short that we reproduce it in full. "Corresponding to the words 'solvent' and solution, some word is very badly wanted to express 'the dissolved substance'. The analogous word is evidently 'solute', and it is as short and euphonious as the others. May I inquire why it is not in general use ? Surely someone must have proposed it."

To Prof. Donnan, therefore, appears to belong the credit of first publication of the suggested use of the word 'solute' in the sense in which it has since been employed.

[ED. NATURE.

Chromosome Cycle of *Ascaris megalocephala*

PAINTER[1] and Schrader[2] have recently suggested that the long chromosomes of the germ-line cells in *Ascaris megalocephala* are peculiar in having a large number of spindle attachments instead of only one as hitherto assumed. Some time ago, I carried out an experiment to test this hypothesis. Uteri of adult females (var. *bivalens*) were irradiated with a Coolidge tube (65 kv., 5 ma., 30 cm. distance, unscreened radiation for 5 minutes). They were then kept for 5½ days at 38° C. and fixed in Carnoy. In several cases the long chromosomes of the first cleavage division were fragmented as a result of the irradiation. Fig. 1 shows a cell in which one of the four chromosomes has been broken in two places, leaving three fragments which are *all attached to the spindle*.



DIAGRAMS OF CHROMOSOME CYCLE OF *Ascaris megalocephala*.
1. Metaphase plate of first cleavage division in material irradiated with X-rays.
2. Metaphase plate of first cleavage division. The stippled part represents the spindle-area.
3. Anaphase of first cleavage division.
4. Spermatogonial anaphase.

It seems that the spindle attachments are confined to about the middle third of the length of the chromosomes. As a result, this region usually forms a characteristic zig-zag inside the spindle region at metaphase (Fig. 2). At anaphase the chromosomes do not form V's, but have the shape shown in Fig. 3.

The existence of multiple spindle attachments does not explain why the chromosomes in the ancestral cells of the somatic tissues fragment at the second to the fifth cleavage divisions, but it does explain why, when this fragmentation takes place, each piece has its own spindle attachment. Probably the club-shaped end portions of the chromosomes (genetically inert so far as the soma is concerned ?) are left without spindle attachments at the time of fragmentation; their degeneration in the cytoplasm is possibly a result of this.

There can be no doubt that the multiple spindle attachments are functional throughout the germ-line cycle (and not merely at the cleavage divisions). They are very obvious during spermatogenesis (Fig. 4), although the chromosomes have a totally different shape then.

It is interesting that in spite of the multiple spindle attachments, the chromosomes of *Ascaris megalocephala* do not fragment during spermatogenesis or oogenesis; probably the spindle attachments are so close together that all those in one chromatid are mechanically compelled to go to the same pole at anaphase.

The existence of multiple spindle attachments in *Ascaris* naturally suggests that the spindle attachments of some other organisms may also be compound, although so close together that they behave as a unit at division. If this were so, it might explain some cases of the evolution of chromosome numbers which are otherwise very difficult to understand.

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University College,
London.

[1] T. S. Painter, "Chromosome Fusion and Speciation in *Drosophila*", *Genetics*, **20**, 327 (1935).
[2] F. Schrader, "Notes on the Behaviour of Long Chromosomes". *Cytologia*, **6**, 422 (1935).

Control of the Enzymic Action of Lipase

A SUBSTANCE has been isolated from the castor oil seed, which controls the reversible action of lipase. The reduced form of this substance, which seems to be the predominating one in seeds, acts as an activator of the hydrolysis of fat by the *Ricinus* lipase and as an inhibitor of the synthesis of fat from glycerol and oleic acid. The oxidised form, which is easily obtainable from the reduced form by autoxidation in air, acts as an activator for the synthesis and as an inhibitor for the hydrolysis. The intermediary form is indifferent for both synthetic and hydrolytic processes.

The substance is a colourless rhombic plate crystal. The melting point 130° C.; $[\alpha]_D^{18} = -77°$. It is soluble in alcohol, methanol, glycerol, ether, acetone, benzene, chloroform, but not in petroleum ether. The solution in alcohol shows blue-violet fluorescence and two selective absorption bands with maxima at 314 mμ and 285 mμ.

The sterol reaction of Liebermann-Burchardt, the Cuboni reaction for œstrogenic hormone, and the vanilin-phosphoric acid reaction for bile acid are positive, but the Salkowski reaction for sterol and Gregory reaction for bile acid are negative.

Details will be published later in the *Japanese Journal of Biochemistry*.

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Sulphur-containing Pigments of Plant Origin

WITH the view of throwing light on the nature of the transient blue pigment, cyanohermidin, formed on exposing to the air an anærobically prepared extract of *Mercurialis perennis*[1], we have recently undertaken the investigation of the more stable blue compound formed on drying the actively growing shoots of this plant collected during the early spring. We have found that this compound changes spontaneously on keeping, or more rapidly on heating its aqueous solutions,

into a red product from which we have been able to separate a series of pigments, by a combination of chemical and physical methods. These pigments are glycosides which contain, in addition to carbon and hydrogen, both nitrogen and sulphur. The occurrence of the latter element in a pigment of vegetable origin has, so far as we are aware, not been recorded before, and we think this observation of sufficient interest to warrant its publication in this form, reserving the detailed description of these new substances for a future occasion.

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T. G. HILL.
BARBARA RUSSELL-WELLS.

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London.
March 31.

[1] Haas and Hill, *Biochem. J.*, **19**, 236 (1925).

A Specific Reaction for the Qualitative and Quantitative Determination of Ascorbic Acid in Serum

ON the findings in some yet unpublished studies on the reducing power of ascorbic acid in phosphate-chloride mixtures, we have developed a specific method for demonstrating ascorbic acid in very weak concentrations. If a little ascorbic acid is added to a solution of methylene blue and the solution is exposed to strong light, the colour will disappear completely within 30 seconds. This decolourisation is promoted by low *p*H and the presence of sodium chloride. Examination for serum ascorbic acid is therefore made with a stock solution consisting of KH_2PO_4 9 gm., NaCl 2 gm., *c.* 0·004 per cent methylene blue solution in 100 ml. 0·1 ml. of this solution is added to 0·9 ml. serum.

The mixture is exposed to the light of a 100-watt Nitra lamp, at a distance of 1 cm., for 30 seconds, and the intensity of the colour is compared to that of a control. Fading of the intensity of colour is distinct even with 0·1 mgm. per cent. The colour change is reversible in the dark.

This reaction to light is not produced by glutamine, ergotionine, creatine, creatinine, urea, adenine, guanine, hypoxanthine, xanthine, uric acid, cystine, phenol, hæmoglobin; nor does any of these substances inhibit the reaction with ascorbic acid. A negative serum reaction became strongly positive 4 hours after the experimenter had taken 500 mgm. ascorbic acid by mouth.

The method may be employed for the quantitative estimation of ascorbic acid, through establishment of the titre by means of dilutions; and apparently also, in modified form, for determination of the ascorbic acid content of milk and urine.

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April 11.

Points from Foregoing Letters

WHEN water moving with low uniform velocity encounters an obstacle, a 'capillary' wave appears, looking like a very fine thread or hair floating on the surface. W. Schmidt submits photographs showing this phenomenon when a gentle breeze is blowing over a lake or when a slow moving stream discharges into it. He points out that only a very thin surface layer is involved, and that this region of retarded motion shows mechanical properties analogous to those of an oil patch.

A drawing of the shape and position of the *Gegenschein* (faint luminescence of the sky seen opposite the direction of the sun) observed at sea, off the coast of Portugal, is given by Dr. Vaughan Cornish. Allowing for distortion due to uneven brightness of the surrounding sky, the luminosity of the *Gegenschein* appears to be symmetrically disposed.

Photograms comparing the intensity of light in the auroral spectrum at night with that under the influence of the sun are submitted by Prof. L. Vegard and E. Tønsberg. They find in daytime an enhancement of certain bands, the red line 6300 A. being four to five times stronger relative to the green line. This, the authors consider, is probably due to the influence of the ozone produced by the sun's rays.

Experiments with pea seedlings, carried out by Miss S. v. Hausen to prove the growth-promoting properties of vitamin C, are reported by Prof. A. I. Virtanen. By removing the cotyledons at a suitable stage, the seedlings are deprived of 90 per cent of their vitamin C, and die or remain dwarfed. The addition of vitamin C enables them to develop and even to produce normal blossoms.

Prof. J. S. Huxley and Dr. G. Teissier suggest the term *allometry* to denote growth of a part at a different rate from that of the body as a whole, and *isometry* when the growth-rate is the same. They further discuss the meaning of several other terms, and suggest a uniform notation for the factors involved in the elementary law of relative growth.

The absorption cross-sections of γ-rays (to produce negative and positive electron-pairs) per atom of tin (atomic number $Z = 50$), terbium ($Z = 65$) and zinc ($Z = 82$) have been determined by J. C. Jaeger. He finds that, by comparison, the Born approximation gives results which are too low, but the error decreases rapidly with decreasing atomic number and increasing energy of the γ-rays.

Prof. R. C. Colwell and A. W. Friend state that, with a short radio pulse and a rapid sweep on the receiving oscilloscope, it is possible to resolve the 'ground' wave into two or three parts, one or two of which are waves reflected from a low-lying region in the ionosphere. These layers are about 20 km. and 45 km. above the ground on the average, and are strongly reflecting for waves in the broadcast band. The lower one rises and falls with changes in the barometric pressure.

On irradiating with X-rays the uteri of horse round-worms, M. J. D. White finds that long chromosomes of the first cleavage division have broken up into three fragments, still attached to the spindle (a fibrous structure which plays an important part in nuclear division). He gives diagrams of chromosome arrangements during stages of nuclear division to support this indication of multiple attachment of chromosomes to the spindle.

Research Items

Gypsy Dancers in the Pyrenees

MISS VIOLET ALFORD, who has given twelve years to study of the folk-lore and customs of the Pyrenees, has recently described some of the material relating to gypsies which she has collected during that time (*J. Gypsy-Lore Soc.*, Ser. 3, 15, 2). For the most part, it belongs to the two ends of the range. Although the central Pyrenees does not lack gypsies, the only encounter with them there was in the valley of the Lez, Ariège. In Catalonia, on the Spanish side of the border, two dances hold first place, the first belonging to the Vallés district, the second to the Penedés district, south of Barcelona. The Vallés *Bal de les Gitanes* appears only at carnival time, when teams visit outlying farms, dance on the threshing floor and afterwards collect sausages and wine for a festal supper. Traditionally they steal cabbages from the gardens where they dance. In the dance of the Penedés district one of the dancers carries a maypole fitted with ribbons which the dancers hold in one hand, while carrying a castanet in the other. The fool carries a thong to lash the dancers and the crowd. In the Basque country the gypsies are regarded with abhorrence, and this is brought out in the role assigned to the despised outsiders, including 'Bohemians', in the *Masquerades*. The gypsies are led by a Gypsy Chief and brandish wooden swords and play wild pranks. A gypsy woman once figured also among 'les beaux', the superior troop in the *Masquerades*, probably as a man-woman fertility figure. In Basse-Navarre and Labourd Basque carnival dancers perform under the name *Kaskarotak*, the regional term applied to gypsies. They perform stick dances in carnival time. At the top of the Nive valley the best dancers become *Volants*. At Ispoure, a traditional colony of gypsies who arrived in the train of the Moriscos and Jews exiled from Spain in 1570–1614 are dancers par excellence and have risen to the rank of 'volants'.

Ojibwa Puberty Customs and Beliefs

IN the course of a study of the religious and social life of the Ojibwa Indians of Parry Island, Ottawa, part of which is now a reserve, Mr. Diamond Jenness describes a number of practices and beliefs relating to pubescent girls (National Museum of Canada, Bull. 78, Anthrop. Series 17). The Parry Island Ojibwa, who number about two hundred and fifty, though about one hundred consider themselves Potawatomi, are descendants of bands who migrated to Canada more than a hundred years ago from Michigan. They now form a single band, electing their chief annually, though formerly he held that position for life, and other things being equal, the position was hereditary. The whole life of the people was strongly affected by their relation to Nature and the underlying spiritual world. A large number of taboos had to be observed; and dreams held an important place in the beliefs and behaviour of members of the tribe. The traditional behaviour of a girl at puberty must follow that of the first Indian maiden to attain adolescence, who was warned and taught by 'Grandmother Moon'. Unless a girl listens to 'Grandmother Moon' when she whistles to her in a dream, she may never reach old age. The first period of seclusion lasts ten (formerly twenty) days, though later periods last for four days only. In harvest time the girl must remain in her special wigwam (nowadays a separate room in the house), until the close of harvest. No man or child younger than herself must approach her. Fresh food of all kinds were forbidden and other taboos had to be observed. She was in grave danger. Yet this mysterious power was not always harmful. It might be diverted to cure a middle-aged man suffering from an apparently incurable weakness, if he lay on his face in her room, so that he could not see her, and she walked slowly up and down his spine. Her power penetrated his frame, healed his malady, and enabled him to rise to his feet with all the vigour of a young man. Girls who had visions during their periods of seclusion sometimes attained great influence in the bands, and taking part in warfare, led the tribe to victory.

Indians in Canada

THE Indian population of Canada numbered 112,510 in 1934, according to the Annual Report of the Department of Indian Affairs for the year ending March 31, 1935 (Ottawa, 1935). There was no large epidemic, and it is noted that tuberculosis is not increasing, as is often said, but actually, though slowly, decreasing, except among those Indians who live in the far north and the remoter parts of British Columbia. Education is increasing, with more schools and better attendance. In Quebec and Ontario the Indians are largely engaged in farming; farther west and north, farming and stock raising are less important than hunting, trapping and fishing, but in most provinces the Indians turn their hands to various forms of livelihood, including steel making among the dwellers in the Caughnawaga reserve near Montreal. Timber cutting on the reserves is important. Indian farming operations tend to decrease and the yields per acre are low.

Ascidians of Mutsu Bay

DR. ASAJIRO OKA in his report on these ascidians (Biological Survey of Mutsu Bay, 28. Ascidiæ Simplices. *Sci. Rep. Tôhoku Imp. Univ.*, fourth series (Biology), Sendai, Japan, 10, No. 3, 1935) describes a large collection obtained by the Survey in 1926 and 1927, consisting of nineteen species belonging to nine genera, nine of the species and one genus being new. With this collection is incorporated another lot collected by Prof. Takatsuki in the same region, containing further species not previously represented. Finally, a specimen of *Cynthia michaelseni* was included which had not previously been recorded. The species are divided into three groups —those characteristic of northern Japan, those whose area of distribution covers entire Japan, and cosmopolitan species. The greater part of the Mutsu Bay forms are limited to northern Japan and to that part of the Japanese coast lying north to Sendai on the Pacific and Akita on the Japan side, the most conspicuous being *Cynthia roretzi* and *Chelyosoma siboja*. The much smaller *Styela plata*, disk-shaped

and attached to the shell of Pecten, is also very characteristic. *Corella japonica*, var. *asamusi*, n.var., grows to a large size and differs very much from the type originally described by Herdman, which is small and covered with mud, the variety having a luxuriant growth of dendritic processes, transparent test and bright red internal body showing through.

Economic Fishery

FOR stocks of fish, no less than for crops of hay, there is an optimum age at which they can be harvested with greatest profit. It has been suggested that the North Sea might be fished more economically with less effort: that the intensity of fishing might be reduced, and yet, when a new equilibrium has been attained, the yield of the fishery thereby considerably increased. The increase in size of the fish would more than compensate for the smaller number caught. Michael Graham, making special use of his investigations on the cod, contributes a new theoretical formulation of this question (*J. Cons. International pour l'Exploration de la Mer*, **10**, No. 3, 264–274). Conclusions are reached which establish the validity of the view stated above. After attention has been directed to certain evidence provided directly by fishery statistics, two independent lines of reasoning are followed up. The first involves direct calculation of the yield from a formula relating the rate of capture with rates of recruitment, growth and natural mortality. It emerges that if fishing could be reduced to raise the average age of the stock one year, the new yield will rise to a level higher than at present for any permissible valuation of the natural mortality rate. The conclusion holds good for cod, haddock and plaice, which together comprise more than 60 per cent of the North Sea trawl catch. Secondly, consideration is taken of the effect of the War-period on landings from the North Sea. Estimates are made from which it is possible to construct a curve representing the hypothetical natural growth-rate of the stock. Taking this curve as a basis, values are obtained of the yearly increase in total weight for different stages in growth of the stock. The effect can then be seen of regulating fishing effort so that the average age rises from the present $2\frac{1}{2}$ years to about $3\frac{1}{2}$. It is concluded that a saving of about 16 per cent in fishing effort will result in a few years in a gain of 13 per cent in the weight of the catch. This contribution to the theory of handling fish stocks and the application to present problems is certainly noteworthy. It is a sign that accumulation of the data of fishery research is beginning to provide us with material of sufficient variety and adequacy to allow of significant theoretical deductions.

Partial Sterilisation and Seedling Growth

THE practice of partial sterilisation by means of steam heat is at present used to a considerable extent for the control of many harmful fungi, and for the eradication of soil insects and weed seeds from potting compost. It has been, for some time, part of the routine of the John Innes Horticultural Institution at Merton, London, but as certain disadvantages were also attached to its use, Messrs. W. J. C. Lawrence and J. Newell have carried out an extensive investigation into the process (*Scientific Horticulture*, **4**, 165–177, 1936, from the Editor, S.E. Agric. Coll., Wye, Kent, 3*s*. 6*d*. net). They have established the facts that no lime in any form must be added to a soil before sterilising; that the ingredients of a compost should be sterilised separately; that fertilisers must be added *after* sterilisation; and that additional phosphate must be given in order to balance the natural deficiency of compost, and also to improve the soil conditions, changed by the sterilisation. The practices of horticulture become more scientific with the advance of time, and the paper under review opens a new field for more detailed research.

New Fungus Diseases of Wheat

A SHORT paper by Miss Mary D. Glynne (*Trans. Brit. Mycol. Soc.*, **20**, Pt. 2, 120–122, January 1936) announces the record of three species of fungi parasitic upon the wheat crop in England. *Cercosporella herpotrichoides*, Fron. has been noted as a cause of foot rot disease in France, the United States, Germany, Holland and Denmark. It appeared at the Rothamsted Experimental Station last year. *Gibellina cerealis*, Pass. has been previously recorded in Italy and Oregon, U.S.A., where it causes 'white straw disease'. *Ophiobolus herpotrichus* (Fr.), Sacc. has been found upon wild grasses in America and England, but has not previously been recorded upon cereals.

Climate of the St. Lawrence

THE first of a new series of memoirs, *Canadian Meteorological Memoirs*, **1**, No. 1, deals with the climate of the Gulf of St. Lawrence and the surrounding regions in Canada and Newfoundland, as it affects aviation. It is by W. E. Knowles Middleton. The region dealt with is of especial meteorological interest for the British Isles apart from aviation, as it is very commonly on the track of wind currents of polar origin that reach Great Britain from some westerly point, having been originally strong winds or gales from the north or north-west, frequent evidence for which is to be found in the part of this memoir that deals with wind statistics. It is also of more general interest as a region of astonishing contrasts, and contains a variety of different climates. Maritime influences are less apparent than might be expected. The cold Labrador current in passing down the east coast of Newfoundland causes frequent coastal fog in summer, and the Gulf Stream is regarded as an aid to fog formation along the Atlantic coast of Nova Scotia and in the Bay of Fundy, but the general west to east atmospheric drift and the presence of the large land mass of North America to the west cause the Continental effect to be in the ascendant. The maritime influence diminishes very rapidly with distance from the coast, a fact which makes it very difficult to form an idea of the climate of any particular place except by an examination of instrumental records covering a number of years. In the case of fog, for example, an item of especial importance for aviation, there is a quick change in the annual distribution of fog frequency on leaving the coast, where there is a very pronounced maximum in the summer, for the interior is subject to radiation fogs due to nocturnal cooling under a clear sky and having their maximum in the winter. Among the many points that are of outstanding interest, two deserve notice; first, the shallowness of most of the infrequent easterly winds, which are rapidly replaced by westerlies at higher levels, and the huge annual range of temperature, which is as great as 145° F. at Doucet, and is of respectable size even in the most easterly and maritime places, for example, 67° F. at Sable Island.

Upper Winds in India

A STATISTICAL compilation of value for aviation on the air route from England to Australia is No. 66 of Vol. 6 of "Scientific Notes of the India Meteorological Department". The author, whose name is not given, does not discuss in detail the ninety pages of tabular matter that constitute the bulk of this paper, which is entitled "Normal Monthly Percentage Frequencies of Upper Winds at 4, 6, 8 and 10 kilometres above sea-level obtained from Pilot-Balloon Ascents", but he includes in a short foreword a reference to earlier notes dealing with the same subject, which indicates that this is the most comprehensive statistical survey of upper winds between Aden and Rangoon that has yet been made. The figures are based on balloon ascents made in the morning at 34 well-distributed stations up to the end of 1931, and the velocities are grouped into six classes : less than 18, 18–36, 36–54, 54–90, 90–144 and over 144 km./hr., and according to the wind direction. In many instances no observations have yet been obtained at 10 km. in individual months, this being particularly noticeable in summer for those regions that have a long rainy season, but in many others this level is very well explored ; for example, in January there are no fewer than 83 observations for Bangalore, 47 for Agra and 45 for Poona, while in July Lahore has 69 and Agra 66 observations. A discussion of the figures will doubtless be given in a paper on the circulation of the atmosphere over India and neighbouring regions which, it is stated in the foreword, will appear shortly.

Magnetic Screening of Apparatus

PROTECTION of apparatus from the effect of external magnetic influences has always been a difficult problem for instrument designers. The ever-increasing progress in the applications of electrical energy, the great sensitivity of controlling and measuring instruments, and the use of modern radio equipment, make magnetic screening highly desirable in many cases. In a paper in the *Nickel Bulletin* published by the Mond Nickel Company, of Thames House, London, W. F. Randall describes new nickel-iron alloys which are most useful for this purpose. These alloys have permeabilities thirty or forty times greater than the values previously obtained with soft iron. If a small compass needle be placed in a 'mumetal' box a few inches away from a powerful magnet, no effect is discernible. A good galvanometer constructed several years ago before the advent of 'mumetal' had two screening shields weighing 145 lb. and giving a shielding factor of 32 ; the weight of the mumetal screen is $7\frac{3}{4}$ lb. and the shielding factor is 960. An exceptionally good mumetal screen gave a shielding factor of 4,500. Nickel-iron alloys have been successfully employed to protect watches from magnetisation. These alloys take a high polish, and form a handsome casing. The older magnetic materials were unsuitable as polarised magnetisation was produced which was detrimental to the working of the watch. Mains transformers in all-electric wireless sets are a fruitful source of stray flux. This trouble can be remedied by an effective magnetic screen either in the form of an enclosing box or, a little less effectively, as a baffle plate of metal between the transformer and the actual receiver.

Organic Glasses

UNDER this title, G. T. Morgan, N. L. J. Megson and E. L. Holmes (*J. Soc. Glass Tech.*, 20, 19 ; 1936) give a general review of the constitution and properties of hard, transparent resins. These may be divided into two groups, called condensation resins and polymerisation resins. The condensation resins comprise (*a*) derivatives of formaldehyde with phenol for example, bakelite), with urea (for example, pollopas), thiourea or toluenesulphonamide ; and (*b*) derivatives of polyhydric alcohols and polybasic acids (the 'glyptals'). The products of the phenol formaldehyde type, first developed industrially by Bakeland in 1908, are still produced on much the larger scale. Goods made from them, which must be cast (as the product cannot be moulded satisfactorily), are generally of the cheap type. The urea, thiourea or phenolic resins are increasingly used for domestic ware. The 'glyptal' type of colourless condensation resins are derived from polyhydric alcohols and polybasic acids such as glycerol and phthalic anhydride. Resins derived from polymerisation processes are among the earliest known, coumarone and indene derived from coal tar being well-known materials employed, yet the production of glass-clear products is only recent. Styrene, also obtained from coal tar, has recently been polymerised, Germany and the United States having been pioneers in the commercial development, particularly in electrical insulation. Other modern polymerisation resins are derived from vinyl halides, ethers and esters, and more recently from acryl derivatives. Many of these products are glass-clear and resilient, and can be turned on a lathe. The article contains tables giving the properties of various products, and includes suggestions for future progress based on what is known on the mechanism of formation of the products.

Microscopic Differentiation of Glues in Plywood

A METHOD of identifying casein and blood albumin glues in plywood by microscopic examination is described in a note by B. J. Rendle and G. L. Franklin (*J. Soc. Chem. Ind.*, 55, 105–6 ; 1936). Casein and blood albumin are two of the adhesives most commonly used in the plywood industry. They are characterised by a high water resistance, and this feature makes it possible for sample blocks of plywood to be sectioned for microscopic examination without separation of the plies. Under the microscope, casein glue is seen to be nearly colourless with a fine granular structure. Under crossed nicols it is slightly anisotropic, producing a sparkling effect against a dark background. Blood albumin is distinctly green in thin sections, with an opaque glassy structure. Under crossed nicols it shows complete extinction. A mixture of eosin and methyl blue is an effective stain for distinguishing between the two types of adhesive and for demonstrating the penetration of the glue into the pores of the wood. A convenient method of application is to mix the two stains together in glycerine jelly, the latter serving as the medium for mounting the sections. A two per cent aqueous solution of methyl blue is mixed with a two per cent solution of eosin in fifty per cent alcohol, in the proportion of three to one. The mixed solution is then added to glycerine jelly, previously liquefied by immersion in a water bath, until it is about the colour of blue-black writing ink. Casein glue is stained a purplish-pink colour, intermediate between 'amaranth pink' and 'pale amaranth pink' in Ridgway's "Colour Nomenclature, 1912", and blood albumin a wine-red or 'vinaceous purple' (Ridgway). The wood itself stains pale mauve in contrast to the relatively deep colour of the glue layer.

The Kodachrome Process of 16 mm. Colour Cinematography

THE introduction has recently been announced by Messrs. Kodak, Ltd., of a new method of colour cinematography, which brings the making of cinematograph pictures in natural colours within the scope of any owner of a 16 mm. cine camera. The new process is marketed under the trade name "Kodachrome".

Processes of colour cinematography may be based either on the additive or the subtractive principle. The former principle involves the addition of primary

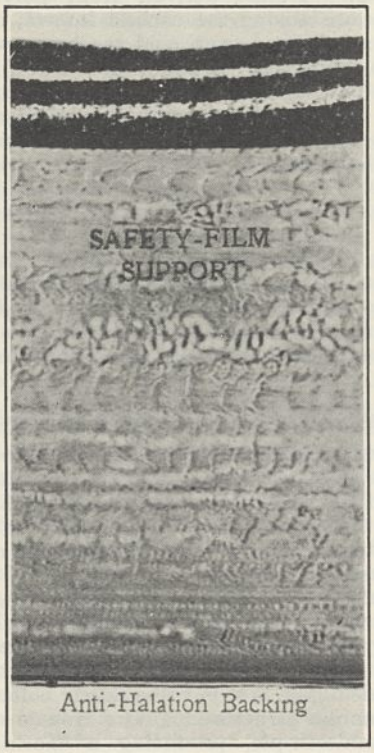

FIG. 1. Section of Kodachrome film. × 500.

colours on the screen, or the juxtaposition of small elements of primary colour on the screen: and in the forms in which the process has been exploited commercially for amateur purposes, this juxtaposition of colour elements has been obtained either by means of a cinema film the base of which incorporates a minute mosaic of colour rulings or of a film the base of which is formed with minute, moulded lenticulations working in conjunction with a filter of three-colour strips mounted on the camera lens. Whichever method be adopted, the additive principle is subject to two important objections. First, the pattern of colour elements interferes with the resolution of the image and may easily, in fact, become obtrusive on the screen; secondly, the white highlights, being formed by the addition of primary colours which themselves represent less than one third of the original white light available for projection, must fall seriously below the screen intensity attainable in black-and-white projection.

In the case of the subtractive principle, of which Kodachrome is the first commercial application in sub-standard cinematography, it is possible to avoid both of these practical shortcomings. In the Kodachrome image there is no form of colour pattern whatever, the colour being present as a dye deposit which is even less granular than a black-and-white film image; and, since the white highlights are represented on the film by clear film areas as free from colour or density as the highlights of a black-and-white film, the screen brilliance is exactly the same as in ordinary cine projection.

The Kodachrome process, moreover, makes colour cinematographic pictures as simple as black-and-white cinematography. In its 16 mm. form, it is a

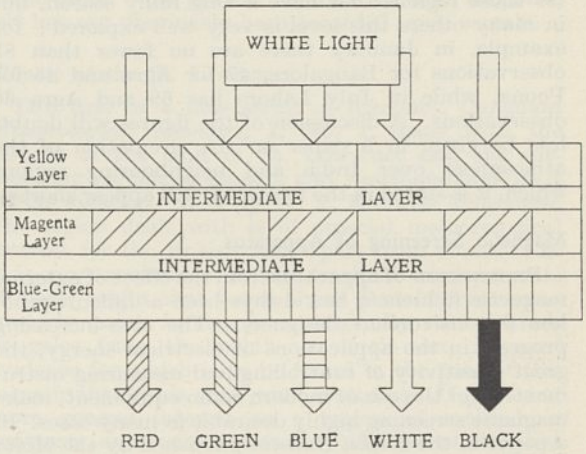

FIG. 2. Scheme for production of primary colours, and of black and white, in finished colour positive.

three-colour reversal process, employing a single film which first effects the colour separation automatically during the exposure in the camera and then, on processing, produces the reversed image in natural colours for projection. The colour is present in the body of the processed film in the form of superimposed continuous dye images of almost grainless quality: hence Kodachrome film can be projected with any 16 mm. projector, without special equipment, giving undiminished screen illumination. Definition and resolution are extremely good.

In picture-taking, the same simplicity is again evident, since Kodachrome film is normally exposed without even a colour filter and with the lens only opened up by one or two stops, compared with Cine-Kodak Panchromatic film. Only for the elimination of haze in distant landscapes is it desirable to make use of a colourless, haze-cutting filter, which does not, however, affect the exposure required. For artificial light work also a correcting filter is required.

The colour separation depends on the fact that the sensitive coating of Kodachrome film, which is scarcely thicker than the single coating of an ordinary film, consists of five exceedingly thin layers—three layers of emulsion with two intervening layers of gelatine (Fig. 1). The total thickness of these five layers is only about 1/1,000 inch. The upper layer is

blue-sensitive and records the blue-component image. The intermediate emulsion layer, to which only green and red rays penetrate, is a green-sensitive emulsion, which therefore records the green-component image. The bottom emulsion, to which only red rays penetrate, is red sensitive and similarly records the red-component image.

In processing, which is effected by a series of continuous machines, the treatment is such as to produce in the three layers of the emulsion positive dye images in the so-called 'minus' colours, the gradations of which represent the distribution of the corresponding primary colours in the subject; namely, a yellow (minus-blue) image in the blue-sensitive layer; a magenta (minus-green) image in the green-sensitive layer; and a blue-green (minus-red) image in the red-sensitive layer (Fig. 2). This production of colour images depends on the use of dye-coupling developers (Fischer, 1912), the action of which is to develop exposed silver halide, forming simultaneously in the film a deposit of dye at the same point as the reduced silver. It has been found possible to discover coupler-developers of this kind which give dye images of the required colours and characteristics.

The first stage of processing is normal development and reversal of the silver image. The reversed film is then re-exposed and completely developed in a blue-green coupler-developer, which reduces the remaining silver halide grains and forms corresponding blue-green deposits in all three layers of emulsion. After drying, the film is then treated with a bleaching solution under such conditions that its action affects only the two upper emulsion layers: in these it bleaches the dye and re-forms silver halide, leaving the blue-green colour in the bottom layer. Then follows a third development, with a magenta coupler-developer, which forms magenta deposits in the two upper layers. After drying again, the film is given a second bleaching treatment which, however, is allowed only to affect the upper layer, leaving the magenta colour in the middle layer. A fourth development, in yellow coupler-developer, leaves the emulsion with dye images of different colour in each layer. In each layer, however, there is silver combined with the dye image and the final treatment is therefore one which removes this silver entirely, leaving the dye images untouched. It is evident that this process lends itself to commercial adaptation to wide fields beyond that of 16 mm. cinematography.

Main-Line Electrification throughout the World

IN a paper on main-line electrification read to the Institution of Electrical Engineers on April 30, E. R. Kaan, a distinguished Austrian engineer, gave a résumé of recent work done in electrifying railways all over the world.

Electric traction on main lines employs nearly always one or other of two systems. The first is the single-phase alternating current system, the voltage with the contact line being usually 15,000 and the frequency $16\frac{2}{3}$. The other is the direct current system, generally at a voltage of 3,000, but when overhead equipment is used it is 1,500. Experts agree that all electric traction problems can be solved equally well from the technical and economic points of view whether A.C. or D.C. is employed; which of these two should be employed depends on local conditions.

Switzerland has done more in electrifying railways than any other European country, only a few branch lines still using steam. The new giant locomotives for the Gotthard line are worthy of mention. The double locomotives are rated at 7,500 and 8,800 h.p. respectively, and are the most powerful in Europe. Each is capable of hauling trains weighing 1,400 tons, brought to them on the level track by two locomotives, up the steep Gotthard slope of 1 in 38 at a speed of 50 miles an hour. Each of these double engines has eight driving axles, and the heaviest express trains can be hauled by one locomotive instead of the two necessary with steam traction. Two can pull the heaviest goods trains, for which three steam locomotives are required.

In Germany, by the end of the year, 1,500 miles of the German Railway Co. will be electrified. Although Germany has very extensive coalfields and lignite at her disposal, it is intended to increase the number of electrified lines. National and political economy are the deciding factors; it is necessary to relieve unemployment and provide work for the highly developed German industry. In southern Germany the energy is obtained from water-power stations which are generally State owned. The single phase A.C. system at 15 kilovolts is used by the company, with the exception of the suburban railways in Berlin, which use D.C.

In Sweden, electric traction has been widely adopted. This is due to the abundance of water-power; the other conditions usually associated with electrification, namely, heavy traffic, steep gradients and unemployment were absent. The water-power stations are chiefly the property of the State. As most of the lines are level, practically only one kind of locomotive, 80 tons in weight, is employed for all types of trains. There are 268 of these locomotives in service. The very satisfactory results obtained are attributed to the high average speed, the fact that a single man can operate an electric locomotive and the considerably lower costs of maintenance.

In Austria, the electrified lines carry 22 per cent of the entire traffic of the Austrian federal railways. In 1914 the Austrians had studied railway electrification. In 1918 the situation became very difficult as the territories to which she was now restricted possessed only lignite. In 1925 it was decided to electrify the whole of the federal railways, and now a great programme has been proposed, comprising the line Salzburg–Vienna, the southern railway as far as Graz, the eastern railway to the Hungarian frontier and the suburban lines of Vienna.

The Hungarian State Railways use the Kando system of electrification, which differs fundamentally from all other systems. It uses three-phase current, which is the standard system of supply and without converting it applies it directly to the traction motors. The generating station is at Banhida, where the furnaces burn inferior earthy coal raised in the vicinity

and not worth transporting. This power station and one of the lines from Budapest were financed by an English loan on condition that a considerable part of the supplies were to be procured from English firms.

In Italy, the Valtelina railway was electrified with three-phase current in 1900, and this introduced the three-phase system into upper Italy. When it was decided to electrify the Bologna–Florence railway, direct current was used. Hence two systems, direct current and three-phase, are used in Italy. The bulk of the necessary electrical energy is obtained from water power stations, two thirds of which are railway owned and one third privately owned.

Mr. Kaan said he hoped that the recommendations of the Weir report for the railway electrification of Great Britain will be carried out, and expressed his great admiration for the way in which the Southern Railway Co. has electrified the London suburban lines and the lines to Brighton, Worthing, Seaford and Hastings.

In France it has been decided to use the grid system of the country to supply the railways. A high-tension grid (60–220 kv.) has been constructed to connect the steam power stations of Paris with the water power stations of the Alps and Pyrenees. In order to afford employment, many lines are scheduled for electrification. It is interesting to notice that some of these are situated in the northern districts of the country, which are rich in coal.

In the United States, not quite one per cent of the 262,500 miles of lines have been electrified. The first long distance line was that connecting Baltimore, Washington and Annapolis. The factors that determined the introduction of electric traction were its greater efficiency in meeting competition and the substitution of water-power for coal.

Mr. Kaan also reviewed the position of electric traction in many other countries and in the British Dominions.

The *Queen Mary* and Timbers of the Empire

THE latest addition to the Cunard fleet, and one of the largest ships now afloat, the *Queen Mary*, may be truly said to be an Empire ship. The decorations of her interior are largely of wood drawn from the forests of many parts of the Empire—India, the great Dominions and many Colonies.

Teak has long been used in ship construction, and some 1,000 tons of this fine timber has been utilised for decks and gangways, window frames and hand-rails and so forth. More interesting, perhaps, are some of the timbers which have been used in the magnificent panelling which forms so marked a feature of the interior fittings of the great saloons, smoking-rooms, lounges, corridors and state-rooms.

The builders, Messrs. John Brown and Co., Ltd., and their advisers have ransacked the Empire and indeed the world to collect examples of some of the richest timbers so far known to the trade; though this by no means indicates that the trades are yet acquainted with a tithe of the beautiful timbers existing in the moist tropical and mixed deciduous forests of the world. Apart from teak, the following woods amongst others have been used: laurel wood (*Terminalia tomentosa*), India; mahogany (*Swietenia*), British Honduras; cedar mahogany (*Guarea cedrata* or *Thompsonii*), Nigeria and Gold Coast; pommele mahogany (*Entandrophragma* ?), Nigeria; Sapele (*Entandrophragma cylindricum*), British and French West Africa; lemon wood (*Xymalos monospora*), Southern Rhodesia and South Africa (or, *Calycophyllum candidissum*, Cuba); tiger oak, said to be *Machaerium Schomburghii*, Guianas; Macassar ebony (*Diospyros macassar* and *Diospyros* sp.), Celebes; Amboyna (*Pterocarpus* sp.), Moluccas; Makoré (*Mimusops Heckeli*) and Avodiré (*Turreanthus africana*), Ivory Coast; Satinee, or Satiné rubane and Satiné rouge (*Brosimum paraense*), French Guiana (or, Satiné jaune, *Zanthoxylum flavum*, French West Indies); Peroba (*Aspidosperma polyneuron* or *Paratecoma peroba*, syn. *Tecoma peroba*), Brazil; oak nut, possibly nut oak (*Macadamia ternifolia*) and Australian walnut (*Endiandra palmerstonii*), Australia; Oregon myrtle (*Acer macrophyllum*), United States of America; Masur birch (*Betula*), figured birch from Finland, North Russia and elsewhere; grey maple, stained maple and sycamore (*Acer*), and olive ash, figured wood (*Fraxinus excelsior*); walnut (*Juglans regia*) and beech (*Fagus sylvatica*), England and Europe. Also Queensland maple and Canadian (dark) birch.

A study of this great ship would be an education in the products of the forests of the world. The following information kindly furnished by the builders would appear worthy of record on the actual utilisation of some of the above mentioned timbers.

First Class restaurant: Peroba, with feature panels in selected maple burr and Masur birch. Port-side aft private saloon, maple burr; starboardside aft private saloon, bleached pommele, feature panel in selected maple burr. Tourist dining saloon, ash burr and grey blistered maple—sideboard, walnut. Forward and aft subsidiary stair and aft corridors promenade deck, figured ash with pillar casings and dado and doors elm burr. Midship entrance promenade deck, figured bleached mahogany with dado and doors in pommele. Two writing rooms, promenade deck, oaknut, chestnut and tables ash burr and straight grained ash and pear. Main hall and promenade deck, same timbers as writing rooms with, in addition, teak. First Class library—a beautiful room—promenade deck, oak burr and sycamore with feature panels in oak burr. Observation lounge and cocktail bar, promenade deck, maple burr with dado and horizontal bandings in cedarmah; counter front and *jardinières* to niche features in finely figured macassar ebony. Corridors, main hall to cocktail bar, promenade deck, maple burr with elm burr dado and doors. First Class children's play room, lemonwood. Sun deck, aft entrance, top and bottom course of walls in straight grained chestnut; centre course and doors in root ash; horizontal bandings in chestnut. Sun deck, forward entrance and sports deck entrance, satinee with doors and dado in elm burr. Long gallery, *Betula* and maple. Starboard gallery, in specially selected laurelwood. First Class smoke room—another very beautiful room—English oak

burr, walnut and tiger oak. First Class lounge, selected maple burr with dado in makoré, walnut skirting and high and low level soffits in Masur birch. Aft and forward staircases, figured ash, dado in elm burr. Main staircase, figured ash. Dado in elm burr with feature panel on promenade deck of specially selected and cut peacock walnut burr, graded to outer sides with special elm burr. It is said that this log was specially cut for the *Queen Mary*. First Class ballroom, skirting and dado in specially cut logs of Makoré with small marquetry banding in the Makoré doors of maple burr; remainder of the room painted. First Class entrance foyers on main and *B* deck, dado in elm burr, with filling above in chestnut, banded. First Class, *A* and *C* decks, elm burr dado with masur birch filling banded horizontally with straight grained birch. Much of the beautiful furniture in the ship is made of Honduras and other mahogany, oak, French walnut and Austrian beech.

It is due to the modern use of veneers and plywood that the decoration of this vast ship in so artistic a manner has become possible. A study of the *Queen Mary* will be a revelation to many of the great progress which has been achieved in this direction.

Educational Topics and Events

CAMBRIDGE.—M. T. Greig has been appointed University demonstrator in anatomy.

The Gordon Wigan Prize in chemistry has been awarded to W. C. G. Baldwin, of Christ's College, for a dissertation entitled "Phenomena associated with Optically Active Absorption Bands".

The Managers of the Balfour Fund propose to consider the appointment of a student as from October 1, 1936. The studentship is of the annual value of £300 and the appointment is for three years. Applicants need not be members of the University of Cambridge. Further information can be obtained from Prof. J. S. Gardiner, Zoological Laboratory, Cambridge, before May 31.

At Clare College, Dr. H. M. T. Taylor, University lecturer in the Faculty of Mathematics, has been elected into an official fellowship.

OXFORD.—During the visit of the British Medical Association in July, honorary degrees of D.Sc. will be conferred on Sir George Newman, Sir Cuthbert Wallace, Sir Henry Dale, Sir Walter Langdon-Brown, Dr. Robert Hutchison and Prof. Charles Singer.

H. O. Newboult and R. Opie, fellows of Magdalen College, have been appointed University lecturers in mathematics and economic science respectively. Dr. B. D. Pullinger has been appointed University lecturer and demonstrator in pathology from October 1, and Dr. S. Zuckerman University lecturer and demonstrator in human anatomy from April 1, 1937.

Balliol College proposes to elect a Skynner senior student in astronomy this term. The studentship is of the value of £200 a year and may be held for two years.

Christ Church proposes to elect this term at least one 'lecturer' and one senior scholar to carry out research in science or literature. The lectureship is worth £300 a year for five years and the scholarship £200 a year for two or four years.

The subject of the course of eight lectures given this term by the Wilde lecturer in natural and comparative religion, Dr. F. L. Cross, is "Religion and Scientific Thought from the Renaissance to Leibniz".

THE mechanisation of university studies is attacked by Dr. W. S. Learned, of the Carnegie Foundation for the Advancement of Teaching, in a recently published report on the progress of the Foundation's elaborate inquiry, begun eight years ago, into the relation of secondary and higher education in Pennsylvania. The chief instrument employed in this inquiry has been an extensive series of tests covering the main aspects of general education and designed to measure the sum total of the student's acquired skills and store of serviceable knowledge—the intellectual fixed capital available for future use. The tests are said to "constitute a searching and comprehensive probe such as has never been available hitherto", and made possible comparisons of ratings of students of different academic grades and of the same student at different stages. The results expose the weaknesses of a system of grouping students according to the extent of the formal academic 'courses' they have completed. Thus: in an examination of eleven thousand students belonging to three academic groups, (*a*) high school final year, (*b*) college second year, and (*c*) college fourth year, 22 per cent of (*a*) were ranked higher and 29 per cent of (*c*) lower than the average of (*b*), while 10 per cent of (*a*) did better than the average of (*c*), and vice versa. Again, in a typical college, 34 undergraduates at the end of their first year scored higher than 72 per cent of seniors on the eve of graduation. Two years later, when the entire college was re-examined with the same test, two-thirds of these brilliant freshmen had actually lost ground. "Although as freshmen they were already beyond that intellectual level at which the college could serve them effectively, they were obliged to mark time for three more years until the calendar should release them".

Science News a Century Ago

The Dudley and Wolverhampton Coalfield

AT a meeting of the Geological Society held on May 11, 1836, Lyell being in the chair, Murchison read a paper "On the Dudley and Wolverhampton Coalfield, and on the Formations connected with it, followed by a Description of the Lickey Quartz Rock". This was one of a series of papers in which Murchison described the structure of the border counties of England and Wales and the southern part of the Principality. The great coalfield of Dudley and Wolverhampton, the most productive in the central part of England, he said, is geologically distinguished by the total absence of the mountain limestone and the old red sandstone, which form the fundamental rocks of so many of the coal tracks of Great Britain. The formations which constitute the sub-strata of the district are known only by their irregular protrusion through the coal measures near Sedgeley and Dudley, and through the new red sandstone at Walsall, or by having been reached in some of the deepest pits. These

rocks belong to the system to which Murchison gave the name Silurian, and compose the greater part of the border counties, with Carmarthenshire and Pembrokeshire.

Encouragement to Literature and Science in France

UNDER the above heading, the *Athenæum* of May 14, 1836, printed the following remarks: "The sum of £130,000 is annually devoted to this purpose by our enlightened neighbours, and is distributed among the Institute of France, the Royal College, the Museum of Natural History, the Board of Longitude, the Royal Library, the Museum of the Louvre, etc.; including an allowance for the encouragement of the dramatic art; for the publication of travels of French *Savants*; for pensions to 90 literary men and artists; and for some other objects. To our own executive we would say 'Go thou, and do likewise'."

Hancock and his Steam Carriages

ON May 14, 1836, the *Mechanics' Magazine* said: "Mr. W. Hancock whose perseverance deserves success, commenced running his steam carriages, the 'Enterprise' and 'Erin' on Wednesday morning last, at nine o'clock, from the Station in the City-road to London Wall; from thence he proceeded to Paddington and returned to the city. On the first day he performed three of these journeys, on the second, four, and on the third (yesterday) two, before noon. The average time of travelling over the ground has been 1 hour and 10 minutes including stoppages to take in passengers, water and coke. This is just half the time the horse-omnibuses take in going over the same ground. In the 9 journeys performed, the number of passengers carried was 220, averaging about 12 persons each trip. Mr. Hancock intends to run his carriages regularly the same number of journeys daily, for the present, and very shortly to increase the number."

Baily and the Solar Eclipse of May 15, 1836

THE annular solar eclipse of May 15, 1836, will always be remembered for the observation by Francis Baily (1774–1844) of the phenomenon to which the name of 'Baily's beads' was given. Baily observed the eclipse at the house of his friend Veitch at Inch Bonney near Jedburgh. "When the cusps of the sun," he wrote, "were about 40° asunder, a row of lucid points, like a string of bright beads, irregular in size and distance from each other, *suddenly* formed round that part of the circumference of the moon that was about to enter, or which might be considered as having just entered on the sun's disc. Its formation indeed was so rapid that it presented the appearance of having been caused by the ignition of a fine train of gunpowder. . . . Finally, as the moon pursued her course, the dark intervening spaces (which, at their origin, had the appearance of lunar mountains in high relief, and which still continued attached to the sun's border) were stretched out into long, black, thick, parallel lines, joining the limbs of the sun and moon; when all at once they *suddenly* gave way, and left the circumference of the sun and moon in these points, as in the rest, comparatively smooth and circular, and the moon perceptibly advanced on the face of the sun." (*Mem. Roy. Ast. Soc.*, 10, 5–6.)

Societies and Academies

PARIS

Academy of Sciences, March 30 (*C.R.*, 202, 1125–1224). ELIE CARTAN: Fields of uniform acceleration in limited relativity. MARCEL GODCHOT, MLLE. GERMAINE CAUQUIL and RAYMOND CALAS: The application of the Raman effect to the study of some methylcyclopentane derivatives. The principal lines of the methylcyclopentane nucleus already described appear in all the derivatives studied. The spectra of the active and racemic compounds may be regarded as identical. JEAN BOSLER was elected *Correspondant* for the Section of Astronomy in succession to the late Willem de Sitter. HERMAN WOLD: Surfaces of mortality. DIMITRI PEREPELKINE: Certain orthogonal varieties in R_n. ALEXANDRE OSTROWSKI: The transformation of the folds in conformal transformation in the neighbourhood of a frontier point. STEFAN KEMPISTY: The area of the surface $z=f(x, y)$. ARNAUD DENJOY: Physics and metrics of ensembles. Remarks on a note of Paul Lévy. RENÉ HARMEGNIES: Some properties of networks. A. KOLMOGOROFF: The Betti groups of locally bicompact spaces. ANDRÉ WEIL: Topological groups and measured groups. M. KELDYSCH and M. LAVRENTIEFF: Suites of harmonic polynomials. GEORGES BOURDELLE: The approximation given by certain transmission dynamometers, energy integrators. MAURICE LUCAS: Constraints imposed by contraction on a body included in a mass of cement. The study in a plane. VALENTIN V. VEDERNIKOV: The solution of the problem in two dimensions of the stationary current of underground waters with free surface. MLLE. MARIE ANTOINETTE BAUDOT: Remarks on a form of a function of action. ARKADIUS PIÉKARA and MAURICE SCHÉRER: Correction to a note on the magnetic change of the dielectric constant of liquids. The data published in an earlier note (*C.R.*, 201, 335) have been found to be in error. THÉODORE V. IONESCU and CONSTANTIN MIHUL: The distribution of the velocities of the electrons in the magnetic field. ROBERT BOSSUET: Alkaline metals in natural waters. A list of springs in which all five alkali metals have been detected, with a second list of springs containing all alkali metals except cæsium. RENÉ LUCAS: The diffraction of light by ultrasound waves. Discussion of the theory of Raman and Nagendra Nath and description of experiments showing the limitations of this theory. PAUL SOLEILLET: Applications of the theory of the coherence of vibrations. LADISLAS GOLDSTEIN and MARCEL LECOIN: The continuous β-spectrum of RaC″. WILFRIED HELLER, OTTO KRATKY and HANS NOWOTNY: The constitution of the iron oxide sols. The results of the application of magneto-optic and X-ray methods. HENRY PARISELLE: Contribution to the study of the complex lead compounds of the oxyacids. Polarimetric study of the reaction between lead nitrate and tartaric acid. MARCEL PRETTRE: The laws governing the initial acceleration of slow combustion and the delay of spontaneous inflammation of mixtures of normal pentane and oxygen. Application to the phenomena of 'knocking' in motors. ANDRÉ KLING, MAURICE ROUILLY and MAURICE CLARAZ: A simple method for estimating the proportion of carbon monoxide in an atmosphere. VICTOR AUGER: The molybdenum blues. GUY GIRE: The hydrolysis of basic nickel sulphate. CLÉMENT

DUVAL : The constitution of the organomagnesium compounds. The results of the electrolytic experiments described confirm the formula of Jolibois. MLLE. YVONNE GARREAU : The oxidation of hydroquinone and of chlorhydroquinone in the presence of ammonium sulphite. The oxidation of a hydroquinone disulphonate in the presence of ammonia. LÉON ENDERLIN : Contribution to the study of the reversible oxidisability of organic compounds : the dihydroxide of bis-*p*-bromophenyl-diphenylrubene. MARCEL FRÈREJACQUE : Controlled hydrolysis of the acetyl derivatives of the reducing sugars. PAUL GAUBERT : The modifications of the facies of uric acid crystals by colouring matters added to the mother liquor. FRANCIS BARILLET : The effect of β-naphthalene sulphonic acid on the crystallisation of copper sulphate pentahydrate. ALFRED SILBERSTEIN : The structure of the double bromide of copper and ammonium. F. BLONDEL and J. BONDON : Remarks on the distribution of the principal mineralisations of Morocco. PIERRE COMTE : The middle and upper Devonian of Léon (Spain). ARMAND RENIER : The appearance of an inflection towards the overlap of the Varisc strata by the Armorican strata in the Franco-Belgian coal basin. ALBERT MICHEL-LÉVY : The presence of mylonites in a Visean conglomerate to the south of Tarare and the interpretation of the old strata in the Monts du Lyonnais. GEORGES ATHANASSOPOULOS : The rise to the surface of Civelles. RAYMOND HOVASSE : Experimental duplications of the anterior parts of tadpoles in *Rana temporaria*. MLLE. ANNE MARIE COLLOT and JACQUES RABATÉ : The presence of *d*-catechol in the bark of the peach tree. ERNEST KAHANE and MLLE. JEANNE LÉVY : The presence in normal blood of an acetylcholinic substance in a concealed state. MLLE. IRÈNE KOPACZEWSKA, W. KOPACZEWSKI and STANISLAS MARCZEWSKI : The spontaneous reversibility of the seric gel formation. CONSTANTIN LEVADITI and PAUL HABER : The evolution of the virus of bird plague in the hepatic cells of mice. ALEXANDRE BESREDKA and LUDWIK GROSS : Vaccination of the rabbit against subcutaneous epithelioma. Intracutaneous inoculation of epithelioma immunises the rabbit against the malignant subcutaneous tumour : the immunity is specific and lasting. LÉON BINET and J. MAREK : Hypoglycæmia in the course of poisoning by the fungus *Amanita phalloides*. FREDERICO NITTI and DANIEL BOVET : Experimental streptococcic septicæmias and their treatment by *p*-aminophenylsulphamide.

GENEVA

Society of Physics and Natural History, March 5. ARNOLD PICTET : The action of a lethal factor in the descent of an interspecific crossing of guinea pigs. CH. G. BOISSONNAS : The influence of the molecular weight on the activity of solutions. P. BALAVOINE : The presence of manganese in tea. D. ZIMMET and H. DUBOIS-FERRIÈRE : The sensibility and the stability of the nickel nitroprusside reaction for reduced glutathione. D. ZIMMET, B. GHINSBERG and L. JANCU : The influence of padutine (callicreine) on the growth and morphogenesis of the tadpoles of *Rana temporaria*.

March 19. M. GYSIN : The origin of a crystalline schist of southern Katanga. The author has studied a chlorito-epidotic felspathic schist containing biotite arising from southern Katanga. He attributes the formation of this schist to the metamorphism of a gabbro rock. To confirm this point of view, he has determined on a Shand stage the quantitative mineral composition of the crystalline schist and has hence deduced the chemical composition. He shows that this composition agrees closely with that of various Swiss gabbro rocks. TH. HILLER : The identification of silver in opaque minerals by the imprint method. CH. CIMERMANN, D. FRANK and P. WENGER : The micro-estimation of zinc by means of oxyquinoline.

MOSCOW

Academy of Sciences (*C.R.*, 1, No. 2, 1936). A. S. BAKALIAJEV : The theorem of unity in the case of some problems of limits in the elasticity theory. M. KREIN : Positive Green functions in Mercer's sense. N. MOISSEJEV : (1) On some anepicyclic regions in the limited problem of three bodies. (2) A simplified scheme of the planetary system. S. SCHUBIN and A. SMIRNOV : A simple example from Born's electrodynamics. M. VUKS : Modified dispersed radiation from crystals, and movements of molecules of a grid. K. S. TOPCHIEV : Symmetrical di-[α-α′-picolyl]-thiourea. N. NAZAROV : Dehydration of methyl-di-tertiary butyl-carbinol. Splitting and isomerisation of di-tertiary butyl-ethylene. I. B. PANSHIN : A demonstration of the specific nature of position effect. H. J. MULLER, A. A. PROKOFJEVA-BELGOVSKAJA and K. V. KOSSIKOV : Unequal crossing-over in the bar mutant as a result of duplication of a minute chromosome section. M. A. CAJLACHJAN : Mechanism of photo-periodic reaction. F. W. SHATILOV : Stimulation of the development of plants and of the ripening of fruits on them by means of ethyl alcohol and temporary anaerobiosis of the root system. P. J. SCHMIDT : The genera *Davidojordania*, Popov and *Bilabria*, gen. nov. (Pisces, Zoarcidæ).

VIENNA

Academy of Sciences, March 12. ERNST SPÄTH, LEOPOLD SCHMID, and HEINZ STERNBERG : Rhœadine and rhœaginine. Rhœadine has the formula $C_{21}H_{21}O_6N$ and contains a methoxyl group, while rhœaginine lacks the methoxyl group and has the formula $C_{20}H_{19}O_6N$. The oxidation, reduction and Hofmann reaction of rhœaginine are described. H. WIESENEDER : Discovery of amphibolite eclogites in the Niederen Tauern. JOHANNA WIESTHAL : Effect of irradiation with radon on different kinds of glass. The solubility of glass in water is increased by irradiation. DORA BUCHGRABER : Estimation of radium and radon solutions. ALOIS KIESLINGER : Geology of the south-east Bacher. OTHMAR KÜHN : A new Burdigalian formation at Horn. FRANZ HERITSCH : (1) Diluvium and late Tertiary near the Faaker See in Carinthia. The Vinza breccia near Faak is ascribed to detritus from the late Tertiary of the Karawankas. (2) The north side of the Karawankas in the Worunizagraben—Faak-am-See—Kanzianiberg region. EMIL WORSCH : Geological survey east of the Faaker See. OTTO DISCHENDORFER and AUGUST VERDINO : Condensation of benzoin and thymohydroquinone. E. HAYEK : Complex chemical behaviour of silver fluoride.

Forthcoming Events

[*Meetings marked with an asterisk are open to the public.*]

Monday, May 11

UNIVERSITY OF CAMBRIDGE (Cavendish Laboratory), at 4.30.—Prof. E. V. Appleton, F.R.S.: "The State of the Upper Atmosphere" (Scott Lectures. Succeeding lectures on May 13, 15 and 18).

ROYAL GEOGRAPHICAL SOCIETY, at 5.—M. Spender: "Photographic Surveys in the Mount Everest Region".

UNIVERSITY COLLEGE, LONDON, at 5.30.—Prof. F. M. Jaeger: "Researches on the Specific Heats of Metals and their Alloys at High Temperatures".*

Tuesday, May 12

INSTITUTE OF PATHOLOGY AND RESEARCH, ST. MARY'S HOSPITAL, LONDON, at 5.—Dr. J. E. McCartney: "The Control of Diphtheria in Hospital Wards".

COLLEGE OF THE PHARMACEUTICAL SOCIETY, at 5.30.—Prof. Arthur Stoll: "Cardiac Glucosides" (succeeding lectures on May 13 and 14).*

INSTITUTION OF CIVIL ENGINEERS, at 6.—Annual General Meeting.

ILLUMINATING ENGINEERING SOCIETY, at 7.—(at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1).—Annual Meeting.
Dr. Morry Cohu: "Progress in Illumination in France".

Wednesday, May 13

SOCIETY OF CHEMICAL INDUSTRY (FOOD GROUP, at 2.30)—Annual General Meeting.
Prof. E. Waldschmidt-Leitz: "Recent Developments in Enzyme Chemistry".

ROYAL SOCIETY OF ARTS, at 8.—Prof. R. G. Stapledon: "The Case for Land Improvement and Reclamation".

Thursday, May 14

UNION OF MODERN FREE CHURCHMEN, at 2.45.—(in the Library, Memorial Hall, Farringdon Street, E.C.).—Dr. Alexander Wood: "The New Physics and its Implications".*

ROYAL SOCIETY, at 4.30.—Discussion on "The Present Status of the Theory of Natural Selection", to be opened by Prof. D. M. S. Watson, F.R.S.

LONDON MATHEMATICAL SOCIETY, at 5.—(at the Royal Astronomical Society, Burlington House, W.1.)—Dr. A. C. Aitken: "Arithmetical Recreations".

UNIVERSITY COLLEGE, LONDON, at 5.30.—Dr. Gerhard Bersu: "Roman Limes in Germany" (succeeding lectures on May 18 and 21).*

IMPERIAL COLLEGE—ROYAL SCHOOL OF MINES, at 5.30.—Prof. F. A. Vening Meinesz: "The Gravity Results of the Undersea and Oversea Journey of the Submarine *K XVIII* in the Atlantic and Indian Oceans".*

CHEMICAL SOCIETY, at 8.—(at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1).—Dr. Clarence Smith: "Modern Chemical Nomenclature".

BRITISH INSTITUTE OF RADIOLOGY, at 8.—Annual General Meeting.

Friday, May 15

KING'S COLLEGE, LONDON, at 5.—Prof. Henri Fredericq: "The Laws of Excitation of the Autonomic Nervous Systems with reference to Chemical Mediators".*

BATTERSEA POLYTECHNIC, at 7.—Prof. F. C. Lea: "The Effect of Temperature on the Strength of Metals" (Lectures arranged by the Armourers and Brasiers' Company. Succeeding lectures on May 22 and 29).*

ROYAL INSTITUTION, at 9.—Sir Richard Gregory, Bt., F.R.S.: "Science in a Changing World: Recollections and Reflections".

Official Publications Received

Great Britain and Ireland

An Index to Acts of Parliament and Statutory Rules and Orders affecting the Chemical Industry. (Published for the Association of British Chemical Manufacturers.) Supplement No. 5. Pp. 6. (Cambridge: W. Heffer and Sons, Ltd.) 6*d*. [34

B B C Annual, 1936. Pp. 160. (London: British Broadcasting Corporation.) 2*s*. 6*d*. net. [84

Annual Report of the Council of the Yorkshire Philosophical Society for the Year 1935, presented to the Annual Meeting, February 10th, 1936. Pp. 51+6+4 plates. (York: Yorkshire Museum.) [94

Research Association of British Rubber Manufacturers. Sixteenth Annual Report for the Year 1935. Pp. 61+2 plates. (Croydon: Research Association of British Rubber Manufacturers). [144

Transactions of the Royal Society of Edinburgh. Vol. 58, Part 3, No. 26: The Geology of Inchkeith. By Lieut.-Col. L. M. Davies. Pp. 753–786+2 plates. (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) 5*s*. 6*d*. [144

Agricultural Progress: the Journal of the Agricultural Education Association. Vol. 13, 1936. Pp. 190. (Cambridge: W. Heffer and Sons, Ltd.) 5*s*. net. [144

The Functions of an International Air Police. (Series F, No. 2.) Pp. 20. (London: The New Commonwealth.) 6*d*. [144

Other Countries

Rensselaer Polytechnic Institute Bulletin. Vol. 34, Extra to No. 4: The Future of Engineering Education. By Dr. William Otis Hotchkiss. Pp. 12. (Troy, N.Y.: Rensselaer Polytechnic Institute.) [74

Institut de France: Académie des Sciences. Annuaire pour 1936. Pp. 407. (Paris: Gauthier-Villars.) [94

Kungl. Sjökarteverket. Jordmagnetiska Publikationer Nr. 10: Earth Magnetic Researches along the Coasts of Sweden. Part 1: Magnetic Declination at the Epoch, July 1, 1929. By Gustaf S. Ljungdahl. Pp. 48+6 plates. (Stockholm: Kungl. Sjökarteverket.) [94

India Meteorological Department. Meteorological Organisation for Airmen. (M.O.A. Pamphlet, 1936.) Pp. iv+51. (Delhi: Manager of Publications.) 1.2 rupees; 2*s*. [144

Old-Time Survivals in South Africa. By Eric Rosenthal. Pp. 38. (Pretoria: Government Printer.) [144

A Shellac Patent Index. By Dr. R. W. Aldis. Pp. vi+115. (Nankum: Indian Lac Research Institute.) 2.8 rupees. [144

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 135: JS-Diagrams for Air. By Seiichi Awano. Pp. 81–104+11 plates. 1.90 yen. No. 136: The Nature of the Torsion-Aileron Flutter of a Wing as revealed by Analytical Experiments. By Katsutada Sezawa and Kei Kubo. Pp. 105–161+3 plates. 55 sen. (Tôkyô: Kôgyô Tosho Kabushiki Kaisha.) [144

Transactions of the National Institute of Sciences of India. Vol. 1, No. 7: A Study of some Microscopical Aspects of Indian Manganese-Ores. By Dr. J. A. Dunn. Pp. 103–124+plates 4–6. (Calcutta: National Institute of Sciences of India.) 3 rupees. [144

Bulletin of the Experiment Station of the Hawaiian Sugar Planters' Association. Entomological Series, Bulletin No. 21: Biological Control of the Sugar Cane Leafhopper in Hawaii. By O. H. Swezy. Pp. ii+57–101. (Honolulu: Hawaiian Sugar Planters' Association.) [144

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 88. Studies in Neotropical Mallophaga. Part 1: Lice of the Tinamous. By M. A. Carriker, Jr. Pp. 45–218. (Philadelphia: Academy of Natural Sciences of Philadelphia.) [144

Elihu Root Lectures of Carnegie Institution of Washington on the Influence of Science and Research on Current Thought. The History of Science and the Problems of To-day. By George Sarton. (Supplementary Publication No. 20.) Pp. iii+30. (Washington, D.C.: Carnegie Institution.) [144

The Hokkaido Imperial University. Calendar 1935–1936. Pp. iv+228. (Sapporo: Hokkaido Imperial University.) [144

Pocket Natural History No. 5: Florida Fishes. By Harold L. Madison. (Zoological Series No. 2.) Pp. 32. (Cleveland, Ohio: Cleveland Museum of Natural History.) 25 cents. [154

Memoirs of the Faculty of Science and Agriculture, Taihoku Imperial University. Vol. 15, No. 14: On a Pair of Surfaces Mutually Related, 2. By Sôji Matsumura. Pp. 307–340. (Taihoku: Taihoku Imperial University.) [174

National Research Council of Canada. Bulletin No. 16: Health Hazards in the Radium Industry. By John D. Leitch. Pp. 19. Bulletin No. 17: Radium Dosage. By G. C. Laurence. Pp. 50. (Ottawa: National Research Council of Canada.) [204

U.S. Department of the Interior: Geological Survey. Bulletin 869: Bibliography of North American Geology, 1933 and 1934. By Emma M. Thom. Pp. ii+389. 40 cents. Water-Supply Paper 763: Surface Water Supply of the United States, 1934. Part 8: Western Gulf of Mexico Basins. Pp. vi+188. 20 cents. Water-Supply Paper 766: Surface Water Supply of the United States, 1934. Part 11: Pacific Slope Basins in California. Pp. xi+364. 45 cents. Water-Supply Paper 768: Surface Water Supply of the United States, 1934. Part 12: North Pacific Slope Basins. B: Snake River Basin. Pp. vii+202. 25 cents. (Washington, D.C.: Government Printing Office.) [204

Jamaica. Annual Report of the Department of Agriculture for the Year ended 31st December 1934. Pp. ii+60. (Jamaica: Government Printing Office.) [204

Catalogues

Philips Technical Review. Vol. 1, No. 1, January. Pp. 32. Vol. 1, No. 2, February. Pp. 33–64. (London: Philips Lamps, Ltd.)

New Oxford Books: a List for Secondary Schools. Pp. xxxii. (London: Oxford University Press.)

The Right Way to Choose your House. No. 1: Facts you should Know. Pp. 16. (London: Clay Products Technical Bureau of Great Britain.)