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Nationalism and Science in China.

After spending half a million dollars over a period of ten years and the dispatch of five scientific expeditions to the Gobi Desert, the Central Asiatic Expedition of the American Museum of Natural History, of which Dr. Roy Chapman Andrews is the leader, has been refused permission to continue its work in Mongolia by the Chinese authorities. This refusal comes at a moment peculiarly inopportune in the interests of science. The expedition was about to open up a new field of exploration, which would have been of the greatest palæontological and, possibly, of anthropological interest.

Up to 1928 this American expedition had been in most friendly and cordial relation with the Chinese authorities, scientific organisations and individual investigators. Indeed, for some considerable time a proposal to establish a branch of the American Museum at Peking had been under consideration, and one of the palace buildings had even been selected for the purpose by Dr. Kungpa King, director of the Peiping Museum of Art. But in 1928 these friendly relations came to an end, largely owing to the activities of the Chinese Cultural Society, now the Commission, for the Preservation of Antiquities. The entire collection of fossils and other specimens made by the expedition in 1928 was seized by the Commission and released only after prolonged and tedious negotiation. Permission to revisit Mongolia in 1929 was refused, and resumption of work was allowed in 1930 only on the understanding that the work of the expedition would then be brought to a close. Results obtained in that year, however, seemed to justify reconsideration. Entirely new fossil fields of Pliocene age were discovered east of the Kalgan-Urga Trail. In consequence, application was made for a renewal of the permit in order to follow up this new and important discovery in 1931 and 1932.

In a letter under date June 5 last, the Commission for the Preservation of Antiquities has informed the authorities of the American Museum of Natural History that there is no longer any necessity for permitting members of the Museum to make further trips to carry on the work in Mongolia. It adds, however, that in the future every facility will be accorded American scholars to visit Peking for the purpose of examining geological material from Mongolia " to conform with the principles of non-discrimination between nationalities in respect of science ". The grounds for the statement that the necessity for the permit hitherto granted no longer exists, are given in the course of this communication. In addition to the fact that the American expedition has repeatedly declared its intention of winding up its work in Mongolia and discontinuing its trips to that area, the Chinese Government, it is stated, has now organised a Western Frontier Scientific Expedition to proceed to Mongolia, Kansu and Sinkiang " to carry on various scientific researches".

There is a subtle irony in the phrasing " principles of non-discrimination between nationalities in respect of science " which will be appreciated. The achievement of the Chinese authorities in the direction of the attainment of this object merits recapitulation. Action similar to that against the American expedition has been taken against the Swedish expedition in Chinese Turkestan under Dr. Sven Hedin; against the French Trans-Asiatic expedition of Dr. Georges Hardt and P. Teilhard de Chardin; and Sir Aurel Stein, as has been recorded recently in these columns (see Nature, July 25, p. 144), has been forced to abandon his expedition in Chinese Turkestan after repeated vexatious delays and difficulties raised upon pretexts entirely without foundation. It is sufficiently clear that the Chinese authorities are sincere in the expression of their desire to show no discrimination between nationalities. They propose to exclude them all!

Vigorous, if misleading, not to say untruthful, propaganda by the Commission in the Chinese press has secured popular support for this hostility to foreign expeditions of scientific exploration. It must not, therefore, be concluded that the interest of the Chinese people in drawing a ring-fence around the field of research within their territory, or in the preservation of their antiquities, is greater than it would be in a western population. The agitation has gone beyond the indictment that these scientific expeditions are taking priceless material out of China; it has not hesitated to inflame popular opinion by imputing political motives to them, and accuses their leaders, Sir Aurel Stein, for example, of subversive speeches against the Chinese Government.

A brief survey of the present situation, which Prof. H. Fairfield Osborn, president of the American Museum of Natural History, contributes to *Science* of August 7, gives the text of the letter received from the Commission for the Preservation of Antiquities, and includes in addition a communication by Dr. Roy Chapman Andrews, in which he sets forth the scope, methods and achievements of the expedition in geology, palæontology and archæology since its inception in 1920. It is a remarkable record, and although already sufficiently well known, it was well worth recapitulation in this context. Between the years 1922 and 1930, it has discovered and developed one of the world's great fossil fields with no less than twelve distinct fauna —Lower Cretaceous to Pleistocene. In addition to the dinosaur's eggs, which attained what was, perhaps, in the circumstances, an unenviable notoriety, and the remarkable series of skulls of the animals which laid the eggs, cretaceous mammal skulls and associated parts of skeletons were found which are the only mesozoic skulls known, with the exception of *Tritylodon* from South Africa. It is unnecessary to pursue further this list which, on one hand, is an almost unique record in the sum total of data new to palæontological science, and, on the other, is a monument to the scientific knowledge, organising ability and powers of endurance of those who were responsible for and took part in the expedition. But what will weigh even more with those interested in the branches of research with which the expedition is concerned, when they reflect on the consequences of this premature ending of its activities, is that it is in this field, if anywhere, that we are, perhaps, most justified in looking for further evidence bearing on the descent and earliest history of man—the main objective of the expedition when it was initiated eleven years ago. No Chinese expedition, however expertly manned and however well-equipped when it takes the field, will compensate for the loss of the experience gained in those five journeys of the American scientific workers to Mongolia.

The claims for consideration of the Central Asiatic Expedition on the ground of achievement are strong. But are they stronger than those of Sir Aurel Stein, Sven Hedin, P. Teilhard de Chardin and others to whom in future China will be closed as a field of exploration? Like the American expedition they have co-operated, or have offered to co-operate, with Chinese scientific organisations and individuals, each in their special field. China has gained, not lost, by the work of these great explorers. By their additions to the sum of human knowledge, she has transcended the bounds of nationality and has entered into the universal realm of science. While men of science of all countries have been looking to China for evidence bearing upon problems of world-wide import, her own horizons have been broadened and her students trained. In other circumstances the organisation of a Chinese expedition to Mongolia might have been welcomed as a valuable and progressive measure in the interests of scientific research without any thought as to whether it was an encroachment on a field in which America had secured a right.

Notwithstanding the difficulties of the present political situation, China has won, and continues to hold the sympathies of influential elements in the western world for her desire to assimilate what is most suited to her needs in western culture, and to join in the movement for the advancement of science. Is she by her own action to be placed, as Prof. Osborn has phrased it, in "the column of backward, reactionary and non-progressive nations"?

The Schneider Trophy Contest.

THE eleventh contest for this trophy for marine aircraft was arranged to take place on Sept. 12 at 12.30 P.M., over a triangular course above the Solent and Spithead off the Isle of Wight. Owing to the last-minute withdrawal of the French and Italian challengers, the event resolved itself into a mere flight around the 350 kilometres (217·5 land miles) course by one of the British entrants in order to qualify. The flight was completed on Sept. 13 by Flight-Lieut. Boothman, R.A.F., flying a Supermarine S6B. seaplane, fitted with a Rolls-Royce R engine, at an average speed of 340·08 miles per hour. During the flight he also broke the world's speed record over a measured distance of 100 km. with flying start, at 342·9 m.p.h. The trophy, having now been won by Great Britain on three consecutive occasions, becomes our property, and the Schneider Trophy competition thus ceases to exist.

It has been felt in many quarters that it would have been an act of sportsmanship on our part to have postponed the competition until such time as the French and Italian competitors were ready to race, but it must be remembered that there is much more in this event than the actual race. It is really a competition amongst designers to produce machines capable of flying at speeds greater than those already attained, and engines able to give the necessary power for a sufficient time to complete the distance. The actual flying of the race, with its demand upon the courage, skill, and physical endurance of the pilots, is really only the grand culmination of the whole scheme. The French and Italians were, presumably, confident of being able to do this when they took the initiative in challenging Great Britain. It is known that they have built machines and trained teams to manipulate them, so that their withdrawal at the last moment can only be construed as an admission that the performance of their products falls so far behind what they suspected of ours that actual participation in the race was merely a waste of effort.

It is also becoming increasingly evident that the regulations governing this competition, which were intended, when laid down, to promote a general advance in the design of a useful sea-going aircraft, are no longer adequate to guard against the competition being won by a freak machine of very little use except for that specific purpose. The closing of this chapter in seaplane development will consequently make an opportunity for some public-spirited person or body to offer a fresh trophy under rules more suited to modern requirements. Newspaper reports have already hinted at the name of M. Schneider's successor.

The figures of the speeds of the winners of the succeeding races give an interesting clue to the phases of development through which the design of aircraft and engines has passed since the inception of this competition:

Year.	Machine.	Country.	Average Speed (m.p.h.).
1913 . .	Deperdussin	France	45·75
1914 . .	Sopwith	Gt. Britain	86·75
1920 . .	Savoia	Italy	107·12
1921 . .	Macchi	,,	110·84
1922 . .	Supermarine	Gt. Britain	145·62
1923 . .	Curtiss	U.S.A.	177·38
1925 . .	,,	,,	232·57
1926 . .	Macchi	Italy	246·49
1927 . .	Supermarine	Gt. Britain	281·65
1929 . .	,,	,,	328·63
1931 . .	,,	,,	340·08

The speed of 45·75 m.p.h. in 1913 is misleading, as the pilot did not cross the finishing line correctly, and had to complete another lap. His real flying speed was in the neighbourhood of 70 m.p.h. Thus from 1913 to 1914 there was a small improvement, consequent partially upon improvement in design, but more upon experience in handling machines under racing conditions. The period 1914–20 does not show any great improvement in proportion to the time that elapsed, but it must be remembered that the seaplane was relatively neglected during the War period, the energies of combatants being directed to the improvement of land machines, operating under much different conditions. The step 1920–21 marks a distinct improvement in aerodynamic design of the seaplane, which, although only 3·72 m.p.h. faster, carried only a 200 h.p. engine, as compared with the 550 h.p. of its predecessor. In 1922 the Supermarine flying boat increased the speed considerably, but with a large increase of power, having a 450 h.p. engine. The 1923 Curtiss seaplane marked a decided change in the aerodynamical outlook. It was the first of the post-War competitions in which a seaplane had been used in preference to a flying boat. Previous opinion had held that while a seaplane could be built with finer lines and less head resistance, it could not be made seaworthy enough. Later experience has proved this to be wrong, and all winners since 1923 have been seaplanes. This machine also showed a decided attempt to deal with the problem of reducing the head resistance of the exterior non-lifting parts, such as the floats, engine radiators, etc. Attention to these details resulted in an increase of speed from 145·62 to 177·38 m.p.h. with only 15 h.p. additional.

Having realised the importance of reducing head resistance by good streamlining and limiting frontal area to the minimum possible, the competition then resolved itself into a battle of the engine designers to give more power from an engine without unduly increasing, primarily the frontal area, and secondarily the weight, either of itself, its accessories, or its fuel and oil. Their success can be judged by the fact that in the next five competitions, 1925–31, the horse-powers were 600, 800, 875, 1900, and well over 2000 respectively. In the case of the last two competitions there was actually not only a decrease in frontal area of the engine, but also its shape was modified to conform to the requirements of good streamlining of the nose of the machine in which it was installed.

At the same time, improvements in the actual aircraft have been continuous, although not so radical. The dispersing of the excess heat from the engine-cooling water has been one of the principal problems, and on the 1931 machine practically the whole of the wings, the tops of the floats, and the sides of the body are covered with a thin annular shell through which the engine-cooling liquid passes, giving a maximum surface exposed to the air without any extra head resistance. The cooling of the engine oil is carried out in a similar manner. A further problem to be surmounted this year arose from the fact that the take-off, climbing, alighting, and taxying test have been arranged so that they are preliminary to, and continuous with, the actual speed flight, instead of being carried out separately as in previous years. This means that more petrol has to be allowed for, which affects both the size of the tanks and that of the stronger structural members necessary to carry the extra weight.

It should be useful now to examine critically what has been attained as the result of the eighteen years' development of this type of marine craft, and to endeavour to profit by these conclusions in framing rules for a new competition. It is quite certain that such machines as are being used to-day are useless in themselves for any other purpose. There are certainly advantages in the fact that national prestige and that of individual firms is increased, and doubtless many engineering lessons have been learned in the course of these experiments that will help to improve the breed of British aircraft, but M. Jacques Schneider's original idea of developing useful sea-going aircraft has been almost entirely submerged in the mere race for speed.

Flying at 400 m.p.h. in the present form of aircraft is much too unsafe to be used as an ordinary means of transport. Such machines are uncontrollable at all speeds lower than about 100 m.p.h., which makes it impossible even to fly them, let alone land or get off in crowded places, or on any but relatively smooth water. Also, the accelerations when turning at these speeds would certainly be distressing, and possibly dangerous, to passengers not physically trained to them. High maximum speed is certainly desirable in order that air travel may exploit it as the advantage that it has over all other means of transport, but it must be accompanied by a more elastic speed range, giving lower minimum speeds and slower accelerations within that range. Another matter in the exploitation of speed is that in order to save time a machine should fly in a straight line from point to point. A really useful seaplane should, therefore, be amphibian in its alighting and getting-off methods, at least for emergency landings.

The question of carrying a useful load has also been entirely lost to sight. The present-day type has practically developed into an engine with wings fitted to it, the body being cut down to the very minimum required to accommodate the unfortunate but necessary pilot. Even if the machine is capable of lifting any surplus load, it certainly has no accommodation for it, because of the desire to keep down frontal area and its accompanying head resistance. It is significant to compare such machines with modern passenger-carrying flying boats, which in spite of the fact that they have been just as keenly developed, by sometimes the same designers, have not progressed far beyond 100 m.p.h. yet in average cruising speeds.

Lastly, there is the question of robustness and its inevitable accompaniment—useful life. No one who has seen and handled, and admittedly been compelled to admire, a modern racing seaplane can contemplate its being used under the rough and tumble of everyday traffic. The working life of the engine on such machines is probably no more than a few hours, even in the hands of the most highly skilled mechanics that the engine-maker can train.

The conclusion that one is inevitably led to is that if such contests of the future are to be national in character, as they have tended to be recently, the energies of the participants should be directed towards producing machines of some use to the world in general. The race for mere speed and record beating is always desirable because of the moral stimulus resulting from any form of competition, but it should be left to the wealthy amateur or commercial enterprise that has direct interests in it, as is done in most other walks of life.

A Plea for Prejudice.

The Place of Prejudice in Modern Civilization (Prejudice and Politics): being the Substance of a Rectorial Address to the Students of Aberdeen University. By Sir Arthur Keith. Pp. 54. (London: Williams and Norgate, Ltd., 1931.) 2*s.* 6*d.* net.

THE gist of Sir Arthur Keith's rectorial address at Aberdeen is expressed in its concluding sentence : " Under the control of reason, prejudice has to be given a place in the regulation of human affairs ". If we understand what the distinguished author means by ' prejudice ', his thesis is so reasonable that we must begin by lifting our hands to heaven for the publication of the address in its entirety. For by the perusal of isolated extracts we had been regretfully led, like many others, to dissociate ourselves in private thought and conversation from the rector's position, whereas after reading the whole we wish we had given the address ourselves—it is so well put. Moreover, in its insistence on the value of feeling, the address is a useful counteractive to the partiality or abstractness of science.

Perhaps the most delightful thing is that this plea for prejudice should come from Keith, whom we, being backsliders, have always regarded with admiration as one of the staunchest champions of reason. Drive out Nature with the fork of logic, and she is sure to come home to roost. Thus Keith, of all men, pleads for prejudice !

Everything depends, however, on what the word is taken to mean, and the author leaves us in no dubiety. How charmingly he puts it : " In the parliament of human nature, as in that of our national affairs, there are two houses—an upper, the ' head ' ; a lower, the ' heart '. . . . The legislators who serve in the lower house or heart are our feelings and passions, our hopes and fears, our likes and dislikes [at home, by the way, in the lower or basal centres of the brain]. . . . The progress of civilization has been possible just because man has been able to bring his lower house or heart more and more under the control of his upper house or head," that is to say, his reason, his logical faculty, his power of conceptual inference or of experimenting with general ideas (which is at home in the cerebral cortex, as who should say). We understand, then, that our prejudices are our inborn likes and dislikes, and the rector's thesis is that they must be given an assigned place in our thought and action.

Among ' prejudices ' Sir Arthur Keith includes our loyalty to our Alma Mater and our love for our mother, our national and local patriotism, our pride of race, and so much more that the word becomes synonymous with our deeply enregistered inborn feelings. Whether we call them, with Thomas Reid, " original and natural judgments ", or regard them with modern psychologists as part of the primary unconscious, matters little. There they are, activating and motivating us, colouring our thought and action, undeniable realities. " They turn favoured opinions into facts. A fact to the faithful is a prejudice to the sceptic. . . . Prejudices and sentiment are first cousins." Just as Carlyle, speaking of man, said " Prejudice, which he pretends to hate, is his absolute law-giver ", so Keith in his enthusiasm for prejudice declares, with all his anthropological learning behind him, that " man has become what he is, not by virtue of his head, but because of his heart ". Inevitably one shakes one's head, for who shall escape his prejudices in favour of that member ?

This brings us to the second part of the rector's argument. Prejudices form a powerful part of our inheritance, grafted into us because they have been of survival value, or, in the author's teleological language, because of their "evolutionary purpose". " Nature has organised the lower house of man's heart to serve her ulterior object—the production of higher and better races of mankind." This almost verges on the theological—not that we think the worse of it for that !

But however we phrase it, part of Nature's tactics or part of the process of human evolution was the segregation of new varieties or sub-species into distinct tribes (possibly hormonic in origin), and in addition to selection there has operated the factor of isolation—a term applied to all the ways of narrowing the range of intercrossing. Seas and rivers, mountains and deserts, and the like, were useful in this isolating, but Nature " established her real and most effective barriers in the human heart ". Automatically those tribes survived that had the strongest prejudices in favour of keeping themselves to themselves in their marriages, the strongest antagonisms to other tribes—the 'race-prejudices' of to-day; and not less powerful than these was that "strange bubble of the human blood —the inbred love of independence". "Nature made sure of her tribal teams by making this love of independence a dominant passion", whence the world-wide success of the Scot.

So far the rector's argument seems unassailable, except that, for more or less legitimate rhetorical (in the true sense) purposes, he uses the term 'prejudices' in a very wide way. We are full of ancient prejudices, which have powerful hands and feet, and some of them were of survival value in the establishment of tribes in prehistoric times, "standing to our historic period as a year does to a day".

Now, however, comes the crux of the argument: Prejudices were once of racial value, but is it not time that we subjected them to criticism and sifting, repression or sublimation? No doubt, the deep inborn feelings are still in some measure part of our heritage—"a tribesman's heart, with its loves and hates, its likes and dislikes, its heritage of prejudices, still beats in every human breast". But is our primary unconscious exempt from evolution? Does our 'tribesman's heart' live a charmed life in the arcana of the changeful germ-plasm? Are we not always summoning our primeval prejudices before the tribunals of reason and of socially-acquired sentiments? May we not safely relegate a good many of them to a rationalised shelf in that museum of relics which willy-nilly we carry about with us, embodied or enminded?

Now, Sir Arthur Keith's convinced answer is that we should hold by our prejudices. "Race prejudice, I believe, works for the ultimate good of mankind and must be given a recognised place in all our efforts to obtain natural justice for the world." The ideal of all mankind sleeping peacefully under one tribal blanket is, he says, Utopian; and even if it were possible, it would cost too much in the involved miscegenation. The price of universal peace is the loss of our racial birthright. On the other hand, the price of racialism is said to be the continuation of "Nature's old scheme of intertribal rivalries and eternal competition". So the two prices have to be weighed against one another. In spite of Sir Arthur Keith's heart ('the future of my dreams is a warless world'), his head wrings from him the conclusion that "Nature keeps her human orchard healthy by pruning; war is her pruning-hook. We cannot dispense with her services". But there is a wide difference between Nature's discriminate sifting (natural selection) and the very indiscriminate and dysgenic thinning which man illustrates in modern warfare. It is a woeful confession of human ineptitude if we cannot find for natural selection, which civilization insists on rejecting, any better substitute than modern war. The rector says that if we accept Nature at all, we have to accept her altogether. But this is just what we do not do. To use his attractive teleological language, one of Nature's ends is just to make man discontented with following her, and it is that 'divine discontent' which man expresses in every effort to raise the struggle for existence into an endeavour after well-being.

In an admirable way, Sir Arthur Keith weighs racialism against deracialisation, self-determination against leagueism, nationalism against mongrelising, using the 'head' most deftly to give the 'heart' a hoist up; and we can find little to object to in his practical conclusion: "Give our prejudices a place in our civilization, but keep them under the control of reason". In other words, we should be impelled by our 'head' to scrutinise our 'heart' from time to time, giving some of its prejudices a pat on the back and subjecting others to a Lenten discipline.

We venture to lay emphasis on Sir Arthur Keith's conclusion, which we might sum up in the words "pay heed to reasonable prejudices", for we must in all these discussions of high affairs avoid the "this or that" fallacy. We cannot divest ourselves, for example, of our national prejudice, and there is no reason to try to do so, unless it becomes insular and chauvinistic. At the same time it is becoming increasingly possible to think sympathetically and understandingly of other nations and their interests, and to begin at least to look at all human problems in the light of the growing interdependence of the peoples of the world. We need not think of our country less though we think of the world more. We may preserve and even strengthen our appreciation of what is precious in nationality, and yet become, though not with ease, loyal citizens of the world. We do not agree with the distinguished rector that this culture of our tribal heart would necessarily involve us in any "pooling of our blood".

Similarly, while it is our deepest personal conviction that human progress at this critical time depends upon bringing strict science to bear on all our practical problems, we are not thereby forced to depreciate the worth of certain elements in our primary unconscious or of the higher values which lie for the most part beyond scientific inquiry. Science is not the only right-of-way towards truth.

We cannot leave this thought-compelling address without expressing our admiration of its fine style, as picturesque as it is pithy, as lucid as it is lightsome. It must have been delightful to listen to, especially in a place where the *genius loci* has such a notably hard head. This is said "without prejudice".

An advocate cannot speak on two sides at once, but when a similar occasion arises, as it will, we hope Sir Arthur will take for his subject the pruning of prejudices; for we are sure that he could deal with that supplementary subject with the same convincing illumination that his present plea illustrates.

J. A. T.

Short Reviews.

Deserts and the Birth of Civilizations. By A. J. McInerny. Pp. 46. (Paris: Herbert Clarke, 1931.)

Mr. McInerny attacks an old problem at a new angle. Like others before him, he would see the influence of the desert in the origin and growth of civilisation. He differs from them in making it solely responsible. In fact, the motto of his essay is "No desert, no civilisation"; and he goes so far as to suggest that any attempt to cultivate desert lands by irrigation at the present day would be a mistake and a possible danger. While it is beyond question that the formation of the great Saharan Desert was crucial in the early history of mankind, few archæologists would be prepared to follow the author in attributing the whole subsequent development of civilisation to the action of the desert areas. In Mr. McInerny's view, they have acted as laboratories for the purification of the air and the release of ozone, thus creating an atmosphere propitious to the development of intelligence and the bleaching of the skin—in short, producing the white man.

Mr. McInerny points to the fact that, with certain exceptions, the great civilisations of the past lie to the north of a series of desert belts, and argues from this that it is not to migrations or to temperature that we are to look for the cause of advance in culture, but in the flow of purified air from the desert zones towards the north. The similar flow towards the south, to the negro or dark belt, could only mitigate, but not eradicate, the more unfavourable conditions of the damp atmosphere, laden with organic impurities, of the tropical forested area. Mr. McInerny is not very successful in explaining away the exceptions in the civilisation of the Yangtse valley and that of Central and South America, where the deserts lie to the north; and if migration is eliminated, the air currents of western Europe seem to be a difficulty. In fact, the author tries to prove too much. Had he endeavoured to show that the character of the atmosphere was one of a number of factors in the problem, he would have had a better chance of carrying conviction.

Hunger and Love. By Lionel Britton. Pp. xi + 705. (London and New York: G. P. Putnam's Sons, Ltd., 1931.) 7*s.* 6*d.* net.

Lionel Britton first became known to the reading public as the author of "Brain, a Play of the Whole Earth", sponsored by Bernard Shaw, praised by Hannen Swaffer, and proclaimed a work of genius by St. John Ervine. His new novel has an introduction by Bertrand Russell. One therefore approaches it with high expectations. It is not customary to review novels in this column. After reading the book, the reviewer is not convinced that its contents justify any departure from the usual practice of Nature. True, there are frequent, almost too frequent, references to protons and protoplasm. These in themselves are not sufficient to justify the claim that the author has written the novel of the machine age. It is a long soliloquy, in which the hazy outline of Arthur Phelps occasionally obtrudes to remind the reader that it is intended to rank as fiction rather than philosophy.

It took Lionel Britton eight years to write the book: the reviewer took six months to read it. Only the prospect of having to write a short notice of its contents sustained him to the end. Britton says a good many penetrating things about contemporary civilisation. The reviewer shares many of his prejudices and most of his opinions, when they are not susceptible of proof. Unfortunately, his way of stating them is prosy, prolix, and disorderly. People who like *Ulysses* may like "Hunger and Love". Scientific workers, who generally attach importance to intellectual tidiness and coherent expression, will be inevitably repelled. Of the few who start it, still fewer will finish its seven hundred and five closely printed pages. It has captured the temper of contemporary biological realism far less successfully than Charlotte Haldane's "Brother to Bert" or the earlier novels of Mr. Wells.

An Introduction to Human Experimental Physiology. By Dr. F. W. Lamb. Pp. xii + 335. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1930.) 12*s.* 6*d.*

There can be no question that the best study of man is upon man himself, but the arrangement of organised experiments for class work on this principle presents many difficulties. Dr. Lamb, as the result of ten years' trial, has succeeded in compiling a workable course of about fifteen lessons on each of the three systems—blood, respiration, and circulation.

Not only will this scheme of investigation of normal man serve as a most desirable preparation of medical students for work in the wards, but also the selection and presentation of the experiments prescribed will satisfy the demands of scientific education. In schools where the classical physiology occupies the preliminary years, this book might well form the basis of a course in clinical physiology during the period given to the study of medicine.

Rumford and the Royal Institution: A Retrospect.

By T. E. JAMES.

BENJAMIN THOMPSON, knighted by George III., and created Count von Rumford by the Elector Palatine of Bavaria as a reward for his services, was born at North Woburn, Massachusetts, on March 26, 1753, and he died at Auteuil, near Paris (where he had settled), on Aug. 21, 1814, aged sixty-one years. His career in early youth was a response, as in many other instances in a new colony, to the varied and often lowly occupations near at hand. For a time he was in the medical faculty at Harvard, and he also engaged in schoolmastering. No one could have foretold that he stood on the threshold of events from which emerged, as if preordained, the governing factors of his life. A matrimonial venture at twenty soon ended in convenient separation. There was a child of the union.

Thompson was a major of New Hampshire militia when the American War of Independence broke out, but he became suspect as one showing 'unfriendliness to the cause of liberty'. Removing to Boston (or shall we say escaping ?), he was arraigned there; finally he cleared himself of the charges against him. In 1776 Boston was evacuated and Thompson's selection to carry the news to England confirmed his allegiance to the mother-country. In favour here, he occupied a post in the Colonial Office, becoming afterwards an under-secretary (1780), charged with military duties relating to the British forces. Next, he appeared in service in America as a lieutenant-colonel in George III.'s American Dragoons. Returning to England in 1783 (then thirty years of age), he retired on half pay, with the rank of colonel.

So far, vicissitudes had had triumphant and material issues. Thompson's record as an experimental philosopher begins during these latter periods. It forms a chapter by itself, too diverse for inclusion here. However strange it may seem, he had been familiar with the discoveries and implications of contemporary science. They did not attract him as diversions, but met natural promptings. In 1779 he was elected a fellow of the Royal Society and in 1792 he received the Copley Medal. Later (1799), he was a member of Council of the Society.

FIG. 1.—Count von Rumford, F.R.S. From the painting after Moritz Kellerhoven, in the National Portrait Gallery, London.

In 1784, Sir Benjamin Thompson, newly knighted, entered on a completely novel mode of life. The Elector Charles Theodore of Bavaria pressingly solicited his services at Munich to initiate schemes in mitigation of social and economic disorders in his dominions. Leave of George III. having been obtained, our soldier-philosopher set forth, actually remaining at Munich for ten to eleven years—the keystone of the arch of progress being military persuasion, to use a mild word, in co-operation with civil authority. Suffice that, as an apostle of order, he routed chaos. Meantime his philosophical studies were pursued, coupled with a vast output of political and economic writings. The following unpublished letter (in holograph *) will, perhaps, be of interest, as indicating two kinds of leanings:

MUNICH, 10*th May*, 1797.

Gentlemen, I send you herewith my Seventh Essay,† which I shall be glad to see published as soon as possible. You will send me 12 copies of it (through Mr. James Meyer of Leaden-hall Street) as soon as it is out of the press. You will please to send me at the same time —or rather immediately on the receipt of this letter —a collection of all the Pamphlets that have been published on the subject of Mr. Pitt's Bill for making better provision for the Poor. You will direct Mr. Meyer to order his Correspondent at Flamborough to forward these articles to me *immediately* by the Diligence, addressed to myself at Munich.

I have hitherto been prevented from sending you my Essay on the "Construction of Kitchen fireplaces" by an earnest desire to make that Publication as perfect as possible. I have hopes however of being able to forward it to you in a few weeks.

I am, with much Regard and Esteem,
Gentlemen,
Yours most sincerely,
RUMFORD.

Messrs. Cadel, jun^r^. & Davies,
London.

P.S.—You will please to make presents in my name of the *Seventh* Essay to all those to whom I requested Presents might be made of my *Sixth*.

Before returning from Bavaria it was sought to

* Archives, Patent Office Library. By courtesy of the Librarian.

† Essay VII, "Of the Propagation of Heat in Fluids", is prefaced thus: "It is certain that there is nothing more dangerous in philosophical investigations, than to take anything for granted".

make Count von Rumford a Minister at the English Court, representing Bavaria. Rejection was emphatic. He was a British-born subject. Thereupon the Count resumed residence in London as a private citizen. The rebuff had unsettling elements; he entertained the idea of a domicile in America, but gave it up, and certainly there were difficulties, for he had incurred legal disabilities. In the end, America saw him no more, although his fame had crossed the ocean, and had received ample recognition.

It was at this time that Count Rumford published his historic suggestions which ultimately formed the basis upon which the Royal Institution was founded in 1799. Drawn up in pamphlet form extending to 50 pages, this issue was widely circulated in North America and elsewhere.* The title ran thus:

"Proposals for forming by Subscription in the Metropolis of the British Empire A Public Institution for diffusing the knowledge and facilitating the general introduction of Useful Mechanical Inventions and Improvements, and for teaching, By courses of Philosophical Lectures and Experiments, The Application of Science to the Common Purposes of Life."

In 1802, Rumford left England for Paris, never revisiting us. To everyone's surprise, he married, in 1805, Mme. Lavoisier, widow of the great chemist, but a separation followed in 1809. His daughter's comment on this venture referred to it as a bold, imprudent step, completing many vexations. By now the strain of military duties had, without doubt, weakened his bodily powers; maybe in some degree his faculties.

Posterity must envisage many blanks and imperfections in any real biographical estimate of this remarkable man. Rumford was more than a dual personality in whose study on that basis the springs of conduct could receive adjustment. A restless youth, followed by moods of militarism, was the ally throughout of a natural philosophical bias. The latter did not, however, tutor the senses, or restrain a riot of philanthropic fancy and effort. Could he have made philosophy the dominating influence, eschewed certain illusions and reaffirmations made in middle life, a calm and dignified passage into that older state which has finality in sight might have been prophesied with some approach to certainty. But it was otherwise.

Rumford's Gifts for Science.

Allusion may be made at this point to a period in Rumford's life when he made certain endowments for scientific purposes, applicable in England and in America. Writing to Sir Joseph Banks in July 1796, he intimated his desire to establish a prize medal in gold (with silver replica) in recognition of studies in the philosophy of heat or light, the awards to rest with the Royal Society of London. Whether preliminary discussions on the subject had taken place with Banks is not known. But by that time Rumford had been a fellow of the Society for seventeen years. He had bid farewell to Munich, was again visiting London, enjoying its scientific life—as witness, he dined twice at the Royal Society Club in 1796. The terms of this Rumford gift need not be recapitulated; but it may be noted that the original design for the medal (1797) did not bear the effigy of Rumford. This early pattern was abolished in Victorian times and the portrait-head of Rumford adopted in perpetuity for the obverse of the medal.* The initial allotment was made to Rumford himself in 1802 and as for the year 1800; he did not receive it until 1804, when it was sent to him at Paris by the hand of the president, Sir Joseph Banks—"the first opportunity I have had, though decreed a year and a half ago", wrote Banks. The American Academy of Arts and Sciences received on the same date as the Royal Society a similar offer, addressed to John Adams, covering 5000 dollars, but restricted to researches made in "any part of the continent of America, or in any of the American Islands". They placed the bust of Rumford, in uniform, on the medal, which the English Society could not, in all the circumstances, have done. The Academy's first award was not made until 1839.

Beginnings of the Royal Institution.

It is recorded that on June 29, 1799, at a meeting of the Managers of the new foundation, the Earl of Winchilsea, as president, acquainted them that he had had the honour of mentioning it to His Majesty King George III., who had been graciously pleased to honour it with his patronage, and to allow it to be called the Royal Institution. It was incorporated on Jan. 20, 1800, and arms, crest, and supporters were granted on Jan. 31.

George Finch, ninth Earl of Winchilsea and fifth Earl of Nottingham, who was chosen first president, occupied a position confirmed and retained for fourteen years. Since he was not, in the precise sense, a man of science, we are referred to general considerations, and those of a personal nature, as justification for such marked and extended confidence. Doubtless he was an acceptable colleague in Rumford's view, on the ground of events in the Earl's career, parallel in certain respects with those in his own. Born at St. James's, Westminster, in 1752, and educated at Eton and Christ Church, Oxford, George Finch succeeded to the peerage in 1769. He died in London on Aug. 2, 1826, aged seventy-three years, bearing the contemporary reputation of being "a nobleman of the old school and a high bred gentleman in his manners". Burley-on-the-Hill, Oakham, Rutlandshire, was the family seat and the Earl became, in course of time, lord-lieutenant of the county.

The American War of Independence found Winchilsea a staunch adherent of George III. He made Rutland an intensive recruiting area for an

* No copy of this pamphlet exists at the Royal Institution. In 1870 it was reprinted for issue in the *Proceedings*, from a copy at Althorp. There is also one in the British Museum. An original and complete copy of the pamphlet may be seen in the Patent Office Library, bound in at the end of an octavo set of Rumford's Essays, London edition.

* Ellis, "Life of Rumford" (1873), says that the head of Rumford on the Royal Society's Medal is from a portrait of him painted in Munich which hung in his house at Brompton, and was presented to the Society by his daughter in December 1831. No such portrait was ever given to the Royal Society.

infantry regiment, raised (so the story went) at a cost of £20,000, serving abroad himself as a volunteer, and becoming (1780) lieutenant-colonel of the 87th Foot. When he settled in England, he enjoyed considerable social and political influence. A member of the Board of Agriculture, he was held in high repute as a practical and discerning landowner, most helpful in days of national difficulty. Loudon ("Encyclopædia of Agriculture", ed. 1825 and 1831) states that the cottages which the Earl of Winchilsea had built had a kitchen, parlour, dairy, and two bedrooms over; also there were several with small holdings attached of from 5 to 20 acres. He also encouraged the practice of letting portions of the pasture to labourers. Another custom was that the cottagers took small portions of farmers' fields to use as gardens—an early step towards our modern allotment system. At the time of the Napoleonic threat of invasion he embodied and commanded, in 1803, a volunteer corps. He was invested a Knight of the Garter in 1805.

FIG. 2.—The Earl of Winchilsea, K.G., F.R.S., President of the Royal Institution, 1799-1813. Painted by S. Woodforde, R.A., 1808. By courtesy of Miss Jasmine Finch.

Winchilsea was elected into the fellowship of the Royal Society in 1807, signing the charter book the following year. In 1822, he accompanied George IV. on his Scottish tour. He was unmarried; and we like to think that he may have made the acquaintance of the youth, Faraday, who entered the service of the laboratory (1813) in the year that he vacated the presidential chair that he had so long occupied.

Empowered with authority for the introduction of a scheme of philosophical lectures, which, in due course, would be continued in a specially designed theatre, Count Rumford was not long in taking decisions respecting a beginning. In 1799, he made inquiries of Thomas Garnett, M.D., then occupying a professorship in the Andersonian Institution, Glasgow, and very favourably known for his successful experimental presentation of philosophical subjects, for information respecting the plan of courses at that centre.

At the time, these men had never met each other. However, Rumford was sufficiently satisfied with the past and present qualifications of Garnett to make him an offer to transfer to London. Accordingly, Garnett resigned office in October 1799, and was appointed, with managerial approval, the first professor of natural philosophy and chemistry in the Royal Institution. It was certainly the belief of Garnett (a widower) that he and his children would be housed in Albemarle Street *; further, that he would be allowed to practise as a physician. But in these matters Rumford seems to have made arbitrary reservations. Notwithstanding these preliminary drawbacks, Dr. Garnett engaged with the utmost zeal in a series of morning and evening lectures, which proved highly attractive, and at which there were crowded audiences. But an incident of significant import for the professor reveals itself in the terms of a letter from Rumford to Sir Joseph Banks, dated May 29, 1800:

> I am very sorry to find, on making enquiry of Dr. Garnett, that your information was accurate respecting his having ascribed the late discoveries of our friend Volta to the French. . . . I have, however, insisted on its being rectified as far as it is possible, in some future lecture.

This letter was followed the next day by another from Count Rumford, stating that Dr. Garnett proposed to rectify his error, in the subjoined terms:

> Having by mistake, on Wednesday, in the course of my public lecture ascribed to the French philosophers a new and interesting discovery relative to galvanism, which, on enquiry, I find belongs to Professor Volta, of Milan, I feel it to be my duty to state this fact in a public manner, in order that Professor Volta may not be deprived in any degree of the honour of a discovery which so justly belongs to him alone. The first news of this discovery, which arrived in this country in the beginning of last month, was communicated to the president of the Royal Society. . . .

In all likelihood, Dr. Garnett would have set the matter in its proper light without the despotic action of Rumford. There is every warrant in the circumstances of his temperament and career for this assumption.

A scheme drawn up by Garnett for a full course of lectures in 1801 became a final stumbling-block. At a meeting of the authorities on Feb. 2, 1801, they resolved that the lectures should commence

* Count Rumford himself had quarters in the Institution's house at this period.

as soon as the new theatre could be got ready for them, and that Count Rumford be authorised " to take all such steps on the part of the managers as shall be necessary in that business ", and that Sir Joseph Banks, Henry Cavendish, and Count Rumford act as a committee to superintend the drawing up and publication of a suitable syllabus. It was further resolved that no syllabus of lectures or other account of what is doing or done, or to be done, at the Royal Institution be published by any person or persons without the permission of the aforesaid committee, or the express leave of the managers, signified in writing.

There was thus a fresh stranglehold, and Garnett was unequal to the occasion. On Feb. 16, 1801, the above decisions were communicated to Dr. Garnett, and at the same time it was decided to engage Mr. Humphry Davy as assistant lecturer on chemistry, director of the Chemical Laboratory, and assistant editor of the *Journals*. He was to be allowed to occupy a room in the house, and be furnished with coals and candles. It is noteworthy that both Banks and Rumford were present when these courses were adopted.

The Royal Institution in 1800.

A glimpse of internal arrangements in which our forerunners participated may be of interest. Early there were set apart two reading-rooms, in addition, a " Conversation Room ". In the former, various scientific periodicals, home and foreign, were available, and it was claimed that effectual measures were in force for securing continental issues without delay ; that, indeed, they frequently came to Albemarle Street " whilst yet wet from the press ". The " Conversation Room " (so inscribed over the door) was supplied with a collection of maps " to assist agreeable talk ". Major James Rennell assisted in this daring venture. Also, it was possible for frequenters to obtain, " at the most reasonable prices ", from the housekeeper's quarters below, soups of various kinds, tea, coffee, chocolate, and what were euphemistically designated " other refreshments ".

The clerk was enjoined to be constantly provided with writing-paper of all kinds, and pens and ink. As to letters, these were taken away every evening for the General Post, by a postman who, at stated hours, was wont to pass along the street with a clanging bell to proclaim his mission. The Royal Institution paid the postman one guinea a year for call services in lieu of the usual allowance of one penny for each letter, and hence it was not necessary for members to put money into the hall post-box with their letters. Such, then, were the postal and other facilities enjoyed at the Royal Institution in 1800.

In 1801, Count Rumford reported that a complete kitchen for a small family, with a roaster of simple construction, a cottage fireplace grate, and a small boiler with steamers had been installed in the housekeeper's room, and these could be examined by callers. A principal kitchen was promised of larger order, to contain many novel fixtures, and to be open for demonstrations. The merit of any new method of cooking or of any new prepared dish might be judged from the actual experiment. Accordingly, a dining-room was in view in which the managers might order " experimental dinners " to which the proprietors and subscribers could be invited ; the attendant expense to be defrayed by " those who partake of them ".

In this year, too, as if through other hands, mention is made of the provision of some elegant bookcases, intended to shelve the library gifts of friends of the Institution. The managers welcomed donations, save works of professedly political tendency; whilst in each volume entry was made of the name of the donor, and date, on the ground that " it was agreeable to the principles of justice and to those of an enlightened policy not to forget acts of generosity ". The *Journal* for 1802 contains an interesting classified catalogue of the library thus far established.

Young and Davy.

In July 1801, Dr. Thomas Young, fortified with the recommendation of Sir Joseph Banks, and reported by Count Rumford as " a man of abilities equal to these undertakings ", was instituted professor of natural philosophy, editor of the *Journals*, and superintendent of the house, with rooms. Rumford went elsewhere, but his control was not withdrawn. Young had been elected a fellow of the Royal Society in 1794, at the early age of twenty-one years. His reputation in the world of science and also in Egyptian hieroglyphics is well known.

Young did not remain long in his post, resigning in 1803. It has been handed down, on authority, that he was not successful as a lecturer to mixed audiences. A medallion in Westminster Abbey by Chantrey commemorates this gifted man. It is regrettable that Young is not represented at the National Portrait Gallery.

By this time many of the original schemes projected by Rumford, in particular the applications of science to domestic purposes, had suffered eclipse, through engendered passive resistance or chill indifference, and his authority and influence had waned. The school of mechanics, the workshops, the models, the kitchens became receding propositions—the lectures, laboratory, and library emphasised the Institution. The charter of a new and revised establishment awaited, however, the vision and genius of Humphry Davy. But if the old principles had been worn threadbare, they died hard. Thus, Banks to Rumford (1804): " It [the Royal Institution] is now entirely in the hands of the profane. I have declared my dissatisfaction at the mode in which it is being carried on, and my resolution not to attend in future." Again : " The Institution has irrevocably fallen into the hands of the enemy, and is now perverted to a hundred uses for which you and I never intended it. Adieu, then, Institution ! " We realise that the parting of the ways had been reached. From the very start Banks had been a constant supporter of

Rumford, though it is hard to believe that he passed all the coin as sterling.

Humphry Davy was knighted in 1812, created a baronet in 1818, and was elected president of the Royal Society in 1820, following Wollaston. Drastic and fundamental changes in the management of the Royal Institution came about during Davy's time. They were consequent on his discoveries, his lectures, his outlook. There were many obstacles, many critics, and much need for philosophical serenity. In 1809 a report stated that "if the support of scientific men is to be obtained something must be done to give the Institution more the form of a public establishment than that of private and hereditary property". It was not long before the decision was taken to seek parliamentary authority for an Act for altering and amending the charter. This received the Royal assent in 1810. A lecture, comprehending a new plan, by Davy, left nothing unsaid. We quote from his words:

> Besides the diffusion of knowledge by popular philosophical lectures, and by other more elementary and more scientific lectures, the new plan will also embrace a design for the promotion of knowledge by experiments and original investigations.

Sir Humphry Davy married in 1812, and on April 5, 1813, he resigned the post of professor of chemistry and director of the Laboratory of the Royal Institution. It is recorded that on his resignation:

> Earl Spencer moved: That the thanks of this meeting be returned to Sir Humphry Davy for the inestimable services rendered by him to the Royal Institution. The motion was seconded by the Earl of Darnley and agreed to unanimously.

Davy's merits were recognised further by his election as honorary professor of chemistry.

FARADAY.

Michael Faraday, born in London in 1791 (which, as a matter of historic coincidence, was the year which marked the creation of Sir Benjamin Thompson, at the hands of the reigning Duke of Bavaria, Count von Rumford), sprang from the ranks of the humbler classes. His father was a working blacksmith, whose home, Jacob's Well Mews, when Faraday was a small child, was within a quarter of an hour's northerly walk of Albemarle Street. Drawn from a family of select and positive religious fervour, traits of this character tinctured the whole of Faraday's ultimate outlook on life and its obligations. Once he wrote, "In my intercourse with my fellow-creatures, that which is religious and that which is philosophical have ever been two distinct things".

Faraday was equipped only with a scanty day-school education, but he had an inquiring mind, strongly imbued in quite early youth with a love of books and what they could teach him; moreover, he was full of curiosity regarding the very popular scientific discoveries of the period. We hear of his attendance at elementary philosophical lectures in his locality, and of making, in spare moments, simple experiments in chemistry and in electricity.

A member of the Royal Institution—a Mr. Dance—occupies a niche in history, for it was through his good offices that Faraday was enabled, by the merest friendly acquaintanceship extended to a frank, industrious, eager youth, to attend four of Sir Humphry Davy's last lectures in the theatre at Albemarle Street. Highly interested in all he saw and heard at these discourses, during which he made notes, and encouraged further by the same friend, he sent the script to Davy. The reply was encouraging. Faraday was then engaged in bookbinding work, and he had been able to secure some occupation in writing or copying from Davy at a time when the professor was injured in one of his eyes by an explosion of the lately discovered nitrogen chloride. Later on, Faraday himself did not escape the results of explosions. In the year 1812, on Christmas Eve, there came a letter from Sir Humphry. In it he said:

> I am far from displeased with the proof you have given me of your confidence, and which displays great zeal, power of memory, and attention. I am obliged to go out of town, and shall not be settled in town till the end of January; I will then see you at any time you wish. It would gratify me to be of any service to you; I wish it may be in my power.

In the following year matters took better shape. The post of assistant in the Laboratory had become vacant and Davy offered it to Faraday at a wage of 25*s*. a week, with two attic rooms at the skyline of the house. He was introduced to the managers as one of good habits, active and cheerful in disposition, and intelligent in manner. His duties were to assist the various lecturers and professors in preparing for, and during lectures; and he had instructions regarding cleaning, care of apparatus, models, and so on. Though only twenty-one or twenty-two, he seems to have held a watching brief amongst the faithful, little realised, we may be sure, by those on the floor of the theatre. Writing to a friend, he said:

> The opportunities that I have had of attending and obtaining instruction from various lecturers in their performance of duties attached to their office, has enabled me to observe the various habits, peculiarities, excellencies, and defects of each of them, as they were evident to me during the delivery. I did not wholly let this part of the things occurrent escape my notice; but, when I found myself pleased, endeavoured to ascertain what had affected me; also, when attending to Mr. Powell or Mr. Brande in their lectures, observed how the audience were affected, and by what their pleasure and their censure was drawn forth.

Faraday left England in the autumn of 1813 in order to accompany Sir Humphry and Lady Davy on a European tour. They travelled in France, Italy, Switzerland, and the Tyrol, returning to London in April 1815. Re-engagement at the Royal Institution as assistant in the Laboratory happily followed, on increased monetary terms, and with apartments. On June 12, 1821, residence in the Institution having been arranged, Faraday married. In 1824 fellowship of the Royal Society was attained; also, in this year he joined the Geological Society, having interest probably more on the mineralogical side of the science than any other. Later, he served on its council. The outstanding event of 1825 was his election at the Royal Institution as director of the Laboratory and superintendent of the House; in that year, too, came his memorable discovery of benzene, announced to the Royal Society in a paper dated June 16, 1825.

By the time he was thirty-eight (1830), Faraday had accomplished a full measure of practical research. He was, moreover, on the threshold of establishing a physical link, namely, the connexion between electricity and magnetism. But he was ever alive to the needs of the Institution as a corporate body, and of its traditions. He kept continually in mind that the Royal Institution had objects of national importance to carry out; that it required sustaining energy, must be efficacious, and maintain its position, well defined years back by Davy. Apart from research, a great debt of gratitude for fulfilment is due therefore to Faraday, and must be part of the festival of thanks.

The inauguration of juvenile lectures and the discourses at Friday evening meetings were features of this period. At the former, those young people who cared to remain found Faraday ready to talk and explain. He had ease of his own in descending from the topmost rung of the ladder of science to convey in the minds of youthful listeners the scientific principles of 'common things'.

Faraday's connexion with the Royal Society was, of course, close and distinctive. He was a member of council in 1830 when the choice for the chair lay between H.R.H. the Duke of Sussex and Sir John Herschel, the astronomer and physicist. In 1832 and again in 1838 he received the Copley medal for his discovery of magneto-electricity and for researches in specific electrical induction respectively. Royal medals were allotted to him in 1835 and 1846, also the Rumford medal (1846). He was on five occasions Bakerian lecturer. On the last of these (1857) the subject was "Experimental Relations of Gold (and other metals) to Light". His final contribution to the Society was "On Regelation", read on April 26, 1860. In this he referred to the work of Tyndall and others. The Royal Society invited him to be its president in succession to Lord Wrottesley, but he stood aside in fixity of purpose. Visitors at the forthcoming centenary celebrations will be able to see at the rooms of the Royal Society the canvas by E. Armitage, R.A., portraying a deputation thereon, in 1857.

As scientific adviser to the Trinity House for a long series of years, Faraday made numberless reports, and paid constant visits to lighthouses.

In 1861, when sixty-nine years of age, Faraday conceived that the end of his scientific pilgrimage was within sight. Hence, writing to the managers of the Royal Institution, he reminded them of forty-nine years' service. His life had been a happy one, and all he desired. In its progress he had tried to make fitting return to the Royal Institution, and through it to science. The course of time had given development, maturity; now he had to face gentle decay. The managers, however, desired his retention of office in such manner as might appear convenient to himself.

In 1866 Faraday received from the Society of Arts its Albert medal—"for discoveries in electricity, magnetism, and chemistry, which, in their application to the industries of the world have largely promoted Arts, Manufactures, and Commerce". This was, in all probability, the last British recognition of his achievements that life permitted him to receive. The Prince Consort, in compliance with the wishes of Queen Victoria, had placed a house at his disposal on Hampton Court Green. There Faraday died on Aug. 25, 1867.

Tyndall.

John Tyndall was a moving figure in philosophy and in those manifold applications of science which distinguished the nineteenth century, tokens of newness of ideas and newness of things. Chosen in May 1853 to be professor of natural philosophy at the Royal Institution, he was a colleague of Michael Faraday for fourteen years. In 1867 he succeeded the master at Albemarle Street, and his future career lay there, embracing in all thirty-four years. Throughout, he maintained a high reputation as a lecturer, writer, and publicist.

Tyndall was born in Ireland in 1820. His early education, though restricted, was broadly amplified through intensive individual effort. He was at the University of Marburg from 1848 until 1851. About this period a lifelong friendship began with T. H. Huxley. The publication of an essay on the cleavage of slate rocks was the proximate cause of his joining the latter in a visit to the glaciers of Switzerland in 1856; they issued afterwards a joint paper on the structure and motion of glaciers. For some years Tyndall was scientific adviser to the Trinity House and the Board of Trade, but he resigned these offices in 1883. Elected a fellow of the Royal Society in 1852, he received the Rumford medal in 1864; and he was on four occasions Bakerian lecturer.

At his first Friday evening lecture at the Royal Institution, delivered on Feb. 11, 1853, Tyndall remarked that he had engaged in it "not without fear and trembling, for the Royal Institution was to me a kind of dragon's den where tact and strength would be necessary to save me from destruction". Many words of wisdom have been uttered from behind the lecture table of the Royal Institution. Words of Tyndall uttered in 1879, in a discourse on the electric light, are singularly appropriate to recall just now—"it is Faraday's spark which now shines upon our coasts, and promises to illuminate our streets, halls, quays, squares, warehouses, and, perhaps at no distant day, our homes".

Tyndall died at Hindhead, near Haslemere, on Dec. 4, 1893.

Faraday's London Friends.

By H. G. Wayling.

FARADAY was essentially a Londoner. Although he was born on the south side of the Thames, he spent the greater part of his life in the northern districts between Regent's Park and Oxford Street, or at the Royal Institution in Albemarle Street, Piccadilly. From the following addresses of some of his scientific acquaintances the metropolis of his day becomes alive again. To visit all these highways and byways on foot would certainly be a tiring tramp. Failing, however, the use of a motor car, all the thoroughfares may be found on any good map of London.

One of the founders of the Royal Institution was Sir Joseph Banks, who lived at No. 32 Soho Square, a little west of Charing Cross Road. He died in 1820, so that Faraday would only know him as a gouty old autocrat. At the same house resided Dr. Robert Brown, amanuensis and librarian to Sir Joseph. Brown became one of the leading botanists in Europe, and sealed his claim to scientific recognition by the discovery of the Brownian movement, a topic which Faraday selected for one of his popular lectures at the Royal Institution. South of Regent's Park and parallel to Portland Place is Charlotte Street, where William Nicholson died. In conjunction with Sir Anthony Carlisle, who dwelt not more than a stone's throw away at No. 6 Langham Place, he effected the decomposition of water electrolytically. As the experiment was carried out at the Royal Institution in 1800, Faraday would know these co-workers, when in a few years later he became interested in the study of natural philosophy.

Still farther west and south of Regent's Park is Baker Street, a name well known to readers of Sherlock Holmes. Crossing it at right angles is Dorset Street, where, at No. 1, lived William Hyde Wollaston and, after him, Charles Babbage. The former, who was the interim president of the Royal Society, after the death of Sir Joseph Banks, was of the opinion that a wire carrying an electric current has a tendency to rotate on its axis; but Faraday, who watched Wollaston's unsuccessful attempts to achieve this feat, succeeded in making a similar wire revolve round the pole of a magnet. When Babbage became the tenant of the house in Dorset Street, he entertained extensively. John Dalton stayed here when he came from Manchester to lecture at the Royal Institution, where Faraday at the rehearsal of these discourses acted as audience and critic all in one. Among other guests of the inventor of the calculating machine was Sir David Brewster, who occasionally left the capital of the north to visit that of the south. Branching off Baker Street is Blandford Street, where Faraday worked as a bookbinder's apprentice.

Not far from here and in a south-easterly direction is Cavendish Square, connected to Oxford Street by a short thoroughfare called Holles Street. In this byway lived Davies Gilbert, a close friend of Davy and his successor to the presidency of the Royal Society. As practically every prominent member of that distinguished society would at one time or another pass through the doors of the Royal Institution, then their research laboratory, Faraday would experience the force of the saying, "the friends of thy friends are my friends." As chairman of the Royal Institution for a recognised period, Charles Hatchett would be another of Faraday's acquaintances. Hatchett was a mineralogist of some distinction, and incidentally, the father-in-law of W. T. Brande, who succeeded Davy as professor of chemistry at the institute in Albemarle Street. Hatchett lived in his later years in Lindsey Row, Chelsea; a terrace of big houses facing the river. Brande was born in Arlington Street, a southern tributary of Piccadilly.

Mrs. Marcet, whose "Conversations on Chemistry" whetted the youthful appetite of Faraday for experimental science, lived in Great Coram Street, Russell Square. Her tea parties were well patronised by several fellows of the Royal Society. Berzelius tasted her hospitality and Maria Edgeworth at times assisted her in these social amenities. Among Faraday's friends were many Quakers. William Allen, who resided in Plough Court, Lombard Street, was one of them. The firm of Allenbury is still in possession of the premises. Allen lectured before the Royal Society, and like most adherents of his particular faith, was earnest in all good works. Another, whose name is among the most notable who have lectured at the Royal Institution, was Thomas Young. Although a member of the Society of Friends, he modified his tenets and comportment with the changing times. This remarkable genius dwelt at No. 48 Welbeck Street, parallel to Harley Street, as befitted a physician of his social status. Then there were William and Richard Phillips, the sons of a publisher in George Yard, Lombard Street. They were fellows of the Royal Society and also prominent members of the Geological Society. It was Richard Phillips who induced Faraday to undertake public analytical work to augment his slender income.

William Haselden Pepys was another Quaker. He kept an instrument-maker's shop in the Poultry, also not far from Lombard Street, being, like many other of his co-religionists, within easy access of the Friends' meeting house in Gracechurch Street. When young Faraday wrote to Davy requesting that a situation might be found for him in the Albemarle Street laboratory, Sir Humphry showed the letter to Pepys and asked for his advice. "Set him to wash bottles" was the reply; a suggestion that Davy did not think worth accepting. Davy lived at No. 26 Park Street, Grosvenor Square, that is, in Mayfair, where his aristocratic wife entertained in great style. A more modest acquaintance of the subject of our theme was Peter Mark Roget, whose electrical jumping spiral may still be seen in the Science Museum at South Kensington. He lived at No. 18 Upper Bedford Place, just north of Russell Square, Bloomsbury. As secretary of the Royal Society, Roget had intermittent correspondence with Faraday—in particular, that on the manufacture of optical glass.

The mention of this topic reminds us that we might cross the river for a change, passing over London Bridge and proceeding down the Borough High Street. Along this route we enter Newington Causeway, once called Blackman Street. Here Sir James South had an observatory and laboratory. With the assistance of Sir John Herschel, he undertook the manufacture of various kinds of glass; and it was a modified form of this experimental ware, containing lead borate, that Faraday employed in his investigations on the relationship between magnetism and polarised light. Mr. Rollo Appleyard, in his recent biography, tells us that Sergeant Anderson, who acted as general factotum to Michael Faraday at the Royal Institution, served his apprenticeship in Sir James South's laboratory in Blackman Street. A short distance ahead is Newington Butts, where the great natural philosopher himself was born.

Returning to the neighbourhood of Oxford Street, where so many of his admirers lived, we pay a call to Hanover Square, which is on the other side of the road to Cavendish Square. At No. 12 resided Mrs. Mary Somerville, a frequent visitor to the Royal Institution. As there is a memorial plaque on its walls, the building can be easily identified. Mrs. Somerville relates that Wollaston, one day, in his usual quiet mysterious way, closed the shutters of her drawing-room; then holding a glass prism in the path of a beam of light that came in through a chink, exhibited to her the dark lines of the solar spectrum. Sir Charles Lyell met his future wife at one of Mrs. Somerville's dinner parties, and when he set up housekeeping he lived for many years at 53 Harley Street, only a few steps away. Lyell accompanied Faraday to investigate the cause of a terrible explosion that occurred at Haswell Colliery, Durham. During his local inquiries Faraday was shocked to find that the foreman of the mine demonstrated some of the tragic details with a lighted candle in his hand, having thoughtlessly given the professor himself a sack of gunpowder on which to sit and watch the demonstrations.

Among the familiar portraits of Faraday is one in which he appears in company with J. F. Daniell, whose name still persists in a well-known voltaic cell. Daniell was born in Essex Street, Strand. He lectured at the London Institution, Finsbury Circus, a rival academy to that off Piccadilly.

Dr. J. A. Paris, the biographer of Davy, was also well acquainted with Faraday. On one occasion when Paris paid a visit to Faraday's laboratory, he criticised adversely the apparently filthy appearance of some of the glass tubes. The next morning a short note was left at the doctor's house, No. 27 Dover Street, containing this laconic statement: "the 'oil' you noticed yesterday, turns out to be liquid Chlorine".

Part of his time Faraday lectured at Woolwich Academy. Here he co-operated with S. H. Christie, a Londoner—born at No. 90 Pall Mall; with Peter Barlow, whose familiar wheel is a type of electric motor; with the chemist Marsh, on whose test for arsenic all analysts rely; and with William Sturgeon, who was the first to use soft iron in the construction of electromagnets. Faraday's first biographer, Dr. Bence Jones, lived in Brook Street, Grosvenor Square. Being the secretary of the Royal Institution, Jones would have exceptional opportunities of knowing his subject both in private and public life. Another of his biographers and close friend was Dr. J. H. Gladstone. He was by marriage related to Lord Kelvin, who accepted his relative's hospitality at No. 17 Pembridge Square, Notting Hill, whenever he could be induced to leave his professorial duties in Glasgow.

The British Association Centenary Meeting.

THE centenary meeting of the British Association will be formally opened on Wednesday next, in the Albert Hall, at 3 P.M., when the Right Hon. J. C. Smuts will assume the presidency in succession to Prof. F. O. Bower, and will receive the invited delegates of societies and institutions, and of universities, colleges, and cities in which the Association has held meetings in the past. On the second day, in the Central Hall, Westminster, at 9 P.M., General Smuts will deliver his presidential address on the subject of "The Scientific World-Picture of To-day".

General Smuts will ask, in his address, what the effect of the recent scientific advances is on our conception of the world. On one hand, we have the ordinary common-sense view of the world, which is based on practical experience and tradition but does no longer square with the principles of science. On the other, we have the scientific world-view of the last century, which left the common-sense nature of the material world essentially unaffected, but could find no proper place for the factors of life and mind, and which thus reduced the world to the picture of a fixed deterministic mechanism. Both common sense and mechanistic science are profoundly affected by the new physical concepts, especially those of space-time and the quantum and their consequences. Matter, in the old sense, is completely transformed, and immaterial electrons and radiations take its place as the substance of the world. Our whole view of the nature of the material world seems to be upset and revolutionised.

Building on these great discoveries, a new world-view has recently arisen which yet, like the older science, emphasises almost exclusively the physical measurable aspects of the world. The world is constructed into a system of mathematical symbols. Matter, in the old sense, having disappeared, the world is made out to be a highly abstract intellectualised shadow world. On this view, however, a world emerges which cannot in any sense be considered real or possess any attribute of power or dynamic quality.

While acknowledging the enormous advance made by physics recently, it is suggested by General Smuts that it would be a mistake to emphasise them exclusively, and that the older concept of organic evolution is no less important for our world-view. The relations between the new concepts of space-time and the quantum on one hand, and those of life and mind on the other, are therefore discussed, and an attempt is made to connect up the system of the new physics with that of organic evolution. By thus avoiding the merely physical view of the world and linking it up with the facts of biology and psychology, which are equally valid with those of physics, a world-view results which, while destructive of the common-sense view of matter, also differs from both nineteenth-century mechanism and the more recent mathematical symbolism. It is shown that this is an evolutionary universe, essentially genetic and holistic; that it has passed through various phases from its microscopic origins to its present macroscopic status; and that inside this macroscopic system the phase of life and mind is emerging as a new high level in the universe. It is finally suggested, as a result not only of organic evolution but also of the new physics, that the essential character of the universe does not preclude new creation, and that there are indications of a certain measure of free movement and creativeness throughout the world which increases in life and mind and in the emergence of new values. Within the deterministic limits of the universe the human spirit may thus have an assured status and a certain measure of creative free play.

General Smuts's address will be published in full in a Supplement to next week's issue of NATURE, together with summaries of the addresses of the presidents of Sections of the Association. The programmes of the Sections, including the subjects of the presidential addresses, were given in our issue of Aug. 8. In addition to several discussions of high scientific importance there mentioned, the evening discourses to be delivered during the meeting are of particular interest. Sir James Jeans will take as his subject "Beyond the Milky Way"; Sir Oliver Lodge, "A Retrospect of Wireless Communication"; Sir Arthur Keith, "The Constitution of Man's Family Tree"; Sir P. Chalmers Mitchell, "Zoos and National Parks"; and Dr. S. Kemp, "Oceanography in the Antarctic".

Special facilities will be offered for visits to a number of public resorts of scientific interest; and these include the Royal Botanic Gardens, Kew, where the director, Sir Arthur Hill, is arranging an exhibition of plants named after botanists, with portraits of the botanists themselves. The exhibit will be placed in the alpine house at the end of the herbaceous ground. An exhibit of this character should be of general interest, since it will serve to explain the somewhat obscure generic names of a number of well-known plants. In the limited space, it is not possible to have a fully comprehensive exhibit, but a selection will be made of well-known plants named after distinguished botanists and travellers. Among them will be found the Swedish creeping plant *Linnæa*, allied to the honeysuckles, which was named in honour of Linnæus and was the favourite plant of the great naturalist; the *Dahlia*, which was named after Dr. Andrew Dahl, the Swedish botanist who was a pupil of Linnæus (Dahl brought this favourite garden plant into cultivation, but unfortunately no portrait of him appears to exist); *Matthiola*, the stock named in honour of Pietro Matthioli (1500–1577); *Lobelia*, named after Mathias de Lobel (1538–1616); *Cunninghamia*, after Richard and Allan Cunningham; *Darwinia*, commemorating Erasmus Darwin, the father of Charles Darwin; *Gesnera*, after Conrad Gesner; *Eschscholzia*, which was named after the botanist Dr. Eschscholtz; *Cinchona*, which bears the name of the Countess Chinchon, the wife of the Viceroy of Peru, to whom the introduction of the knowledge of the drug is usually ascribed; *Camellia*, named in honour of George Joseph Kamel, who travelled in the East; *Magnolia*, named after Pierre Magnol (1638–1715), professor of medicine at Montpellier; *Tradescantia*, named after John Tradescant (died 1638), who was gardener to Charles I.; *Sparmannia*, the well-known South African plant, which was named after Dr. A. Sparmann, the Swedish botanist who accompanied Capt. Cook on his second voyage round the world and introduced this well-known greenhouse plant to cultivation; *Fuchsia*, named in honour of Dr. Leonard Fuchs (1501–66) the author of the celebrated "Herbal"; and *Kniphofia*, the "Red Hot Poker", named after Johann Hieronymus Kniphof (1704–1763), a professor of medicine at Erfurt.

A very large number of delegates and other visitors from abroad are attending the meeting. Many of these are presenting papers or taking part in discussions in the various sections, among them being the following:

Section A: Dr. J. Bjerknes, Bergen; Prof. A. S. Eve, Montreal; Dr. H. Spencer Jones, Cape Town; Prof. J. C. McLennan, Toronto; Prof. M. N. Saha, Allahabad; Prof. F. Schlesinger, New Haven; Dr. B. F. J. Schonland, Cape Town; Prof. W. de Sitter, Leyden; Prof. P. Zeeman, Amsterdam.

Section B: Prof. N. J. Bjerrum, Copenhagen; Prof. J. N. Brønsted, Copenhagen; Prof. P. Debye, Leipzig; Prof. H. von Euler-Chelpin, Stockholm; Prof. V. Henri, Marseilles; Prof. P. Karrer, Zurich; Prof. R. Kuhn, Heidelberg; Prof. H. Wieland, Munich; Prof. A. Windaus, Göttingen.

Section C: Prof. H. A. Brouwer, Delft; Prof. J. W. Jongmans, Heerlen; Prof. P. Niggli, Zurich; Prof. P. D. Quensel, Stockholm; Dr. E. O. Ulrich, Washington.

Section D: Prof. H. Fairfield Osborn, New York.

Section E: Prof. J. H. Wellington, Transvaal; Prof. W. Werenskiøld, Oslo.

Section F: Edgar Atzler, Berlin; Dr. Hermuth Boller, Vienna; R. L. Hall, Grahamstown; Pierre Jolly, Paris; Henri Laugier, Paris; Dr. Elton Mayo, Massachusetts; Dr. H. S. Person, New York.

Section G : Brig.-Gen. C. H. Mitchell ; Dr. Elihu Thomson, Lynn, Mass.

Section H : Dr. R. Broom, Douglas, S. Africa ; Dr. H. C. van Riet Lowe, Cape Town ; Prof. Sergio Sergi, Rome ; Prof. V. Suk, Brno ; Dr. G. Thilenius, Hamburg.

Section I : Prof. Frank Allen, Manitoba ; Dr. R. Alexander, Pretoria ; Prof. D. W. Bronk, Pennsylvania ; Dr. C. K. Drinker, Harvard ; Prof. Yandell Henderson, Yale ; Prof. C. Heymans, Ghent ; Dr. J. M. Rivers, New York.

Section J : Prof. W. Köhler, Berlin ; Prof. H. Piéron, Paris.

Section K : Prof. F. E. Lloyd, Montreal.

Section L : Prof. F. Clarke, Montreal ; the Hon. S. Rivers Smith, Tanganyika.

Section M : Dr. W. Lawrence Balls, Giza ; Dr. D. J. Hissink, Groningen.

Among other visitors from abroad whose names do not appear in the handbook and time-table of the sectional meetings, but who will probably take part in some of the proceedings, we notice the following : Dr. C. G. Abbot, Washington ; Prof. Max Bodenstein, Berlin ; Prof. Niels Bohr, Copenhagen ; Prof. A. H. R. Buller, Manitoba ; Dr. J. McKeen Cattell, New York ; Prof. R. Chodat, Geneva ; Prof. E. J. Cohen, Utrecht ; Prince Conti, Florence ; Baron de Geer, Gothenburg ; Prof. W. K. Gregory, New York ; Prof. W. Heisenberg, Leipzig ; Prof. G. Hevesy, Freiburg ; Prof. A. E. Kennelly, Harvard ; Prof. J. P. Lotsy, Velp ; Prof. A. B. Macallum, London, Ont. ; Senatore Marconi, Rome ; Prof. R. A. Millikan, Pasadena ; Dr. Th. Mortensen, Copenhagen ; Dr. H. Nagaoka, Tokyo ; Prof. J. Perrin, Paris ; Dr. H. M. Tory, Ottawa ; Prof. R. Willstätter, Munich ; Prof. R. W. Wood, Baltimore.

International Union of Physics, Brussels Meeting, 1931.

A MEETING of the International Union of Physics was held in Brussels on July 12, and was attended by representatives of about fourteen countries. Prof. Gerlach, of Munich, and Dr. Rupp, of Berlin, were also present by the invitation of the president. A revised set of statutes, prepared by the executive committee, was considered and passed.

At the previous meeting of the Union an invitation had been given to hold a meeting in England so soon as it was possible for all nations to take part. Sir Richard Glazebrook, as representing Great Britain, expressed his pleasure that, under the new statutes, this condition was now satisfied, and cordially welcomed the German visitors to the meeting. He then renewed the British invitation, saying, however, that he had been informed that there was a very strong desire that the Union should visit America on the occasion of the Chicago Exhibition in 1933, and that it was for the Union to decide. A telegram was then read from Prof. Millikan, cordially inviting the Union, and this invitation was strongly supported by Dr. Kennelly and Dr. Schlesinger, the American delegates.

After some further discussion, the General Assembly of the Union decided unanimously to accept the invitation to Chicago, and to invite Prof. Millikan to become president of the Union in succession to Sir William Bragg, whose term of office had expired.

Discussion then followed on matters brought forward either by national committees or by individual physicists. Among these were the proposals of the British National Committee as to the definition of the calorie and a name for the unit of thermal conductivity, and of M. Cotton as to names for magnetic units. As the result of the discussion, a sub-committee was appointed to deal with symbols, units, and nomenclature in physics and to report to the General Assembly. At the first meeting of this sub-committee, held on July 12, Prof. Kennelly in the chair, the following resolution was agreed to unanimously :

That this Commission recommends to the Executive Committee of the International Union of Physics that the following two propositions be communicated to the next General Assembly as recommendations from this Commission.

1. That the Unit of Heat when measured in units of energy be the Joule, defined as equivalent to 10^7 ergs.
2. That the gramme-calorie is the amount of heat required to raise the temperature of one gramme of water from 14·5° to 15·5° of the International Scale of Temperature.

Note on Proposition 2.

" According to existing measurements, the gramme calorie is equivalent to

$$4{\cdot}18_6 \text{ Joules.}$$

" The definition is consistent with the decision of the International Steam Tables Conference in 1929 to adopt as a unit suitable for their purpose an International Kilocalorie equivalent to 1/860 of an International Kilowatt Hour, the difference being that between the Absolute Watt* and the International Watt."

* International Watt = 1·00039 Absolute Watts.

Obituary.

SIR THOMAS STANTON, C.B.E., F.R.S.

THE death at Pevensey Bay on Aug. 30 of Sir Thomas Ernest Stanton tragically ended a distinguished career largely devoted to the service of the State. He was one of the greatest research engineers Great Britain has produced, and a worker whose name will rank with those of Rankine and Osborne Reynolds, under the latter of whom he studied and carried out some of his early work.

Sir Thomas, who was sixty-five years of age, had retired in December 1930 from the post of superintendent of the Engineering Department at the

National Physical Laboratory at Teddington, a position he had occupied for nearly thirty years. Born on Dec. 12, 1865, the son of Thomas Stanton of Atherstone, he was educated at Atherstone and Manchester Grammar Schools, whence he proceeded to Owens College, where, after experience with Messrs. Gimson and Co., engineers, of Leicester, he was appointed demonstrator by Osborne Reynolds in the Whitworth Laboratory, a position he held for five years.

In 1896, Stanton removed to Liverpool, on appointment to the senior lectureship in engineering at University College. Three years later he became professor of civil and mechanical engineering at Bristol, a position he held until 1901, when he joined the staff of the National Physical Laboratory, which was then in the earliest stages of its development.

Stanton proceeded to build up the Engineering Department to its present position of eminence. Few have exerted a wider influence in the application of laboratory methods to engineering problems. For some years he was also in charge of the aerodynamical work of the Laboratory. His personal researches covered an extensive field, including the study of wind pressures on structures, the resistance of materials to intermittent stresses, lubrication, the heat-transfer and friction between solid surfaces and moving fluids, and the movement of projectiles at speeds exceeding the velocity of sound. These and other researches have formed the subject of numerous papers presented during the past thirty years to the Royal Society, the Institution of Civil and Mechanical Engineers, and the more important engineering journals. His book on "Friction" (1923) is also very widely known. So recently as May last he delivered the thirty-seventh Sir James Forrest Lecture, on "Engineering Research," before the Institution of Civil Engineers.

Stanton was admitted a fellow of the Royal Society in 1914 and served on the Council during 1927–29. He was a D.Sc. of the University of Manchester, a fellow of the Royal Aeronautical Society, and a member of the Institutions of Civil and Mechanical Engineers. For his work in the War he received the C.B.E. in 1920 and he was knighted in 1928.

Despite a somewhat retiring disposition, Stanton's advice was much sought, for it was known to be kindly, sound, and sagacious. He was genial and unassuming, and his popularity with his colleagues was amply evinced on the occasion of his retirement from the Laboratory. During the past year his life had been clouded by ill-health. He married in 1912 a daughter of Mr. John Child, of London, and he leaves, besides Lady Stanton, a daughter aged eighteen years and a fourteen-year-old son, to whom we offer our deep sympathy.

DR. L. W. SAMBON.

IT is with deep regret that we have to record the sudden death of Dr. L. W. Sambon in Paris on Aug. 31. By his death a striking personality has passed away.

Sambon was born in Italy in November 1865. He was of Anglo-French parentage, his father being Comm. Jules Sambon, an antiquarian and numismatist of repute, and his mother an Englishwoman. He was educated in England and Switzerland, and later studied medicine at St. Bartholomew's Hospital Medical School and in the University of Naples, where he took his medical degree.

From an early age Sambon took great interest in numismatics, archæology, natural history, and volcanology. As a medical student, he rendered valuable service during the great cholera epidemic in 1884, and was awarded for his work bronze and gold medals by the Italian and French Governments. In 1897 he settled in London, where he devoted himself to medical research at a time when tropical medicine was almost in its infancy. His first article on "Acclimatisation of the White Man in Tropical Lands" roused a great deal of controversy, but it had a good effect. It brought him in contact with Manson, who was at that time Medical Adviser to the Colonial Office, and their association was interrupted only by the death of Manson.

In the summer of 1900, Sambon carried out the now classical malarial experiment in the Roman Campagna (Ostia) with Dr. George C. Low and one of us (T.).

Sambon was for many years a lecturer at the London School of Tropical Medicine. He published many papers on sunstroke, blackwater fever, malaria, sleeping sickness, pellagra, typhoid, schistosomiasis, and so on. He was at the time of his death carrying out investigations on cancer, in Westmoreland—a subject on which he had already published several reports. He wrote much on the history of medicine. He studied the surgical instruments of ancient times and utensils found in Roman graves, and his interpretations of these relics have thrown considerable light on the medical knowledge of past ages.

Sambon has been called volcanic, he has been accused of being a dreamer and a visionary, but whatever theories he may have advanced, which may have been at the time considered far-fetched, those theories undoubtedly fertilised the fields in which he worked.

A. J. ENGEL TERZI.
S. MAULIK.

WE regret to announce the following deaths:

Dr. Aristides Agramonte, president-elect of the Pan-American Medical Congress, known for his work on bacteriology in Cuba, who associated himself with the work of clearing the Panama Canal zone of disease, aged sixty-two years.

Prof. Errol Lionel Fox, professor of chemistry at Washington College, Chesterton, Maryland, on July 17, aged thirty-eight years.

Dr. Russell A. Oakley, principal agronomist in the Division of Forage Crops and Diseases of the Bureau of Plant Industry, United States Department of Agriculture, on Aug. 6, aged fifty-one years.

News and Views.

THE celebration of the centenary of the birth of James Clerk Maxwell is to be held in Cambridge on Oct. 1 and 2, following immediately on the Faraday celebrations and the British Association meeting. About ninety delegates have been nominated by the principal academies and learned societies of the world and by the home universities. Amongst the delegates are Profs. Kennelly and Millikan from the United States; Profs. Cotton and Brillouin from France; Prof. Max Planck, Prof. Debye, Prof. Bohr, Prof. Siegbahn, His Excellency the Marchese Marconi, General Smuts, Prof. Zeeman, and Prof. Nagaoka. The University of Cambridge has also invited a number of guests and will have the pleasure of welcoming at the celebration many of those who worked in the Cavendish Laboratory in its first years under Maxwell—Dr. William Garnett, Sir Ambrose Fleming, Sir Richard Glazebrook, Sir Napier Shaw, Sir Arthur Schuster, Prof. W. M. Hicks, and others. Before the opening of the celebration in Cambridge, it is expected that many of the delegates will attend the unveiling of memorial tablets to Faraday and Maxwell in Westminster Abbey. The Royal Institution and the University of Cambridge have obtained the permission of the Dean and Chapter for the placing of these memorials, and it has been considered appropriate that they should lie, with the Kelvin tablet, in close proximity to the Newton tomb. The Master of Trinity, Sir J. J. Thomson, will unveil the tablets at noon on Sept. 30.

THE official proceedings in Cambridge of the Clerk Maxwell celebrations open with the Vice-Chancellor's luncheon in Corpus Christi College on Oct. 1. At 2.45 P.M. a procession is to be formed to the Senate House, where the Chancellor will welcome delegates and receive addresses. The Master of Trinity will then deliver the memorial lecture. After this will follow an 'At Home' in Peterhouse, Maxwell's first home in Cambridge, and in the evening a reception will be held in St. John's College. On the morning of Friday, Oct. 2, addresses will be given in the Arts School by Prof. Max Planck, Sir Joseph Larmor, and Prof. Niels Bohr. In the afternoon an address will be given in the Cavendish Laboratory by Sir James Jeans, also short addresses by contemporaries of Maxwell: Dr. Garnett, Sir Ambrose Fleming, and Sir Oliver Lodge. An exhibition of Maxwell apparatus and manuscripts is being organised, and visitors will have an opportunity of seeing the work of the laboratory. The proceedings will be closed by a banquet given by Trinity College. The addresses given at the celebration together with a contribution by Prof. A. Einstein are to be published by the University Press in a commemoration volume.

THE National Portrait Gallery has a collection of portrait sketches in pencil on sheets of drawing-paper which includes a head of Michael Faraday, bearing the date 1831. A friendly letter in Faraday's handwriting addressed to William Brockedon is appended. Various other well-known people of the period—for example, Brunel, drawn in the same medium—form a small collection of much interest in contemporary portraiture. Some in the series have received slight additions by coloured chalk in order to enhance the effect. William Brockedon, son of a local watchmaker, was born at Totnes in 1787. He died in London in 1854. He was a painter of repute, an author, and an inventor. In the year 1834, Brockedon was elected a fellow of the Royal Society. In all, he exhibited 36 pictures at the Royal Academy, and 29 at the British Institution. He founded the Graphic Society in 1831, an association of one hundred artists. Also, in 1830, he helped in founding the Royal Geographical Society, and was a member of the first council of that body. As an inventor, Brockedon was well known. One of his patents referred to a substitute for corks, composed of vulcanised india-rubber; another (1843), a process for compressing pure blacklead powder (obtained from Cumberland's dwindling sources) into compact blocks from which lead pencils were afterwards fashioned. Brockedon was the author of "Illustrations of the Passes of the Alps", two vols., 1828–29.

MR. SNOWDEN, Chancellor of the Exchequer of the new National Government, introduced his emergency budget in the House of Commons on Sept. 10 and a White Paper (Cmd. 3952. London: H.M. Stationery Office, 3*d.* net) was issued setting out the proposed reductions in national expenditure. The measures proposed are based largely on the report of the May Committee, reference to which was made in our columns in the issue of Aug. 8. We criticised then the principle of singling out research activities for curtailment, and it is gratifying to find that Mr. Snowden has at any rate mitigated the blow. Whereas the May Committee recommended the abolition of the Empire Marketing Board, it is now proposed to reduce its grant by a quarter of a million; and the suggested reduction of £250,000 in the grant to universities and university colleges has been made £150,000, which, it is explained, will not affect annual grants, in that it represents an accumulated balance normally used for non-recurrent purposes. In other directions, the recommendations of the May Committee have been followed more closely. The vote for the Ministry of Agriculture and Fisheries is to be reduced by £580,000, which involves postponement of new developments for agricultural research and also of the Government grant towards the reconstruction of the Royal Veterinary College. It will also be impossible to operate the new fisheries research ship during 1932. The Colonial Development Fund will be restricted to £750,000, thus saving £250,000; while the expenditure of the Forestry Commission will be reduced by nearly half a million pounds, by restricting afforestation schemes.

THE flood-lighting of London has been criticised on the ground that it is an unjustifiable expenditure of public money at a time when economy should be practised. The cost, however, is being entirely defrayed by certain firms and other bodies connected with the electrical and gas industries. It was originally organised in honour of the International Illumination Congress. The headquarters of the Congress were in London, but meetings were held in several other cities, including Edinburgh and Glasgow. At the Edinburgh meeting, Mr. Clifford C. Paterson, president of the Congress, presented a paper entitled "The British Standard Specification for Street Lighting", which should prove very useful in improving the illumination of many of our streets. Many improvements have been introduced into the 1931 specification. An important point is the introduction of the phrase 'average illumination' into the specification. It is now specified that, in any tender, values must be given of both the maximum and average illumination on the roadway. A great obstacle in the way of starting average illumination is the difficulty hitherto experienced in practice in measuring it. For practical purposes it is now found that it is unnecessary to measure the illumination in the street by means of a photometric device. The data are best obtained by calculation from the known candle-power distribution data of the fitting that is to be used. A graphical method is given of computing the average illumination, and this eliminates much of the laborious arithmetical work involved.

THE eleventh Shipping, Engineering, and Machinery Exhibition being held at Olympia was opened on Sept. 10 by Sir Austen Chamberlain, First Lord of the Admiralty. Referring to the interest and sympathy of the Government in general, and the Admiralty in particular, to the exhibition, Sir Austen remarked that upon no section of enterprise has economic stress fallen more heavily than on those branches of trade, commerce, and industry which are represented in the exhibition. It speaks well, however, for the vital strength of these trades that even in such times they can provide so magnificent and novel an exhibition. The organisers of the exhibition are Messrs. F. W. Bridges and Sons, Ltd., who have the support of the British Engineers' Association (Inc.), the Society of Motor Manufacturers and Traders, Ltd., and the British Marine Oil Engine Manufacturers' Association. The honorary president is Admiral of the Fleet Lord Wester Wemyss, while Dr. H. S. Hele-Shaw is the chairman of the honorary committee of experts. The exhibition will remain open until Sept. 26, and during that time official visits will be paid to it by more than fifty engineering and scientific societies. The exhibits cover a very large field, and there are few which are not, indirectly or directly, the outcome of scientific research.

THERE are altogether some 300 exhibitors at Olympia, and about 40,000 copies of the advanced catalogue, printed in three languages, have been sent all over the world. The official catalogue is on sale at the exhibition at 1*s*., and visitors can from this easily find the position of the exhibits they are most interested in. A classified index is first given, under such headings as electrical machinery and apparatus, engines, gauges, instruments (electrical, navigating, and scientific); this is followed by a list of exhibitors and by descriptions of the exhibits, the latter covering nearly 300 pages, and being given according to the order in which the stands are arranged. How largely scientific instruments have been adopted for the control of engineering processes can be seen by the inspection of the exhibits of the various instrument makers. For example, Messrs. Elliott Bros. (London), Ltd., have on view a collection of heat economy and control apparatus, including automatic boiler control, flue gas analysis, smoke density, and temperature equipment, such as will be found in a modern power station. This exhibit is typical of many others. An exhibit which was attracting much attention on the day of opening was the latest Admiralty type of echo sounding gear with transmitter and hydrophone, made by Messrs. Henry Hughes and Sons, Ltd. But there are many other exhibits of great scientific interest. As the exhibition will remain open until Sept. 26, many visitors to the Faraday Exhibition at the Albert Hall will no doubt also visit Olympia, and we note that an official visit to the exhibition is to be made by the British Association on Sept. 25.

IN his presidential address to the annual conference of the Sanitary Inspectors' Association at Bridlington last week, Sir Leonard Hill directed attention to some problems of population. In Great Britain the annual excess of births over deaths per 1000 living, which was 12 at the end of last century, is now less than 3, so that if the decline continues, soon the population will become stationary. Three children per family are required to maintain the population and make good losses, but no-child or one-child families are becoming the rule among the masses. We ought to be able to send to the dominions and colonies 250,000 young virile emigrants annually, for if the British and Australians cease to breed enough virile colonists to till and defend Australia, how can we stem invasion by the Japanese, who are multiplying at the rate of a million a year? Luxury, decay of virility, doles, the employment of mercenaries, and limitation of breeding has preceded the downfall of empires in the past; yet if kept within bounds, who can doubt that limitation of breeding is an excellent thing? But if the white man is limiting his breeding by birth control, which is now practised in all classes of the community, we must see to it that the coloured races are also taught the method of doing so. At present such races are kept down to the level of the food supply by high infant mortality, famines, and epidemic disease. A less cruel world can only be brought about by a rational limitation of the birth-rate, but this must be coupled with realisation of the duty of keeping up a virile race. At present, unfortunately, the unskilled and less desirable portion of the population continues to breed more than the skilled and better classes.

ON Sunday, Sept. 13, the Institute of Metals began its annual autumn meeting in Zurich and more than two hundred members were present, including about a hundred foreign members from fifteen different countries. This cosmopolitan gathering — presided over by Dr. Richard Seligman—considered twenty-five important original communications, dealing with a wide range of metallurgical and engineering problems and discoveries. Abstracts of some of the papers presented on the first day of the meeting appear elsewhere in our pages (p. 502). The meeting terminated on Sept. 15 with a steamer trip on Lake Zurich. A series of tours were arranged for the meeting, in the course of which several large metal works were visited.

THE subject of the tenth autumn lecture, given by Mr. U. R. Evans on Sept. 13, before the annual autumn meeting of the Institute of Metals, was "Thin Films in Relation to Corrosion Problems". He pointed out that the thin oxide films which are responsible for the apparent stability of such metals as aluminium and stainless steel are usually too thin to give interference tints; they are invisible whilst in contact with the metallic basis, but are perfectly visible when removed from it. Although the films produced by air alone give some protection, the stability can be increased by special treatment with oxidising agents. The slightly thicker films produced on heating in air give rise to beautiful interference tints (such as the temper-colours on iron); but they tend to crack and have usually little protective value. Almost all methods of removing a film—whether an 'invisible' film or a film thick enough to produce an interference tint—depend on treatment which will dissolve the metal immediately below, thus allowing the film to peel off. For films on aluminium, nitric acid or gaseous hydrogen chloride has been used; for iron, a solution of iodine; for other metals, anodic treatment in a chloride or sulphite solution.

MOST natural oxide films, Mr. Evans explained, are not wholly impervious to ions; they contain weak points. To be useful they must be 'self-healing'; in other words, the secondary corrosion product must be precipitated so close to the weak points in the film as automatically to seal the defect. The movement of electrode potential with time provides a valuable method of observing whether, in any particular case, the weak points are healing up or are extending. A corrosion product can only be protective if produced very close to the metal. When part of the surface of an immersed metallic specimen is 'screened' from oxygen, any weak points on the screened area will tend to develop, whilst on the 'well aerated' part they will tend to heal up; foreign bodies lodging in condenser tubes often cause local attack, probably as a result of their screening action. Under conditions where metal is continually bent, or abraded, or bombarded by air bubbles, whilst in contact with a corrosive solution, the mechanical erosion will often prevent self-healing, and corrosion will then continue. Such cases cannot be explained on purely mechanical or purely chemical principles; both influences must be taken into consideration: consequently a greater collaboration between engineer and chemist is called for than has been obtained hitherto.

THERE have been many artificial ice rinks constructed in various parts of the world during the last fifty years. The essential principle of all of them is practically the same. The refrigerating plant cools a liquid which does not readily freeze; the liquid is then led through long tubes on the ice 'plate'. The tubes are placed so close together that they practically form a continuous surface of iron and any intervening gaps are caulked. A thin layer of ice about 20 mm. thick suffices, so the amount of water required is not large. Water sprinkled on the plate freezes almost at once, and the plate is undercooled to such an extent that the upper surface of the sheet of ice is kept below the melting point. The factor that governs the extent of refrigeration required is the temperature of the air above the ice. Indoor rinks are usually heated to such an extent that inactive spectators feel comfortable; the atmosphere therefore becomes unpleasant owing to its large vapour content. In the *Escher-Wyss News*, vol. 40, there is an interesting article on open-air ice rinks, with special reference to the Dolder ice-rink recently opened at Zurich. It has proved a great success; even if it rains during the night and morning, it is quite fit for skating for the rest of the day. After a shower the surface of the ice is as smooth as a mirror, as some of the rain water always freezes. The rink is situated on the heights north-east of the Dolder Park, in a sheltered position in a forest clearing, and is surrounded by fir and pine trees. At night time it is brilliantly illuminated. Owing to the crowds which frequent it, the surface of the ice wears down rapidly and it has to be freshly watered every day. The question of installing an ice factory in connexion with the rink was considered, but owing to the large number of domestic refrigerators in Zurich and the difficulty of transport it was abandoned.

AN interesting and comprehensive wood preserving exhibit is being arranged by the British Wood Preserving Association in connexion with the forthcoming meetings of the forestry subsection of the British Association. The exhibit will be staged in the Department of Botany, Imperial College of Science, Prince Consort Road, South Kensington, and will remain open during the whole meeting. A large portion of the exhibit consists of fence posts of many species of home-grown timbers collected from estates in Great Britain, which illustrate markedly the advantages of preservative treatment if timber is required to give a good life in service. Side by side with posts of timber naturally undurable, which have been made to give a life of from twenty to twenty-five years through proper treatment, are specimens of the same timbers, from the same sites, which show considerable decay in from two to six years through not having been treated. Other exhibits will show how timbers, such as Douglas fir, which do not take preservatives readily, even under pressure, can be made to absorb preservatives readily and evenly through being 'incised' before treatment. A section of the exhibit is to be devoted to the attacks of fungi and insects upon timber used in buildings, both at home and abroad.

UNDER the joint auspices of the British Association, the British Institute of Adult Education, and the Commission on Educational and Cultural Films, an exhibition is being held in South Kensington during the week of the Association's meeting, showing some mechanical aids to teaching and learning. Among other exhibits, there is to be a section for those many ingenious devices and mechanical aids which have been invented by teachers for helping their pupils to understand special points. Any teacher who is willing to lend an exhibit is asked to communicate a description of his apparatus to the honorary organiser of the Teachers' Exhibits Section, Mr. E. J. Atkinson, 4 Hawkins Crescent, Harrow, Middlesex. As it has only now been found possible to include this section, teachers interested are asked to communicate with the honorary organiser without delay.

SIR JAMES JEANS will speak under the auspices of the British Institute of Philosophy on "The Mathematical Aspect of the Universe" at University College, London, on Oct. 13, at 8.15 P.M. The public can obtain tickets (for which there is no charge) on application to the Director of Studies, University Hall, 14 Gordon Square, W.C.1.

LORD RUTHERFORD is to preside over a dinner of past and present scholars of the Royal Commission for the Exhibition of 1851, which is to be held at the Mayfair Hotel, Berkeley Square, on Monday, Sept. 28, at 7.15 (for 7.30). More than a hundred scholars have signified their intention to be present, but there are probably many others who have not yet received the notices, especially those who have left their universities abroad *en route* for the centenary meeting of the British Association. Mr. Evelyn Shaw, secretary to the Commissioners, would be glad if any research scholars of the Royal Commission who have not previously seen the announcement of the dinner, and wish to be present, would apply at once to him at No. 1 Lowther Gardens, Exhibition Road, S.W.7, for a dinner ticket, the price of which is 11*s*. 6*d*., exclusive of wines.

NEW speed records were set up at Calshot on Sept. 13, when the Schneider Trophy was won for the third consecutive time by Great Britain. Flight-Lieut. J. N. Boothman flew the course at the average speed of 340·08 miles an hour, an increase of 11·45 miles an hour on the speed reached in the last race. Later, Flight-Lieut. G. H. Stainforth made four flights along the three kilometres speed course; his average speed was about 379·05 miles per hour. Lieut. Stainforth's machine was a Vickers Supermarine Rolls-Royce, *S1596*, and the times for his four flights give the following speeds: first run, 373·85 m.p.h.; second run, 388·67 m.p.h.; third run, 369·87 m.p.h.; and fourth run, 383·81 m.p.h.

ONE of the most noteworthy of the many successful flights of the German airship *Graf Zeppelin* was the Arctic cruise which took place in the end of July this year. Dr. H. Eckener has announced through a German scientific news service some of the preliminary results of this voyage of exploration. From Leningrad the course was northward to Cape Kanin, to the east of the White Sea, and then to Franz Josef Land and 82° N. latitude. A visit was then paid to the unknown west coast of Northern or Nicholas Land and Taimir Land, after which the airship passed westward over the Yenesei mouth and the Kara Sea to Novaya Zemlya, which was traversed from north to south. The whole cruise was most successful, and was favoured by fine weather, with good visibility. The area of sea between Franz Josef Land and Northern Land is little known. The limits of Northern Land were determined and two islands discovered. Corrections were made to the charts of Franz Josef Land. A feature of the cruise was the large number of photographs and films that were taken, which should prove of great service in revising and adding to the maps.

THE physical and chemical survey of national coal resources is one of the most important tasks undertaken by the Fuel Research Board, which has an organisation now covering practically all the coal-producing areas of Great Britain. Survey Report No. 19 (London: H.M. Stationery Office, 2*s*. 6*d*. net) has been issued, containing the results of an examination of the Lower Mountain Mine Seam of the Lancashire coalfield. This seam is worked over the northern area of the coalfield, and the Survey reports on samples taken in the Burnley, Accrington, and Bacup district. The figures show the seam to contain coal with valuable properties. Its caking index is high, and typical samples have an exceptionally low sulphur content (0·4–0·6 per cent). Taken in conjunction with a low content of ash which is often highly refractory, it is clear that the coal may be used for the preparation of high-class metallurgical coke. It is the custom of the Survey to examine individually the component bands across a seam. Thus it was found that the sulphur and ash giving high average figures for the seam was at times mainly concentrated in a thin band, suggesting that an apparently indifferent coal might, by a suitable cleaning process, be made to yield a high-grade product.

WE have received the eighth number of *Brighter Biochemistry*, the illustrated journal of the Biochemical Laboratory, Cambridge (May 1931). The number is quite up to the standard of its predecessors, and the three editors may be congratulated on their production. The greater number of articles and poems are by, and about, the workers in the Sir William Dunn Institute, but other well-known names jostle those of mythical personages in its pages. A personal acquaintance with a number of the victims, as well as authors, will give the reader greater interest in the magazine: but much amusement should be obtained by those who are conversant with recent papers on different aspects of biochemistry. The price is 2*s*., which should be sent to the editors at the Sir William Dunn Institute: this is considerably cheaper than the price of most of the forms of entertainment of equivalent amusement value.

MESSRS. Baillière, Tindall, and Cox announce the early publication of Baillière's "Encyclopædia of Scientific Agriculture", in two volumes, to the production of which some eighty leading scientific workers in agriculture have contributed.

Letters to the Editor.

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

A Focusing Method for Producing Electron Diffraction Patterns.

IT is a well-known fact that divergent electron beams of uniform velocity can be focused by means of magnetic fields. This focusing device is used, for example, in cathode ray oscillographs. It has been found that the focusing principle can be applied successfully to experiments in which electrons are diffracted. The chief advantage, among others, lies in the considerable gain in intensity as compared with the usual methods.

The arrangement is illustrated by the diagram (Fig. 1.). Electrons are emitted from a short spiral filament or flat spiral A. A hollow metal cone B is placed at a short distance from the filament. This cone has a narrow hole (about 0·2 mm. in diameter) at its apex. The accelerating field is applied between the filament and the cone. M is the coil which produces the magnetic field and S the specimen under investigation, which is placed at such a distance from the coil that the field is practically zero. P is the photographic plate or the fluorescent screen.

The direct rays, after passing through the field coil, converge towards a point Z on the plate. The diffracted rays which emerge from the specimen describe a series of cones, the angular opening of which is determined by the individual spacing to which they belong. These cones intersect the plate in ellipses. If, however, the diameter d of the diffracting specimen is small compared with its distance D from the plate, these ellipses become very nearly circles. The region in which a series of identical cones intersects the plate has consequently a definite width, that is,

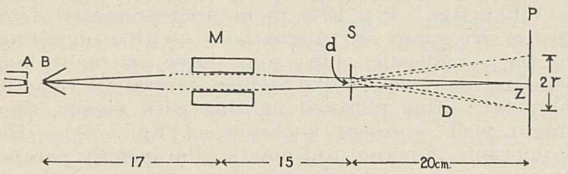

FIG. 1.

the focusing is, strictly speaking, not ideal. The width is approximately $(r/D)^2d$ where r is the radius of the ring. In the accompanying photographs (Fig. 2), r/D is of the order of 1/10 for the largest ring and d about 5 mm. The width of the rings due to the imperfect focusing is therefore only about 5/100 of a millimetre.

The magnetising current necessary for the focusing depends for a given apparatus essentially upon the velocity of the electrons. The adjustment is so sensitive that the current can be used directly for calibration. In the present apparatus it can be read to about 1 per cent. The determination of the electron wave-length λ is further simplified by the fact that the magnetising current is simply inversely proportional to λ over a fair range.

The use of wide beams also facilitates the otherwise rather difficult preparation of the specimens. It is, for example, feasible to use fine metal gauzes for their support. Local unevenness of the samples becomes less important owing to the averaging effect of the large area exposed.

The intensity of the diffraction patterns is high on account of the large exposed area of the sample. With a single plate Wimshurst (Wommelsdorfsche Kondensatormaschine) giving about 100 microamperes at 20-60 kv., the diffraction rings from metals, salts

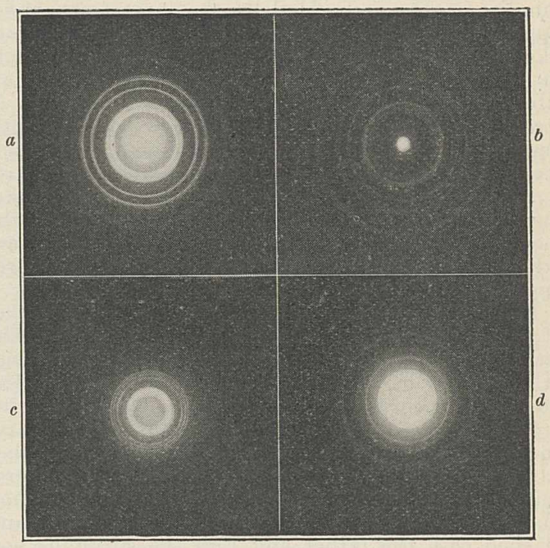

FIG. 2.—Electron diffraction patterns. *a*, Sodium chloride; *b*, gold leaf; *c*, paraffin; *d*, gold film produced by cathodic sputtering.

and paraffins can easily be observed on a fluorescent screen. The time of exposure of a photograph varies from a fraction of a second to a few seconds. The photographs accompanying this note have been obtained under these conditions. The distance specimen to plate was 20 cm.

I wish to express my deepest gratitude to Sir William Bragg for permission to do this work in the Davy-Faraday Laboratory and to Dr. A. Muller, of the same Laboratory, for constant help and valuable advice.

A. A. LEBEDEFF
(Optical Institute, Leningrad).

Davy-Faraday Laboratory,
Royal Institution,
July 23.

Acromegaly in the Far North.

IN his letter in NATURE of Aug. 8 on the pituitristic character of Egil Skallagrimson, Prof. Seligman has brought forward a remarkable subject which made a forcible impression on myself some years ago. His opinion of the Gardariki skull confirms the existence of pituitary disorder among the viking Scandinavians, but he does not allude to the very peculiar features which distinguish Egil's case from common clinical conditions, nor to the interesting heredity which the sagas record.

Egil closely resembled his father, Skallagrim, and paternal grandfather, Kveld Ulf, in "growth, appearance, and bent of mind" (Egla S. xx., xxxi.); while the name of the latter suggests that he recalled his maternal grandfather, Ulf the Fearless, who was ancestor through a son, Hallbjorn, 'Half-Troll' (half-giant), to the equally remarkable family of Ketil Haeng, culminating in Grettir the Strong, whose bones, like Egil's, were dug up in a churchyard and admired for their astonishing size (Gretla S. lxxxiv.).

Gigantism seems to have become endemic in the

Fyrdafjord district of Sogn (Norway), where Skallagrim was able to find a dozen near his home who were " more like giants in growth and seeming than mortal men . . . all the strongest men and many shape-strong ", men who, like their chief and his father, used to run ' berserk ' in fits of uncontrollable rage followed by exhaustion (Egla S. xxv., xxvii.).

After the emigration to Iceland three of these giant families can be recognised by the same features reappearing in their descendants : that descended from Skallagrim, that of Giant-stead, and the descendants of Ani, among whom we may note a grandson, Steinar, who was " of all men the biggest and mighty of strength, an ugly man, crooked of growth, long-legged and short of body . . . quarrelsome and headstrong " (Egla S. lxxx.). Here again are signs resembling pituitary disorder, coupled with a morose, uncertain temper. Thorir, 'Long-chin', one of the most famous berserks, and Ofeig, 'Clumsy Foot', are other cases where characteristic pituitary features appear in a berserk family.

Egil and his father were noted for premature greying of their black hair with baldness at twenty-five. The father and grandfather of Grettir, in the line of Ofeig, 'Clumsy Foot', were also prematurely grey. The precocity, both mental and physical, of Egil and his brother may be associated with this premature senility, and possibly indicate a correlated excess of either adrenal or pineal function. Skallagrim had several children who died young, but there is no suggestion that they suffered from a total premature senility, and in such case the father and Egil the surviving son would scarcely live to the ages of 88 and 81 respectively, or perform astonishing feats of strength on the day of death.

Grettir, far from being precocious was distinctly backward, and seems unexpectedly feeble in the development of genitalia (Gretla S. xiv., lxxv.) : possibly in his case pituitary disorder passed into a stage of hypo-function, but he was in full vigour when killed at 35. Although mentally very alert and a clever poet like Egil and Skallagrim, Grettir like his father was noted for laziness, which also suggests hypofunction. On the other hand, the Egil family were unusually brisk ; but Thorbjorg the Fat, a granddaughter of Egil, may have developed pituitary hypofunction. Egil had also, and Grettir was credited with a son who died at 17, after promising to develop into something altogether extraordinary (Gretla S. lxvii.)

The tendency to berserk (*hamask*), so obviously resembling the running *amok* of Malays, was closely interwoven with " shape-changing " or being " shape strong " (*hamrammr*, vide T. R. Eddison, 1930, "Egil's Saga", notes, p. 245 ff.; and Du Chaillu, 1889, " Viking Age ", ii. p. 425). The latter may broadly be regarded as peculiar behaviour in the dusk, such as sleepiness and surliness (Kveld Ulf), berserk fits (Skallagrim), mad drinking fits (Egil), dusk prowling, supposedly in animal shape (Storolf Haengson), terror of the dark (Grettir). We may imagine that evening terrors would provoke an adrenal release which might become translated, in those with constitutional adrenal excess, into a fit of berserk rage. Berserk fits, being involuntary, may also be compared with the 'uncinate' epileptiform seizures of pituitary hypertrophy, and there seems to be a strong hysterical element, because the subject was believed to be impossible to wound, which may mean that he was insensible to pain and did not bleed from non-arterial traumata.

As regards heredity, I have traced 52 male and 19 female descendants of Ulf the Fearless in 12 generations. Seventeen of the males are recorded as peculiar in one or more of the above ways, 6 others probably were so, but details are not available in the sagas at my hand, and of these 4 males evidently transmitted the heritage : 4 males transmitted without being noticed as unusual themselves. Females naturally have attracted less attention, but 3 of the 19 seem to have been unusual and 8 transmitted. Skallagrim and Grettir were each the offspring of berserk families on both sides—among 14 members of the associated families, 7 seem to have been peculiar ; while the two other berserk families from Fyrdafjord referred to above include 7 peculiar among 9 individuals. In brief, half, of both sexes, may be believed to have had a peculiar hereditary constitution ; and the condition seems not to be sex-linked. These details are drawn from the well-known sagas of Egil, Grettir, Laxdale, Burnt Njal, and the Norse Kings : lack of space makes publication of the genealogical table inadvisable, while it may yet be improved by reference to the sagas of Ketil Haeng and others not yet translated. It is certain that descendants of Ulf the Fearless settled in Greenland, because, soon after its discovery, fourteen ships reached that land from Borgafjord of Skallagrim's settling, and Breidafjord the home of Grettir's mother, through whom he derived from Ulf : it is therefore quite possible that the Gardariki skulls include some of Ulf's descendants.

The description of the unusually tall Grettir as " a handsome man . . . with a face rather broad and short, red-haired and somewhat freckled " (Gretla S. xiv.), places him at once as that well-known German-resembling Caledonian type which attracted the attention of Tacitus ; it also suggests the much more ancient Cro-Magnon with dysharmonic face, a conspicuously giant type.

On the other hand, the Egil family, with its black hair, great height, thick skull, prognathism, precocity, and fits of rage, is curiously parallel to the tall negroid in everything except indolence, which was certainly displayed on the Grettir side, and pigmentation of the skin. *Hamrammr* may even be compared with the ' Leopard Society ' prowling of West Africa. This parallel is interesting, because rock-tracings at Tanum in South Sweden introduce us to sea raiders and settlers who were familiar with the leopard, the camel, the ostrich, and the turtle, as pointed out by Du Chaillu ("Viking Age", ii. p. 124). Some are represented of immense size, many are prognathous—with a suggestion of the acromegalic chin—some have unusually long legs and short bodies like Steinar, several are remarkably fat ; often pictured fighting with vigour, they might well represent ancestors of Egil. Also the Fomorians, supernatural giants, who exactly parallel the Scandinavian Trolls in Irish tradition and played the part of vikings in their earliest history, were explained as " sea-raiders from Africa " by the medieval scholarship in Keating's well-known " History of Ireland ". As a hypothesis, the tall and fair Scandinavian, or even taller red Caledonian, raiding up and down the Atlantic coasts in very early days, might conceivably contact with the tall negroids of Jaloff, and thus acquire with captured women the seeds of a black-haired stock unbalanced in many ways and marked by excessive height, such as that producing Egil Skallagrimson.

MICHAEL PERKINS.

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APART from the high scientific value of Prof. Hogben's comments,[1] there is an immediate practical application.

Cases of infantilism—not the most severe—due to hypo-function of the anterior portion of the pituitary, though not very uncommon, are extremely difficult to treat, since no harmless reliable extract of the gland suitable for hypodermic injection is yet on the market and authorities are still doubtful as to how far anterior pituitary extract is absorbed when given by the mouth. If, as suggested, the gland is stimulated by light, then such individuals should profit by a stay during the darker part of our English year at higher altitudes, in areas with more sunlight than we get in this country. It happens that for some years I have been interested in a case of moderate infantilism due to anterior pituitary deficiency, and the improvement during a year in Switzerland (beginning in the autumn) at a height of about 3000 feet, with bright days and a good deal of snow in winter, greatly exceeded the progress made in any previous year in a boarding-school in the south of England, the hours of work indoors not being very different. That the psychic conditions were more favourable in Switzerland should, however, be taken into consideration.

C. G. Seligman.

Toot Baldon, Oxford,
Sept. 3.

[1] Nature, 128, 375, Aug. 29, 1931.

An Oxidisable 'Active Nitrogen'.

In the earlier part of this century it was often the practice to decolorise flour by exposing it to dilute nitrous gases obtained by sparking air, and in studies made by Leetham (1903) and Cramp and Hoyle (1907) it was found that the bleaching properties of the gases thus prepared were much enhanced if the air were ozonised before it entered the small H.T. arcs in which the nitrogen oxides were formed; this effect could be traced to an increase in the yield of nitrogen peroxide when ozone was present in the air supply.

In 1912 Lowry investigated the phenomenon quantitatively by photographing the nitrogen peroxide absorption spectrum in a column of gas 64 ft. long, this great length being rendered necessary by the extensive dilution of the substance being measured (1 : 3000 to 1 : 1000), and found that the effect could also be observed when the air was treated with ozone *after* being sparked; from this and other evidence of less importance he concluded that an unstable modification of nitrogen, which can be oxidised by ozone but not by oxygen, is produced in the main discharge. As the Rayleigh active nitrogen does not react either with oxygen or with ozone we have made a further examination of Lowry's very interesting claims, but using a different, and, we believe, an entirely new, technique of measurement of the nitrogen peroxide.

Our method depends upon the fact that the spectral region wherever nitrogen peroxide absorbs most strongly is close to that at which a vacuum potassium photocell is most sensitive (namely, the blue-green), and we have found that when intensity of light transmitted (calculated from the photoelectric current) is plotted against concentration of absorbent gas, the Beer-Lambert law holds between 0·01 and 3·25 per cent NO_2, the range wherein we have worked. It is thus possible to effect practically instantaneous determinations of nitrogen peroxide, and by suitable choice of (*a*) length of gas column, and (*b*) accuracy of measurement of photoelectric current, the method can be made to give results much more exact than those obtainable by ordinary spectroscopic means; in our work, where concentrations of 1 : 3500 to 1 : 1000 have been encountered, we have used a column only 8 inches long but with a 6 ft. column, 1 part of NO_2 in 75,000 of air may easily be determined.

We have made an extended search, using both pure nitrogen and nitrogen-oxygen mixtures over a wide range of experimental conditions, for any oxidisable modification of nitrogen or for any nitrogen oxide which may react only with ozone and not with oxygen, but have obtained no evidence for any such substance, although we have confirmed the earlier findings as to the increase in NO_2 yields when the air is ozonised before or treated with ozone after it is sparked; this last effect may, however, be observed only when the time which elapses between the gas leaving the spark and entering the measuring tubes is very small.

The explanation of the results obtained by earlier investigators would, therefore, appear as follows. The primary product of the spark in air is nitric oxide, which can change to nitrogen peroxide either by the slow termolecular reaction with oxygen or by the rapid bimolecular reaction with ozone. We have calculated, from an application of Bodenstein's data (1919) upon the kinetics of the former reaction to the experimental data given by Lowry, that under his usual conditions the NO would be less than half oxidised before it reached the downstream end of his 64 ft. trunk, whereas with ozone present the oxidation would be complete even before the gas entered this tube.

This calculation has been entirely verified in experiments in which two absorption tubes have been used, one immediately below the discharge and the other some distance from it; the concentration of NO_2 measured in the first is much less, at high flow speeds, than in the second, whereas, as the gas velocity is gradually reduced the difference becomes progressively smaller and finally disappears, an effect which is paralleled by Lowry's observation that the effects of ozonising either before or after sparking are negligible at small flow speeds.

We would point out that Lowry several times suggests that the slow oxidation of nitric oxide by oxygen may account for his observations, but, possibly owing to there having been no accurate data available upon the kinetics of the reaction at the time of his investigations, rejects this explanation in favour of that already mentioned: hence, while we can confirm his experiments, we cannot, in the light of present knowledge, accept his theory.

A full account of these experiments will shortly be published.

E. J. B. Willey.
S. G. Foord.

The Sir William Ramsay Laboratories of
Physical and Inorganic Chemistry,
University College, London,
Aug. 22.

Cytology of *Anchusa* and its Relation to the Taxonomy of the Genus.

Anchusa myosotidiflora was placed in the genus *Anchusa* by Lehmann [1] in 1818 after being originally described as *Myosotis macrophylla* by Marschall [2] in 1808. In 1851, C. Stevens [3] assigned it to the newly described genus *Brunnera*, calling it *Brunnera myosotidiflora*. This splitting of the genus, however, was not accepted until the almost simultaneous publications of Ivan M. Johnston [4] and O. Stapf [5] appeared, the species being regarded as members of *Anchusa* by M. Gürke [6] and others. Johnston concluded that *A. myosotidiflora* with its variety *grandiflora* and *A. neglecta*, because of their "peculiar nutlets, leafy and ranker habit, and different inflorescence", fully deserved the position given them by Stevens. He accordingly retained them in the genus *Brunnera* and by following the law of priority as *B. macrophylla*, *B. sibirica*, and *B. orientalis*.

Caryolopha sempervirens (L.) Fischer and Trautvetter[7] (1837), like *Brunnera*, was also referred in more recent works to the closely related genus, *Anchusa*, but on morphological grounds Johnston considered it also merited recognition as generically distinct from *Anchusa*.

A tabular comparison of Johnston's arrangement with that of Gürke, with a summary of my own cytological observations (Fig. 1), is given below.

Gürke's Classification.	2*n* Chromosome Number.	Chromosome Types Classified according to Position of Point of Attachment.			Chromosome Length in Microns.		Johnston's Classification.
		Sub-terminal.	Median.	Sub-median.	Shortest.	Longest.	
Anchusa Barrelieri	16	2	4	10	4·2	6·1	*Anchusa Barrelieri*
,, *ochroleuca* seedling	24	3	6	15	5·5	8·0	,, *ochroleuca* seedling
,, *italica* var. 'Pride of Dover'	32	4	6	22	4·7	8·5	,, *italica* var. 'Pride of Dover'
,, *officinalis*	16	2	6	8	5·9	8·5	,, *officinalis*
,, *hybrida*	16	2	6	8	5·2	7·8	,, *hybrida*
,, *sempervirens*	22	4	6	12	1·8	3·8	*Caryolopha sempervirens*
,, *myosotidiflora*	12	4	2	6	1·4	3·0	*Brunnera macrophylla*

It is apparent that Johnston's changes in classification are fully substantiated by the microscopical observations, for both *Brunnera* and *Caryolopha* differ markedly from each other and from *Anchusa* in size, type and number of chromosomes. Nevertheless,

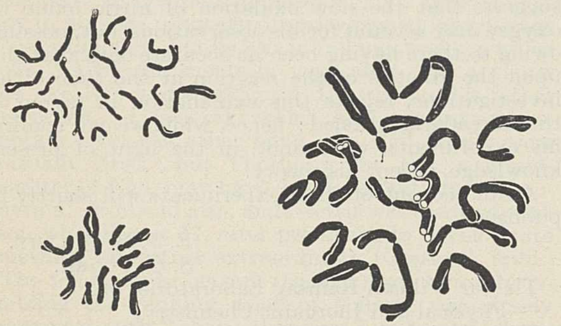

FIG. 1.—Chromosomes of *Caryolopha sempervirens* (top left hand); *Brunnera macrophylla* (bottom left hand); *Anchusa officinalis* (right).

while recognising that collectively these differences justify the generic changes, there is to be seen a definite similarity between certain chromosomes of all three genera which may possibly indicate the moderately close relationship which Johnston assumes exists between them.

In a less abbreviated account to be published shortly, it is hoped to indicate more fully the value of cytology as a corroborant of herbarium methods in the classification of plants.

S. G. SMITH.

Department of Botany,
McGill University,
Montreal.

1 "Plantæ et Familia Asperif. nuciferæ descripsit." Berlin; 1818.
2 "Fl. Taur.-Cauc.", **1**, Leipzig; 1808.
3 *Bull. Soc. Nat. Moscov.*, **24**, 1; 1851.
4 Contrib. Gray Herb. of Harvard Univ., **73**; 1924.
5 *Curtis's Bot. Mag.*, **151**, Tab. 9110; 1925.
6 In Engler and Prantl, "Die naturliche Pflanzenfamilien", **4**, Abt. 3a: 71-131. Leipzig, 1893.
7 *Ind. Sem. Hort. Petrop.*, **3**; 1837.

Thrips tabaci as a Vector of Plant Virus Disease.

IN NATURE of June 6, Dr. Kenneth Smith reports finding *Thrips tabaci* Lind. to be a vector of tomato spotted wilt in England. Since recent Australian work on the transmission of this disease has not yet been published, the following particulars may also be of interest:

The first record of successful insect transmission of tomato spotted wilt was made by Pittman,[1] who described three experiments with thrips; the insects used in the last of these experiments were identified by an entomologist as *Thrips tabaci*. Later, Samuel, Bald, and Pittman published a bulletin,[2] in which the main vector of the disease in South Australia was claimed to be the thrips *Frankliniella insularis* Franklin. In this bulletin a number of experiments with *Thrips tabaci* were recorded which proved negative, but the possibility that *Thrips tabaci* might act as a vector was not yet excluded. This was because transmission, even with *Frankliniella insularis*, was often so irregular that it was felt that some unknown factor influencing transmission had not been discovered. Another fact which indicated that *Frankliniella insularis* was not the only vector was that spotted wilt was a serious disease in Victoria, although *Frankliniella insularis* was extremely rare in Victoria.

In a bulletin now in the press, further work on transmission with *Frankliniella insularis* is described, in which it was found that when adult thrips were fed on a diseased plant and then transferred to healthy plants the disease was never transmitted. For successful transmission to occur, it proved to be essential that the thrips should have fed on the diseased plant in the *larval* stage. No analogous case with other insect vectors of virus diseases appears to have been described yet. (One of the writers, G. S., however, was much interested to find, on passing through Honolulu recently, that Dr. M. B. Linford, of the Hawaiian Pineapple Growers' Experiment Station, had discovered that *Thrips tabaci*, the insect vector of the yellow-spot disease of pineapple, was also unable to transmit the disease unless it had fed on a diseased plant during its larval stage.)

With this additional information of transmission, and also the fact that the incubation period of the virus in the thrips (*Frankliniella*) was found to be between five and seven days, the experiments with *Thrips tabaci* are being repeated. Already this species has been found to act as a vector of spotted wilt, as originally claimed by Pittman, and as now verified independently from England by Dr. Kenneth Smith. It is not yet known whether this, or possibly still another species of thrips, is the vector of the disease in Victoria. Several facts, however, suggest that in South Australia *Frankliniella insularis* is a more 'efficient' vector of the disease than *Thrips tabaci*.

Dr. Smith's observations on dahlia plants infected with spotted wilt are also interesting. In our forthcoming bulletin, besides thirty species of *Solanaceæ*, three species in the *Compositæ* and one each in the *Papaveraceæ* and *Tropæolaceæ* are proved to be hosts for the spotted wilt virus.

GEOFFREY SAMUEL.

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University of Adelaide.

J. G. BALD.

Council for Scientific and Industrial
Research of Australia,
July 24.

1 *Jour. Counc. Sci. and Ind. Res. Aust.*, **1**, 74; 1927.
2 *Counc. Sci. and Ind. Res. Aust. Bull.*, 44; 1930.

Lines of Large Frequency Shift in the Raman Spectra of Crystals.

PROF. F. RASETTI [1] has described lines in the Raman spectrum of fluorite and calcite, which show a remarkably large shift of about 7000 cm^{-1}. Owing to the theoretical importance of this fact, which would indicate the co-operation of electronic transitions of considerable energy in the Raman spectra, I wish to point out that these lines can be explained as lines of the phosphorescence of gadolinium. It is a well-known fact that natural fluorite nearly always contains rare earths. These earths, when excited by ultra-violet light or cathode rays, show a phosphorescence having a spectrum of very sharp lines. The spectrum of fluorite was examined by G. Urbain.[2] The following table shows that the observed lines coincide with the lines of phosphorescence of gadolinium.

$\Delta\nu$ from Hg λ2537.	Observed lines. λ	Lines of gadolinium, after Urbain. λ
7256	3109	3108
7273	3110	3110
7285	3112	3113
7298	3113	3115

The agreement is as good as the limit of error in the exact measurement of the lines of phosphorescence will allow. In addition, Urbain observed other lines between 3118 A. and 3147 A. That these lines were not observed in the Raman spectrum is easily understood. These lines coincide partly with the strong lines of mercury in this region, and further, Urbain showed that the lines between 3147 A. and 3132 A. disappear when the amount of gadolinium in the fluorite becomes very small. Conversely we can conclude that the material examined by Prof. Rasetti contained only a very small quantity of gadolinium.

An analysis of the spectrum of calcite is not possible, since the spectrum of phosphorescence of gadolinium in calcite has not yet been examined. The known spectrum in calcium oxide shows also in the spectral region under consideration the main lines of gadolinium.

Hence in the examination of materials which are likely to show a phosphorescence spectrum of sharp lines, the appearance of such lines, as well as the lines of the Raman spectrum, is, if they are excited with ultra-violet light, always possible.

It can also be seen from the above, that similar lines of large frequency shift are not recognisable in the examination of other materials, since they most probably contain no rare earths.

R. TOMASCHEK.

Physical Laboratory,
University of Marburg,
July 24.

[1] NATURE, April 25, 1931, p. 626.
[2] *Ann. de chim.*, 1909, and "Handb. d. Experimentalphysik", 23, 484; 1928.

The Fine Structure of Spectral Lines of Light Scattered by Liquids.

GROSS [1] has investigated by means of an echelon grating the fine structure of spectral lines scattered by liquids, and has found that in addition to the lines scattered without change of wave-length there appear new lines symmetrically situated relatively to the primary ones. The number of those new lines depends from the substance investigated, and the distance between them depends upon the angle formed by the incident and the dispersed rays.

Similar investigations were carried out by Vacher.[2] He used for that purpose a Fabry Perot interferometer. His observations, however, do not confirm Gross's results. Though he found that the primary line is widened by increasing the angle between the incident beam and the direction of observation, yet he states that this widening takes place only towards the long wave-length. Also, he did not observe the appearance of single lines.

The discordance between the results mentioned above induced me to undertake a similar investigation, using a different experimental arrangement. I put the vessel with the liquid investigated inside the mercury lamp, which had the form of a ring (the detailed description of the apparatus will be given in a paper which will be published in *Bull. de l'Acad. Pol.*). A current of 4½ amp. passed through the lamp burning at 110 v. The scattered light after passing through a monochromator fell on a Lummer-Gehrcke plate. I used in my experiments two different quartz plates of thicknesses of 3·92 mm. and 6·888 mm. and lengths of 13 cm. and 20 cm. respectively. In the case of benzene there does not appear in the scattered light any new line, though the components observed by Gross were of the same intensity as the primary component. Taking in consideration Gross's data, those lines should appear half-way between the neighbouring orders of the primary line. The spectra of the scattered light in both cases, benzene and white paper, differ only by the continuous background and by a slight widening of the lines which appears in the case of benzene. I obtained similar results with water.

The same experiments were undertaken with a different arrangement of apparatus; I irradiated the liquid at a definite angle (90°). In this case also the spectrum does not alter in any noteworthy way.

Since Vacher and I are not able to confirm the phenomenon observed by Gross by means of other interferometric apparatus (Fabry Perot interferometer and Lummer-Gehrcke plate), hence a more accurate investigation of that problem, and the explanation of the difficulties involved, would be desirable.

ST. RAFALOWSKI.

Physical Laboratory of the Society of
Sciences and Letters, Warsaw,
July 8.

[1] Gross, NATURE, **126**, 201, 400, 603; 1930.
[2] Vacher, *Phys. Ber.*, **12**, 1044; 1931. *C. R.*, **191**, 1121-1123; 1930.

Vitamin A and the Antimony Chloride Reaction.

FOR the determination of vitamin A by means of the reaction of Carr and Price, the blue colour of the mixture is estimated with the Lovibond tintometer. If analysed by the spectroscope, the blue mixture shows two absorption-bands at 572$\mu\mu$ and 610$\mu\mu$ respectively (Morton). The blue colour depends only on the intensity of the 610 band.

Recently Morton and Heilbron have announced that the strength of different vitamin A preparations corresponds better with the extinction of the mixture in the 572$\mu\mu$ region than in the 610$\mu\mu$ region.

We can confirm this by the following facts: By treating a vitamin A preparation from saponified cod liver oil or saponified extract of cow's liver with some drops of furan, methylfuran, pyrrol, indol, or skatol (all substances of related chemical structure) and then adding antimony chloride, the mixture turns purple instead of blue, and in the spectroscope the 610$\mu\mu$ band is no longer seen, while the 572$\mu\mu$ band remains unaltered. The physiological activity is unimpaired and the preparation (without antimony chloride) shows the $328\mu\mu$ band just as the original substance did.

It is known that liver may contain indol-like substances and so it can be understood that in some vitamin A preparations the $572\mu\mu$ band is the stronger and in others the $610\mu\mu$ band is the stronger. In fact, we have obtained saponified vitamin A preparations in which the two bands were of equal strength and others in which either the $610\mu\mu$ band or the $572\mu\mu$ band was the more intense.

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Effect of Light on the Surface Tension of Boys's Soap Solutions.

WHILE investigating the phenomenon of the surface tension of different dilutions of Boys's soap solutions (2·5 per cent sodium oleate and 25 per cent glycerine in water) I found that, whenever the solution was exposed to light, there was an abrupt but small fall of surface tension of the solution; but when the solution was kept in a cool, dark room, this abrupt change was not noticed during the experiment, if all the other conditions remain the same.[1]

In 1924, Du Nouy [2] found that the surface tension of colloidal solutions is not constant, but decreases rapidly as a function of time, and concluded that this phenomenon is due to the adsorption of the molecules in suspension, in the surface layers, as a function of time.

I have found now, by two different methods, namely (1) the surface tension balance method[3] and (2) the weighing method,[4] that the decrease in surface tension is a function of the time for which the solution is exposed to light, and not a mere function of the time as found by Du Nouy. The dark time—that is, the time for which the soap solutions are kept in a cool, dark room—has almost no effect on the surface tension of soap solutions. A possible reason for this is a chemical action, not adsorption in the surface layers alone.

The detailed study of the investigation, with observations, curves, and discussion, will soon appear in the *Indian Journal of Physics*, Calcutta.

L. D. MAHAJAN.
Physics Laboratory, Mohindra College,
Patiala, India, July 20.

[1] L. D. Mahajan, "The Surface Tension of Different Dilutions of Boys's Soap-Solution", *Phil. Mag.*, in press.
[2] Du Nouy, P. L., "Surface Tensions of Colloidal Solutions and Dimensions of certain Organic Molecules", *Phil. Mag.*, vol. 48, August 1924, p. 264.
[3] Warren, E. L., "Surface-tension Balance", *Phil. Mag.*, No. 27, August 1927.
[4] "Properties of Matter", by Poynting and Thomson, p. 161.

Inheritance of Melanism in Moths.

IN 1926, Prof. J. W. Heslop Harrison and Dr. F. C. Garrett published an account of experiments in which the moth *Selenia bilunaria* was fed upon hawthorn foliage which had been artificially contaminated with salts of lead and manganese respectively. In the second generation of moths fed upon the treated material, melanic forms appeared, and the melanism afterwards was inherited on Mendelian lines. No melanics appeared in the control moths fed upon untreated foliage.

So important are these results as regards the origin of mutations that a repetition of the experiments was begun at the John Innes Horticultural Institution in 1927. Three families from three different localities have been reared, one for five and two for six inbred generations. After two generations fed upon untreated foliage had been raised, in order to ascertain that the material was genetically pure, portions of each family were fed upon foliage treated with lead and manganese respectively, a control portion being also retained on untreated foliage. In all, 1231 control, 1472 lead treated, and 283 manganese treated moths have been reared, and no signs of melanism have appeared in any individual. Analysis showed that the lead, at any rate, was present in the moths of the final generation reared.

A detailed account of the experiments is being prepared for publication; the results, being negative, lead to no immediate conclusions on the hypotheses that had been advanced to account for the results of Prof. Harrison and Dr. Garrett.

A. W. MCKENNY HUGHES.
John Innes Horticultural Institution,
Sept. 12.

The Structure of the Spectrum Se III.

THE analysis of the spectra Se IV and Se V has been reported by us in a previous paper.[1] The experimental data described there have led further to the identification of a system of energy-levels characteristic of the spectrum of doubly-ionised selenium. Combinations between the deepest terms $4s^2 4p^2$, ^3P, ^1D and the terms $4s^2 4p5s$ ^3P, ^1P have been established by comparison with the spectra of Ge I and As II (unpublished data by K. R. Rao). About two hundred lines belonging to the spectrum have entered into the scheme. The $4s^2 4p^2$ term-differences are $^3P_0 - {}^3P_1 = 1740$, $^3P_1 - {}^3P_2 = 2196$, $^3P_2 - {}^1D_2 = 9095$, the $4s^2 4p5s$ differences are $^3P_0 - {}^3P_1 = 504$, $^3P_1 - {}^3P_2 = 3610$, $^3P_2 - {}^1P_0 = 1265$, and $4s^2 4p^2\ {}^3P_2 - 4s^2 4p5s\ {}^3P_2 = \nu 126454$ ($\lambda = 790 \cdot 80$).

The above work was done partly at the Imperial College, London, and partly at the Physical Laboratory, Uppsala. A full report will be published later.

J. S. BADAMI.
K. R. RAO.
Physikalisch-Technische Reichsanstalt,
Berlin, Aug. 7.

[1] *Proc. Roy. Soc.*, vol. 131, p. 154; 1931.

Group-Capt. Martin Flack.

IN my obituary notice of the late Group-Capt. Martin Flack, I mentioned the fact that, "beginning research with Sir Arthur Keith, he discovered anatomically the sinu-auricular node". These words perhaps do not express fully enough the debt which Martin Flack owed to Sir Arthur, who had been searching for such a structure. He put Flack on to the examination of the heart of a mole, which first gave clear evidence of a structure of which he (Sir Arthur) had found some evidences in the human hearts sent to him for examination by Sir James Mackenzie. Flack completed the discovery by experimental evidence, in the case of hearts of living animals.

LEONARD HILL.
Sept. 11.

Radioactivity and Earth Movements.

IN a notice of my Glasgow lecture on this subject (NATURE, Sept. 5, 1931, p. 419) occurs the passage: "Amongst other instructive conclusions are that 'we may regard the Pacific crust as being like that of the continents' (p. 570)". As I have already received several invitations to justify this alleged "conclusion", I wish to point out that what I actually wrote was: "we may therefore regard the Pacific crust as being like that of the continents, but with gabbro passing down into amphibolite in place of the sialic upper layer".

ARTHUR HOLMES.
Durham, Sept. 12.

Research Items.

Hawaiian Temples.—In the course of a study of the archæology of Kauai Island, Hawaii (*Bull.* No. 80, Bernice P. Bishop Museum), Dr. Windell Clark Bennett describes the various types of *heiaus* (temples), of which there are traces, and discusses their uses and affinities. To-day only their foundations survive. Temple forms are influenced by two factors. Many old temples were remodelled by later chiefs ; and the temple architect was a priest whose business it was to study the forms of old *heiaus* and design new ones, incorporating features which seemed to him the cause of the success of important *heiaus*. A great confusion of forms and features was the result. The principal types in both small and large *heiaus* are those (1) with open platforms, (2) walled enclosures, (3) terraced platforms; each of these in the group of larger *heiaus* having several subdivisions. In function the *heiaus* fall into five general classes : (1) The sacrificial *heiau*, called by various names, but chiefly *luakini* and *pookanaka*. (2) The agricultural *heiau*, for which one of the commonest names was *heiau hoouluulu*. Its purpose was to induce rain, increase the crops, and fulfil any other purpose useful to agriculture. (3) Fishing shrines, *hoa*, located along the shore and used in sacrificing to the fish god in order to increase the catch of fish. (4) The *pohaka o kane* or family *heiau*, for private prayer or worship. (5) Miscellaneous *heiaus*, including a great variety of *heiaus* built by lesser chiefs and priests for such purposes as circumcision, aid in child-birth, impelling love, paying debts, surf riding, hula dancing, and tapa making. To-day the purpose of the *heiaus* is little known and the information given is likely to be faulty. There seems to be no connexion between the functional and descriptive classifications.

Malaria in South Africa.—An important survey of the distribution and conditions of spread and of control of malaria in the Transvaal and Natal has been carried out by Prof. N. H. Swellengrebel (" Report on Investigation into Malaria in the Union of South Africa, 1930–31 ". Union of S. Africa : Dep. Pub. Health, Pretoria, 1931). Of some twenty species of anopheline mosquitoes met with in these two countries, only two, *A. costalis* and *A. funestus*, are of practical importance as vectors of malaria, because they alone enter into such close contact with man that they become infected ; this fact much simplifies anti-mosquito, and particularly anti-larval, measures. Interesting details are given of the distribution of various species of anopheline larvæ that may occur in the collections of water met with on an average farm. The prophylactic use of quinine and screening from mosquitoes are found definitely to reduce the incidence of malaria, judged by the ' spleen rate '. Thus the spleen rate among children was 88 per cent in unscreened farms and 44 per cent in screened ones, even though these measures were far from perfect. Recommendations are made for the control of malaria, and include the formation of an administrative control unit and a research field station, instruction of school teachers and of future farmers' wives in the principles of hygiene and anti-malarial measures, promotion of the sale of quinine by the Government, and a system of medical examination of recruited labour before acceptance, so that malaria carriers may be detected and excluded.

Starch Digestion in Silkworms.—It is widely believed that the nutrition of herbivorous insects depends chiefly upon the carbohydrates, starch especially, of their food substances ; and in regard to the silkworm it has even been recommended that the nutritive values of mulberry leaves might be determined by the iodine reactions of the leaves. Osamu Shinoda shows that in one race of silkworm (" Hasegawa-Shimpaku ") starch is not digested at all (*Annot. Zool. Japon.*, vol. 13, p. 117; 1931). Since the sugar content of the leaves is too low to sustain the life of the larva, whence does it synthesise the carbohydrates ? Apparently from proteins, in the presence of desamidase, which is shown to exist in the blood of the fifth instar larvæ experimented with. Another significant discovery was that the wall of the hind-gut was impermeable to glucose, and this leads the author to suggest that the symbiont hypothesis of hind-intestinal organisms in various xylophagous insects (for example, the protozoa of termites, or bacteria of lamellicorn beetle larvæ) requires many more confirmatory experiments.

The Permeability of Protoplasm to Water.—The rate of contraction of the protoplast in a cylindrical plant cell, such as the filament of *Spirogyra* provides during the process of plasmolysis, proceeds so regularly and symmetrically that the volume alterations of the protoplast with time can readily be measured. The velocities thus obtained must either be determined by the rate at which the external solution is penetrating the cell wall, or by the rate at which the solvent, water, is leaving the protoplast. In *Die Naturwissenschaften*, July 24, 1931, Bruno Huber shows that good grounds exist for regarding the velocity of such volume changes as a measure of the permeability of the protoplasm to water. When such measurements are extended over a wide range of biological material, it is evident that the living protoplast has a characteristic water permeability, very different in different objects, in different species, or even in different tissues of the same plant. In a study of the cells of the stem hypodermis of *Majanthemum bifolium*, it appeared that the permeability of the protoplast for water was 10,000 times as high as for cane sugar, 600 times as for potassium nitrate, and 120-140 times as for urea. These data supply interesting quantitative evidence for the ' semi-permeability ' of protoplasm in which, as Lillie expressed it (*Amer. Jour. of Physiol.*, **45**, p. 406; 1918), " a high degree of semi-permeability . . . appears to require a high degree of impermeability to water ".

Genetics of Japanese Morning Glory.—The genetics of the Japanese Morning Glory, *Pharbitis Nil*, has been studied entirely in Japan, during the last twenty years. The species shows much variation in flower-colour and pattern. In a paper by Yoshitaka Imai (*Jour. of Genetics*, vol. 24, No. 2) twenty-one genes affecting flower-colour have been studied. There are three different types of white, as well as purple, magenta, duskish tinged, speckled, rayed, flecked, etc. Flecked and duskish are two mutable genes. The former shows much variation and may give rise to self-coloured bud-sports. Normal plants derived by seed from the normal part of a mosaic flecked plant are in part homozygous normal and in part heterozygous for flecked. Some ' fringed ' flowers also arise, which are found to be periclinal chimæras. Duskish gives about one per cent of mutations to the normal blue, and also certain variegated types which vary widely.

Carboniferous Bellerophons.—A memoir by Dr. J. Weir on the " British and Belgian Carboniferous Bellerophontidæ " (*Trans. Roy. Soc.*, Edinburgh, **56**, 1931, pp. 767-861, pls. i.-ix.) completes the history of this group of Palæozoic gasteropods in the British area. The forms from the Ordovician and Silurian have already been described by Cowper Reed, and those from the Devonian by G. F. Whidborne in monographs published by the Palæontographical Society. Dr. Weir recognises 78 species and varieties of Bellerophontids in the Carboniferous belonging to 7 genera: *Bellerophon, Waagenella, Bucaniopsis, Patellostium, Tropidocyclus, Zonidiscus*, and *Euphemus*.

Quaternary Ice Margins (North Sea).—Prof. J. K. Charlesworth has published and described a valuable map of north-west Europe, showing the successive positions of the Quaternary ice-margins in the region of the North Sea (*Proc. Roy. Irish Acad.*, **40**, B (4), 1931, pp. 67-83). It is concluded that the Elster and Saale glaciations of Germany and Holland correspond to the older drifts of the British Isles. At the period of the Saale glaciation the ice-sheets were united and their margin over the North Sea cusp-shaped. The Newer Drift of the British Isles is equivalent to the Brandenburg stage of the Continent (or possibly to the Warthe stage). At this time the British ice was separate from the Norwegian ice and formed a piedmont mass over the western part of the North Sea. The Highland glaciation is of the same age as the Finiglacial stage of Fennoscandia; both were local in their distribution and bordered by the late-glacial sea. The new reconstruction, the first to be attempted by a British geologist, corrects certain errors in two of a series of maps recently published by Antevs to show the extent and distribution of the Quaternary ice-sheets in different parts of the world (*Bull. Geol. Soc. Am.*, **40**, 1930, pp. 631-720).

Curvature of Island and Mountain Arcs.—In NATURE for Nov. 15, 1930 (vol. 126, p. 787), an account is given of Dr. N. Kumagai's investigation of the form of the Japan islands arc. Prof. T. Terada has recently continued the subject, taking other insular arcs and several mountain ranges (*Earthq. Res. Inst. Bull.*, vol. 9, pp. 144-150; 1931). The island arcs belong to four groups, those of the Pacific Ocean, the West Indies, the Atlantic and Indian Oceans. The results are plotted by taking the latitude of the middle point of the arc as abscissa and the radius of curvature of the arc as ordinate. The diagram is divided into three regions by two straight lines drawn from the origin. The Pacific and West Indian groups lie in the middle region, a result that is of some interest, as the West Indies are usually cited as belonging morphologically to the same type as the Pacific islands. The Atlantic and Mediterranean groups lie in the sector of smallest radius of curvature, and the Indian Ocean group in that of largest radius. In the middle section, and to some extent in the others also, the radius of curvature increases with the latitude. A second diagram shows the corresponding relations for mountain-ranges, and it is worthy of notice that the European mountain arcs fall in the same zone as the Atlantic and Mediterranean island arcs, while the Asiatic mountain-ranges lie, like the Pacific islands arcs, in the middle zone.

Electrification of Coal Dust.—When, in ventilating a coal mine, air containing small quantities of coal dust in suspension is drawn or forced through metal ducts, it is found that the whirling action of the air on the dust is capable of electrifying the dust, and that the electric charges generated are communicated to the metal ducts. If these ducts are highly insulated, they may be raised in electrical potential sufficiently to cause sparks to pass from the ducts to surrounding objects. A research carried out by Messrs. S. C. Blacktin and H. Robinson, of the Safety in Mines Research Board, and issued as Paper No. 71 (London: H.M. Stationery Office, 6*d*.), shows that in order to get such sparks as would be sufficient to cause an explosion of firedamp in a mine, the insulation of the metal ducts has to be so good that under actual mining conditions it would only exceptionally be reached, and the chance of an explosion being produced by this cause is correspondingly small.

Generalised Thermodynamics.—Many attempts to derive the second law of thermodynamics from statistical theories have been made, but particular interest is attached to that given by Prof. G. N. Lewis in the July issue of the *Journal of the American Chemical Society*. The method differs considerably from those of classical thermodynamics and of statistical mechanics, and from a single postulate it is shown that the laws of thermodynamics and the laws of fluctuations are derivable as a generalised thermodynamics. The partition of a quantity x between two (or more) independent systems is made to depend on what are defined as specific probabilities, the ratio of which, for any two partitions, is postulated as dependent solely on the nature of the two systems and on their respective contents. The definition of temperature, entropy and its relation to fluctuations, and thence the general equations of thermodynamics, follow mathematically. Prof. Lewis considers that his postulate constitutes the first really valid statement of the second law of thermodynamics, and his deductions are certainly very interesting and rigorous.

Prediction of Isotopes.—The *Journal of the American Chemical Society* for August contains two papers dealing with the above subject. In the first, by H. L. Johnston, an arrangement which is a kind of periodic table is used, the atoms being arranged in order of isotopic mass numbers. The atoms are first arranged in four main types: the $4N$ type, with atomic weights exactly divisible by four, and regarded as composed of N alpha-particles; the $4N+1$ type, containing one free proton; and the $4N+2$ and $4N+3$ types, containing two and three free protons. A further classification is carried out, based on the number of 'free' electrons in respective nuclei, the numbers at the heads of columns representing nuclear electrons in excess of $2N$, which may be arbitrarily taken as nuclear electrons outside α-particles. Atoms experimentally observed and reported are shown, and possible but hitherto undiscovered atoms are indicated. The latter include Sr^{84}, Zr^{88}, Pd^{104}, Cd^{108}, Te^{120}, A^{38}, Ca^{42}, etc. Aston has directed attention to an isobaric triplet of mass 96, and the table predicts triplets of masses 77 and 124. Certain regularities in the table are emphasised as possibly having significance with respect to structural relationships within the nuclei. The second paper, by H. C. Urey, uses the plot of numbers of nuclear protons and electrons as co-ordinates, as proposed by Barton. The known nuclei lie on this diagram between two lines of slopes 2 and 1·61, there being well-defined clusters, each possessing an approximate centre of symmetry. The pattern from Li^6 to A^{36} is taken to indicate that all possible nuclei in this region are known, or unknown ones very rare. Between A^{36} and Cu^{63} there is a low density of points and irregularity, which seem to indicate unknown nuclei. A parallelogram pattern for these higher nuclei indicates many unknown nuclei. The structure of the nucleus is then considered on the lines of the hypothesis that it consists of helium nuclei, internal binding electrons, external protons, and external electrons, and it is shown that the isotopic isobars Io^{230} and UY may be expected.

Science and Curative Medicine.

IN the fifth Stephen Paget Memorial Lecture before the Research Defence Society (*Quart. Jour. Research Defence Soc.* summer issue), Dr. H. H. Dale gave some examples of the effect of research on curative medicine. After referring to the founder of the Society, in memory of whom the lecture was instituted, Dr. Dale pointed out the remarkable change which had come over therapeutics in the last thirty years. Not only have new drugs been introduced after experimental trial in the laboratory, but also the investigation of old drugs, found to be of use empirically, has resulted in explanations being obtained for their actions, so that they can be prescribed with confidence that they will be of value, rather than with the pessimism which feels that at any rate they will do no harm. Only passing reference need be made to insulin, salvarsan, ipecacuanha and emetine, as their therapeutic efficacy is so well known: but it might be pointed out that the experimental investigation of emetine led to the differentiation of the different dysenteries, for only one of which emetine is a remedy, and finally to the development of a method of cultivating the amœbæ *in vitro*, so that new substances likely to be of value in amœbic dysentery can now be tested first in the test-tube, without the use of experimental animals other than the amœbæ themselves.

Many active remedies are mixtures of different chemical compounds, which it is often impossible to separate by chemical means: even when prepared synthetically in the laboratory, it is not always possible to obtain them in the pure state, free from toxic or inactive by-products: their potency can only be determined by tests on animals or tissues obtained from them. Among these may be mentioned immune sera, the extract of the posterior lobe of the pituitary gland, insulin, salvarsan. Until the potency of pituitary (posterior lobe) extract was controlled under the Therapeutic Substances Act, 1925, one extract might be eighty times stronger than the weakest of a series. Nowadays all are standardised in terms of the International Unit, which is the same amount of activity, whatever preparation is used. Recently a particular make of foreign insulin sold in Great Britain for a short time was imperfectly standardised by animal tests: reports were received that patients relapsed into diabetes because the batch used was too weak, or suffered from dangerous symptoms because another batch was too strong. Animal tests indicated that the batches might be 40 per cent weaker or 60 per cent stronger than the indications on the labels. The controlling authority under the Therapeutic Substances Act had power to deal with this situation, and no more of such inadequately standardised insulin has been distributed. Insulin would never have come into practical use without control of its activity by regular tests on animals: if such tests were now abandoned, it would lose the greater part of its value in the treatment of diabetes.

In concluding his lecture, Dr. Dale referred to the work of the National Institute for Medical Research in preparing international and British standards for remedies requiring biological test and in developing suitable methods of assay; as well as to the researches being carried out in virus diseases.

Activity Coefficients and the Debye-Hückel Equation.

DISCREPANCIES between experimental results and calculations from the Debye-Hückel equation are known to exist even at high dilution with salts of higher valency, as well as for univalent types in non-aqueous solvents. Gronwall, La Mer, and Sandved have assumed that the incomplete mathematical solution of the Poisson-Boltzmann equation as given by Debye and Hückel might explain part at least of the discrepancy. They deduce, as a further approximation, the equation for the activity coefficient of a salt of symmetrical valency type:

$$\log f = \frac{-\epsilon^2 z^2}{kTDa} \cdot \frac{1}{2} \cdot \frac{x}{1+x} + \sum_{m=1}^{\infty} \left(\frac{\epsilon^2 z^2}{kTDa}\right)^{2m+1} \left[\tfrac{1}{2} X_{2m+1}(x) - 2m\, Y_{2m+1}(x)\right]$$

in which ϵ, z, k, T, D have the usual significance in the Debye-Hückel theory; $x = $ 'a' k, where 'a' is the distance of closest approach of the ions; and $X(x)$, $Y(x)$ are functions of x defined and tabulated through the fifth approximation, that is $m = 2$.

For values of $a/z^2 > 1{\cdot}5$ A., only the first term of this expression, corresponding to the Debye-Hückel approximation, is usually required, but for lower values, corresponding to 'a' < 6 A. for a bi-bivalent salt, the contribution of higher terms cannot be neglected. In low dielectric solvents the higher terms become important, and may even predominate over the first approximation even for 1, 1 valent types. The general solution should yield positive and physically reasonable values for 'a' which are constant over a legitimate concentration range.

La Mer and Parks, in the June number of the *Journal of the American Chemical Society*, describe experiments with cells involving the process $Cd + PbSO_4 = Pb + CdSO_4$ (using cadmium and lead amalgams), which were in good agreement with the theory for the region 0·0006 to 0·01 molal, and yielding positive constant (3·6 A.) values of 'a' which are physically plausible. The Debye-Hückel approximation gave impossible values of 'a'. If cadmium sulphate is dissociated incompletely in the classical sense, this influence on the activity coefficient is too small to be detected below 0·01 molal. It is also shown that 'a' is practically independent of temperature, so that hydration is probably not included in it.

Scatchard, in the same journal, points out that it is incorrect to calculate the heat of dilution from the interionic force formula by differentiation at constant volume, since the experimental data refer to constant pressure. The difference between the two heat quantities is small and can be determined, that between the two dielectric constants is probably also very small, but that between the temperature coefficients at constant pressure and constant volume is generally more important. The calculations are, therefore, made for constant pressure, which involves the addition of a term dependent on the thermal expansion of the solution. The difference is said to amount to about the error of measurement of heat of dilution in very dilute solutions. In the calculation the dielectric constant is assumed independent of concentration, but the extended calculation of Gronwall, La Mer, and Sandved referred to above is applied instead of the simple limiting law of Debye and Hückel. Even in the use of the limiting law, however, neglect of thermal expansion is shown to lead to considerable error.

Archæology and Surveying in Southern Rhodesia.

WE have at times had occasion to refer to difficulties placed in the way of archæological and ethnological research owing to vexatious regulations imposed by the governments of the countries in which research is to be prosecuted. It is not often that the other side of the picture is presented, and that an accredited expedition is known to have abused the privileges that have been granted. Our attention has been directed to a particularly flagrant case. The official report of the Debates of the Legislative Assembly of Southern Rhodesia for May 7 records a reference to the case of Dr. Frobenius, who, it will be remembered, conducted an expedition in Rhodesia in 1929 and communicated some of the results of his investigations at Zimbabwe and elsewhere to the South African meeting of the British Association in that year. Dr. Frobenius, it is stated, was in receipt of substantial assistance from the Government of Southern Rhodesia. A money grant of £92 : 4 : 0, representing half the costs, was supplemented by an equivalent share borne by the railways, and, in addition, a native commissioner was granted six weeks leave on full pay to assist him.

Notwithstanding the fact that, in return, Dr. Frobenius entered into an agreement to share any finds equally with the Government and to submit any specially valuable find to arbitration, the whole of the relics found were removed from the country without the knowledge of the Government. When this was condoned on the condition that they were divided up at Cape Town, they were removed to Germany. Since then Dr. Frobenius has returned such objects as he considers the share of the Government, and has refused either to return or to submit to arbitration the only gold object stated by him to have been found within the Colony. The Colonial Secretary, in making a statement on the matter, was good enough to contrast the action of Miss Caton-Thompson, on behalf of the British Association, in returning all her finds to the Colony.

According to the official report of the debates in the Legislative Assembly of Southern Rhodesia, in the debate on the estimates the deletion was moved of the item "Geodetic and Secondary Triangulation, £5000." In defending the appropriation the Minister of Agriculture and Lands pointed out not only that every self-respecting colony undertakes work of this kind as early as possible in its history, but also that had Southern Rhodesia started it earlier a great deal of money would have been saved. It would appear that much of the present cost of the Geological Survey is due to the fact that, before the Geological Department can pursue its legitimate work of mapping the geological formations, much preliminary work has to be done, which is made necessary by the fact that there is no Ordnance Survey to which reference can be made. Indeed, it was stated by another member that the surveyors who are engaged in the work of triangulation often have to refer to the Geological Survey for information. The Minister also referred to the position in the Union of South Africa. In the Boer war it was found that the maps of the country were utterly defective and a reproach. Immediately after the Union a triangulation of the whole country was begun, and the expenditure now stands at £20,000 a year. The result is that, as the Director states, the triangulation of the Union, which is just about completed, is as fine as any in the British Empire. The motion to delete the appropriation was withdrawn.

In the same debate reference was made to expenditure on afforestation, in which Southern Rhodesia is also pursuing a forward policy. Indeed, throughout the debates it is encouraging to note that the members of the Legislature are fully alive to the advantages of the application of science to the development of the colony, even if not immediately remunerative.

Exhibition of British Optical Instruments.

THE Loan Exhibition of British Optical Instruments which was opened at the Science Museum, South Kensington, on Aug. 28, will remain on view until the end of October, and will provide the public with an opportunity to see collected together in a comparatively small space representative exhibits contributed by most of the important optical firms in Great Britain.

Binoculars are very adequately represented by the exhibits of Messrs. Ross and Messrs. Barr and Stroud, among those of the former being a three power prism binocular telescope with objective aperture of 60 mm. Telescopes are exhibited by Messrs. Ross and Messrs. W. Ottway and Co., the latter firm showing also a selection of stainless steel mirrors. Photographic objectives designed for special purposes, such as aerial photography, the projection and taking of cinema pictures, etc., have received considerable attention by British manufacturers in recent years, and these are included in the lenses shown by Messrs. Ross and Messrs. Taylor, Taylor and Hobson. A portable cinematograph, taking standard size films, is notable amongst Messrs. Ross' exhibits.

Among the surveying instruments is the Tavistock theodolite, reading to one second of arc, which is made by Messrs. Cooke, Troughton and Simms, who are also exhibiting a 45° prismatic astrolabe. This instrument has been designed for the accurate determination of latitude and longitude on shore, and has been used with marked success by the Hydrographic Service of the Admiralty. Messrs. E. R. Watts and Son are showing a selection of 'constant' bubbles, the air-bells of which remain the same length over a wide range of temperature, a vertical magnetic force variometer, and various surveying instruments. A selection of 'Heath' sextants is shown by Messrs. W. F. Stanley and Co.

The collection of microscopes includes a new binocular instrument made by Charles Perry, according to the design of Prof. D. M. S. Watson, of University College, London, and a new model Vickers projection microscope. The latter, which is of very robust design, taking objects up to 50 lb. in weight, can be used for opaque or transparent objects at magnifications of from 3 to 5000 diameters, and is fitted up for demonstration. Other firms exhibiting microscopes are Messrs. J. Swift and Sons, Messrs. C. Baker, and Messrs. W. Watson and Sons. The last-named firm is exhibiting also a selenium densitometer, designed by the British Photographic Research Association, for determination of the density of photographic negatives.

An aerial camera, of a type which has been used all over the world, is exhibited by the Williamson Manufacturing Co. This takes 100 photographs (9 in. × 7 in.) with one filling. Topographical stereoscopes designed for use in examination of aerial photographs for surveying purposes are shown by Messrs. Barr and Stroud.

A small model Hilger interferometer for the correction of prisms and lenses is fitted up to show the optical imperfection of a piece of glass, and a strain viewer by the same makers is arranged to show strain in a glass tumbler. In addition to a spectrographic outfit for metallurgical analysis, Messrs. Adam Hilger are exhibiting an outfit for spectrophotometry in the ultra-violet region of the spectrum. Messrs. Bellingham and Stanley also are showing a spectro-photometry outfit. This apparatus assumes a special interest just now in connexion with the spectral test employed by Dr. Bendien in his experiments on cancer diagnosis. This consists of a spectrograph with quartz optical elements, and a photometer of the sector type driven by an electric motor; the photometer design is based partly on the suggestions recently made by H. J. McNicholas in the Bureau of Standards *Journal of Research*, vol. 1, pp. 942-949. Absorption measurements are obtained by taking a number of exposures, each with a different opening of the variable sector. On the resulting photograph, positions are found in each spectrum where the amount of light passing through the tube of solution is equal to that passed by the variable sector, and from the data obtained an accurate absorption curve can be obtained. Polarimeters for use in the visible and ultra-violet are shown by both these makers.

A rangefinder by Messrs. Barr and Stroud, specially adapted for short ranges in the Museum, is fitted up for demonstration. The internal construction of a rangefinder and various optical parts used in the construction are also shown.

Price catalogues of the instruments in the exhibition are available to the public.

The exhibition is on view during the normal opening hours of the Museum, namely, Mondays, Tuesdays, Wednesdays, Fridays, 10 A.M. to 6 P.M.; Thursdays and Saturdays, 10 A.M. to 10 P.M.; Sundays, 2.30 P.M. to 6 P.M.

Evolutionary Tendencies in the Jaws and Teeth.

DURING the recent International Orthodontic Congress in London, Prof. Elliot Smith delivered an address on "Evolutionary Tendencies in the Jaws and Teeth". He pointed out that, in the human child, there is a delay of four years after the milk teeth have erupted before the permanent teeth commence to appear, and a further ten to fifteen years are required to complete its dental equipment. Up to the seventh year, that is, during the pause between milk and permanent teeth, the child is growing a very large brain, and, again, for a further period of fifteen years or so, when his dental affairs are relatively sluggish, he is learning how to put his complicated cerebral equipment to its fullest biological uses. During this period he develops a chin, because the growth of the tooth-bearing part is restrained by the long delay in the eruption of his teeth. The delay in tooth and jaw development is undoubtedly due to the growth of the brain and the subsequent development of its full functions, which disturbs the orderly process of uniform growth of the jaws and eruption of teeth.

In the apes, the process of eruption of the second teeth follows more closely on that of the first teeth; the second permanent molars erupt before the deciduous molars are replaced by the premolars. Dr. Degerøl, of Copenhagen, has recently pointed out that, in Neanderthal man, the simian type of sequence was still retained in the eruption of his teeth. There are reasons for inferring that the defective chin development of Neanderthal man may be associated with this fact—that the precocious cutting of his teeth permitted the tooth-bearing part of the jaw to keep pace more nearly with the growth of the rest of the jaw and preclude the development of a chin.

In the evolution of man from his simian ancestors the two fundamental structural advances were the great growth of the brain and the changes in the facial region culminating in the development of a chin. To the consequences of these evolutionary changes must be ascribed the origin of the problems of orthodontia. There is no just reason for the belief that the reduction or absence of the third molar is a sign of the early disappearance of this tooth in the human species, or that dental troubles, such as crowding and displacement of teeth, are due to evolutionary changes now active.

University and Educational Intelligence.

CAMBRIDGE.—At St. John's College the following research exhibitions have been awarded: for biochemistry, M. C. Franklin, Canterbury Agricultural College; for experimental physics, R. H. Sloane, Queen's University, Belfast.

THE City and Guilds of London Institute gives prominence in its report for 1930 to the work of the South London Technical Art School established at Kennington in 1879 for training persons engaged in the art industries of the locality, which were chiefly modelling from terra cotta, and for the study of architectural decoration. The school occupies a unique and useful place and has trained the majority of the leading sculptors and some of the foremost painters in Great Britain. The Engineering College was attended by 522 students, a larger number than in any of the four preceding years, and the number of first-year diploma and undergraduate students and of special and post-graduate students was larger than in any year since before the War. The number of candidates examined at the Institute's technological examinations in Great Britain and Ireland and overseas (chiefly in India and Ceylon and New Zealand) increased, respectively, to 14,721 (more than in any year since the War) and 1608.

SOME trends in recent scientific research in America are reflected in statistics of the doctorates conferred in the sciences in American universities. These have been tabulated year by year since 1919 by the National Research Council, the annual bulletin of which on the subject constitutes a useful index to the relevant theses. The total number of these doctorates has increased every year, rising from 336 in 1921 to 1055 in 1930. Of the subjects of the 1055 theses on which science doctorates were conferred last year, about one-third are, as usual, in the field of chemistry. Next comes zoology with 100. Psychology has dropped from 112 to 92 and physics from 101 to 89. All previous records were broken in botany (81), mathematics (74), geology (63—previous record 45), engineering (49), physiology (46), geography (17), whilst the following universities conferred more science doctorate than they have ever done before: Wisconsin (86), Cornell (80), Michigan (55), Ohio State (50), Massachusetts Institute of Technology (29), Pittsburg (15), Virginia (12), Indiana (11), Kansas (11).

Birthdays and Research Centres.

Aug. 26, 1860.—Sir Thomas Ranken Lyle, F.R.S., formerly professor of natural philosophy in the University of Melbourne.

During the last ten years, in addition to being associated in many public utilities, both industrial and educational, I have, in conjunction with my private assistant, Mr. Z. A. Merfield, been carrying on researches aiming at the improvement of diffraction gratings and microscopic test-rulings. The late Mr. Grayson's ruling machines, which I purchased from his executors, have in many respects been reconstructed and improved.

We have developed a type of speculum metal with a high reflecting power which is untarnishable, and we can prepare and polish the ruling diamond so as to have any desired operating faces. Thus we are able to produce gratings by which the major portion of the incident light is diffracted into any desired spectrum.

We have supplied rulings to different research institutes, on speculum for optical work and on glass for X-ray investigations. We have also succeeded in producing microscopic rulings for ultra-violet investigations with rulings at rates up to 250,000 an inch.

The work is being continued ; at present, on further improvement of speculum and on more accurate temperature control of the ruling chamber.

Sept. 23, 1850.—Prof. Richard Hertwig, foreign member of the Linnean Society of London and formerly professor of comparative anatomy and zoology in the University of Munich.

Zurück blickend auf die sechsig Jahre meiner zoologischen Thätigkeit, empfinde ich es als ein grosses Glück, dass in diesen Zeitraum der gewaltige Aufschwung fiel, den die Biologie dem Wirken Darwins verdankt. Dieser Aufschwung kam zunächst der Morphologie zu Gute, der vergleichenden Anatomie und Entwicklungsgeschichte. In den letzten Jahrzehnten folgte die experimentelle Zoologie, die exacte Erblichkeits- und Variabilitätsforschung und die vergleichende Physiologie.

Mir will es sogar scheinen, als ob durch die grossen Erfolge der experimentellen Zoologie die morphologischen Probleme allzusehr in den Hintergrund gedrängt würden. Lange Zeit mit experimentellen Untersuchungen beschäftigt, habe ich mich neuerdings wieder der Morphologie der Radiolarien zugewandt und mich überzeugt, wie viel Interessantes hier noch zu entdecken ist. Die Morphologie bildet die Basis, auf der die Physiologie weiter baut. Wir müssen trachten, diese Basis ständig zu verbreiten und zu sichern. Damit werden wir auch der Palaeontologie und Thiergeographie gute Dienste leisten.

Sept. 23, 1850.—Prof. W. Mitchinson Hicks, F.R.S., emeritus professor of physics in the University of Sheffield.

I should like to publish a new edition of my "Analysis of Spectra", which is now out of print; but the advances in real observational knowledge and in that of spectral relationships since its appearance in 1922 are so enormous that it would be hopeless at my age to attempt it. I am anxious, however, to put into form for publication a connected account of the fundamental quantitative relations in spectra contained in that book and of new data in support.

Sept. 24, 1874.—Prof. Alex. Findlay, professor of chemistry in the University of Aberdeen.

The fact that Pasteur's method of resolving racemic compounds by crystallisation from solution has found application in only a small number of cases, provoked the investigations in which I have been engaged in recent years. What connexion, if any, exists between the constitution of a racemic compound and its stability relative to that of the active antipodes, and what are the factors which influence the temperature at which the relative stability of racemic and active forms undergoes change ? Answers to these questions have been sought by a study of freezing point and solubility curves.

I have also been much interested in the pædagogy of chemistry, and in my leisure time I am collecting materials for a history of chemical teaching in Aberdeen.

Sept. 24, 1865.—Prof. C. F. Jenkin, formerly professor of engineering science in the University of Oxford.

I am chiefly interested in investigations on the fatigue of metals and building materials; and in earth pressures.

Sept. 26, 1881.—Mr. P. P. Laidlaw, F.R.S., pathologist to the Medical Research Council.

I am at present engaged on the improvement of dog distemper anti-serum and the separation and purification of the most active constituent of whole serum, so that a therapeutic product of high potency can be secured at will. It is hoped that the knowledge gained from this study may be of assistance in the production and improvement of anti-sera for other virus diseases.

The outstanding problem for the research worker in virus diseases is believed to be luxuriant cultivation of viruses, apart from living cells, and it is hoped that many workers will endeavour to solve this problem.

Societies and Academies.

London.

Institute of Metals, Sept. 14 (Annual Autumn Meeting, Zurich).—**H. Waterhouse** and **R. Willows** : The effects of cold-rolling and of heat-treatment on some lead alloys. The hardness numbers of the cast alloys ranged from 5 to 18 Brinell. Cold-rolling hardened the soft alloys and softened the hard alloys, the hardness immediately after cold-rolling lying in all cases between 8 and 11 Brinell. Most of the alloys, especially those containing cadmium and antimony, were re-hardened to approximately the 'as cast' hardness by suitable heat-treatment, quenching and ageing. Certain alloys age-hardened after air-cooling or even more restrained cooling from the heat-treatment temperature. The age-hardness persists for several months at least, but is destroyed by severe cold-working and self-annealing.—**H. Sutton** and **L. F. Le Brocq** : The protection of magnesium alloys against corrosion. Of the methods of protection examined the most promising appeared to be that of chemical treatment of the surface followed by the application of lanolin or a suitable enamel.—**D. G. Jones, L. B. Pfeil**, and **W. T. Griffiths** : Nickel-copper alloys of high elastic limit. The elastic limit is low in substantially pure nickel-copper alloys in the fully annealed and in the cold-drawn conditions, but high elastic limits are developed in all compositions as a result of low temperature heat-treatment following cold-working. High elastic limits may also be produced in nickel-copper alloys containing small amounts of such elements as silicon, which render the alloys susceptible to heat-treatment.—**D. Hanson** and **I. G. Slater** : Unsoundness in aluminium sand-castings. (1) Pin-holes: their causes and prevention. To eliminate pin-holes treatment with nitrogen or with chlorine is sometimes successful, but cannot always be relied upon to produce castings perfectly free from pin-holes; titanium tetrachloride is effective with 'Y'-alloy, but was found to be less certain with other alloys, although the grain-refinement which it produces may make the pin-holes very small without reducing the total volume of the cavities. The most generally successful method is treatment with a mixture of equal parts of nitrogen and chlorine, by means of which all the alloys examined could be made practically sound by a treatment of twenty minutes' duration at 700° C.—(2) The effects of using metal previously subjected to corrosive conditions. The extent and amount of unsoundness produced depends upon the type and time of exposure, and also upon the particular alloy examined. The suggestion is made that the deterioration is the result of electrolytic action on corrosion, involving the liberation of hydrogen in the nascent state which is absorbed by the metal. On re-melting and casting, the hydrogen is evolved in the molecular condition and produces pin-holes.—William Hume-Rothery: The macro-etching of aluminium-silicon alloys. The macrostructure of aluminium-silicon alloys can be revealed satisfactorily by means of a solution of cupric chloride containing 150-160 gm. per litre. Etching is carried out by immersing the specimen several times in the copper chloride solution, the deposit of copper being removed between each immersion. A final brightening can be obtained by treatment with a dilute solution of chromic acid.—J. E. Newson and A. Wragg: Note on the failure of a high-strength brass. The reeling process for straightening, after extrusion, in the case of a brass with a high yield-point, is responsible for residual stresses of such an order that failure due to internal cracking may result during storage or on subsequent machining.

Paris.

Academy of Sciences, July 27.—C. Camichel, C. Crescent, and L. Escande: Contribution to the study of intermittent springs with underground gallery. Experimental study of the causes of variable flow.—J. Pasquier: The equations $s=f(x, y, z, p, q)$, integrable by the method of Darboux.—Edouard Callandreau: The conjugated points of de Fontviolant's equation of elasticity.—Alfred Rosenblatt: The stability of laminar movements of viscous incompressible liquids.—Henri Mineur: A new method for the study of galactic rotation.—Pierre Guintini: The movement of rotation of the B-type star ensemble.—P. Biquard: The absorption of ultra-sound waves by water.—Paul Bizos and Tarlé: The unification of all forms of string instruments.—R. Guyot: The reflection of very short electromagnetic waves. Pierret oscillators furnish a means of obtaining short electromagnetic waves, 12–20 cm. in length. The reflection of these short waves by water and by saline solutions has been studied. Results are given for water and for fourteen salt solutions, containing up to 13 per cent of common salt.—Léon Bloch, Eugène Bloch, and Pierre Lacroute: Multiplets in the spark spectrum of bromine (Br II).—C. Marie and N. Thon: The measurement of the stresses of electrolytic deposits of metals.—Charles Liagre: The theory of the lead accumulator. The experiments described lead to the conclusion that the classical equation PbO_2+Pb+ dilute sulphuric acid in excess$\rightleftharpoons 2PbSO_4+$dilute sulphuric acid is a true expression of the facts.—R. Lespieau, M. Bourguel, and R. L. Wakeman: The Raman effect in chemistry. The sensibility of organic spectrum analysis. Analysis by the Raman spectrum, improved by the use of the Chalonge and Lambert microphotometer, detects a very small quantity of an ethylenic hydrocarbon in the presence of cyclo-hydrocarbons, and can determine the proportion of the former to about 1·3 per cent.—M. Prettre: The ignition of mixtures of acetaldehyde and air. These mixtures show a double ignition point similar to the air-hydrocarbon mixtures previously described. The lower point can be suppressed by the addition of an antidetonant such as lead ethyl.—Charles Dufraisse and Marius Badoche: Researches on the dissociable organic oxides. The hydrocarbon produced by the removal of a phenyl group from rubrene. The compound obtained by the prolonged action of the Grignard reagent on iso-oxyrubrene, although a phenyl group has been removed, still retains the essential characters of rubrene.—Paul Fallot: The geology of the neighbourhood of Xauen (Spanish Rif).—Jean Risbec: A parasite of the spring caterpillar of the cotton plant (*Earias huegli*).—Georges Bourguignon: The relations of vestibular chronaxy with emotivity, in the normal state, in pseudo-Mongolism and in dementia præcox.—E. Brumpt: Pruritis and dermatitis produced in bathers by the cercariæ of fresh-water molluscs.—A. Blanchetière: The action of pepsin on the solutions of monamino-acids, isolated or mixed.—Georges Blanc and J. Caminopétros: Experimental researches on the sensibility of domestic animals, carriers of *Rhipicephalus sanguineus*, to the virus of exanthematic fever. Domestic animals (dog, rabbit, rat, pig, sheep, pigeon), normal carriers of *R. sanguineus*, are not sensible to the virus of exanthematic fever. The fact that the virus of this fever is transmitted by *R. sanguineus* to its descendants proves that exanthematic fever in the Mediterranean region is an infection of the tick of the dog, without any domestic animal acting as a reservoir of the virus.—Marcel Labbé, Maurice Villaret, L. Justin-Besançon, Mlle. D. Kohler, Mme. Schiff-Wertheimer, and P. Soulié: Preliminary researches on certain protrusions of the eyeball, especially Basedowian exophthalmia.

Leningrad.

Academy of Sciences, *Comptes Rendus*, 1931, No. 3.—A. Tsvetkov: On the fundamental psycho-physical law. A formula is offered to express the relation between the intensity of the stimulus and the number of the excited nerve cells.—J. Orlov: The remains of a primitive representative of Pinnipedia from the neogene deposits in western Siberia. The remains have been found in fresh-water neogene deposits near Pavlodar. The animal is described under the name *Semantor macrurus* g. et sp. n., and regarded as belonging to a new family Semantoridæ, which differs more from the three known families of Pinnipedia than these families differ between themselves.—K. K. Flerov: (1) A review of the elks (*Alces* Gray) of the Old World. Three subspecies of *Alces alces* L. are distinguished, namely, *A. alces alces* L. distributed from western Europe as far east as the Yenisei river and the Altai mountains; *A. alces pfizenmayeri* Zukov. (with *jakutensis* Millais and *bedfordiae* Lyd. as synonyms) occurring east of the Yenisei; and *A. alces* subsp. from the Ussuri region.—(2) On the generic characters in the family Tragulidæ (Mammalia, Artidactyla). Three genera of living Tragulidæ are distinguished, namely, *Moschiola*, *Hyemoschus*, and *Tragulus*.—G. Nadson and E. Stern: The combined action of metals and of X-rays on yeasts. Oligodynamic action of metals on yeasts is altered if the metals act simultaneously with X-rays. In this case the oligodynamic effect of different metals shows an inverse correlation with their atomic weight.—E. Stern: The combined action of metals and X-rays on luminous bacteria. Experiments with *Photobacterium phosphorescens* confirmed the results obtained with yeasts (see above).

Official Publications Received.

BRITISH.

Journal of the Indian Institute of Science. Vol. 14A, Part 2: The Photochemical Oxidation of Organic Hydrocarbons. Part 2: Toluene, and the Oxidation of Benzaldehyde. By C. J. Kothari and H. E. Watson. Pp. 11-30. (Bangalore.) 1.4 rupees.

Report and Balance Sheet of the National Botanic Gardens of South Africa, Kirstenbosch, Newlands, Cape, (and the Karoo Garden, Whitehill, near Matjesfontein), for the Year ending 31st December 1930. Pp. 30. (Kirstenbosch.)

Transactions and Proceedings of the New Zealand Institute. Vol. 62, Part 1, March. Pp. 66. (Wellington.)

The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 69, No. 416, August. Pp. 933-1044+xx. (London: E. and F. N. Spon, Ltd.) 10*s*. 6*d*.

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1369 (Ae. 496—T. 3062): Further Experiments on the Flow around a Circular Cylinder. By A. Fage and V. M. Falkner. Pp. 13+10 plates. 1*s*. net. No. 1371 (Ae. 498—T. 3054): Drag Tests on a Large Model in a Small Tunnel. By F. B. Bradfield and W. G. A. Perring. Pp. 11+10 plates. 9*d*. net. No. 1385 (M. 70—T. 2974 and a): Mode of Deformation of a Single Crystal of Silver. By Dr. H. J. Gough and H. L. Cox. Pp. 13+8 plates. 1*s*. net. (London: H.M. Stationery Office.)

FOREIGN.

Department of Agriculture, Straits Settlements and Federated Malay States. Scientific Series, No. 5: The Bionomics of some Malayan Rhynchota (Hemiptera-Heteroptera.) By N. C. E. Miller. Pp. ii+142. (Kuala Lumpur.)

The Bulletin of the Central Meteorological Observatory of Japan. Vol. 4, No. 1: Note on the Meteorology of the Sun. By Rikiti Sekiguti. Pp. ii+88. Vol. 4, No. 2: The Climate of Japan. By T. Okada. Pp. vi+89-416+10+35 plates. (Tôkyô.)

Publications of the Astronomical Observatory of the Warsaw University. Vol. 6. Pp. iii+60. (Warsaw.)

The Carnegie Foundation for the Advancement of Teaching. Twenty-fifth Annual Report of the President and of the Treasurer. Pp. vii+206. (New York City.) Free.

Records of Oceanographic Works in Japan. Compiled by the Committee on Pacific Oceanography of the National Research Council of Japan. Vol. 3, No. 2. Pp. ii+35-62+11 plates. (Tokyo: National Research Council of Japan.)

Scientific Papers of the Institute of Physical and Chemical Research. No. 310: On the Diffraction of Proton Wave. By Yoshikatsu Sugiura. Pp. 29-40. 20 sen. No. 311: The Solarization of Fluorite, and the Law of Lumino-Transformation. By Satoyasu Iimori and Eiichi Iwase. Pp. 41-67+5 plates. 45 sen. Nos. 312-315: Physical Investigations of Conflagrations in Tokyo, by Torahiko Terada and Tyokuro Utigasaki; Propagation of Combustion along the Surface of Inflammable Liquid, Part 1, by Tosirô Kinbara; Rupture Phenomena of Liquid Drops, by Toshimasa Tsutsui; Effects of Carbon and Iron in Blue Powder on Sherardizing (Abridgment), by Masawo Kuroda. Pp. 69-126+8 plates. 95 sen. (Tokyo: Iwanami Shoten.)

CATALOGUES.

Floras (and Kindred Subjects) of Europe, Asia, Africa, America and Australia. (Catalogue No. 188.) Pp. 16. (London: Dulau and Co., Ltd.)

Price List of Microscopical Rock Sections and Geological Accessories. Pp. 12. (London: Gregory, Bottley and Co.)

Standard Meteorological Instruments. (List M.2.) Pp. 140. (London: Negretti and Zambra.)

A Catalogue of Book Bargains. (No. 530). Pp. 16. (London: William Glaisher, Ltd.)

Diary of Societies.

TUESDAY, SEPTEMBER 22.

LONDON NATURAL HISTORY SOCIETY (at London School of Hygiene and Tropical Medicine), at 6.30.—Mrs. Norman Lowe: A Rambler in Siam.
QUEKETT MICROSCOPICAL CLUB (at 11 Chandos Street, W.1), at 7.

FRIDAY, SEPTEMBER 25.

ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY (in Rehearsal Room of the Royal Albert Hall), at 3.30.—Dr. R. S. Hutton: The Rise and Early Development of Electroplating (Address).—At 7.30.—D. J. Macnaughtan: Electrodeposition and the Engineer (Address).

CENTENARY.

SEPTEMBER 19 TO 25.

FARADAY CELEBRATIONS.

Saturday, Sept. 19 (at Royal Institution).—Reception.

Monday, Sept. 21, at 11.30 A.M. (at Royal Institution).—Informal Meeting.
At 3.—Reception.
At 8 P.M. (at Queen's Hall).—Commemorative Meeting. Speeches by Representatives of Institutions in various parts of the world.

Tuesday, Sept. 22, at 10.30 A.M. (at Kingsway Hall).—Conference.
At 8.30 P.M. (at Royal Institution).—Conversazione.
At 8.30 P.M. (at Institution of Electrical Engineers).—Conversazione.

Wednesday, Sept. 23, at 4.30 (at Royal Albert Hall).—Faraday Exhibition.

Thursday, Sept. 24, at 3 (at National Physical Laboratory).—Garden Party.

Friday, Sept. 25, at 7.45 (at Dorchester Hotel).—Entertainment by H.M. Government.

CONGRESSES.

SEPTEMBER 1 TO 19.

INTERNATIONAL ILLUMINATION CONGRESS. (For Programme see NATURE, Aug. 29.)

SEPTEMBER 13 TO 18.

INSTITUTE OF METALS. (For Programme see NATURE, Sept. 5.)

SEPTEMBER 13 TO 19.

INTERNATIONAL MEDICAL EDUCATIONAL CONGRESS (with special reference to Balneology) (at Carlsbad).

SEPTEMBER 16 TO 24.

INTERNATIONAL GEOGRAPHICAL UNION (at Paris).

SEPTEMBER 18 TO 20.

NATIONAL SMOKE ABATEMENT SOCIETY. (For Programme see NATURE, Sept. 12.)

SEPTEMBER 18 TO 21.

ASSOCIATION OF SPECIAL LIBRARIES AND INFORMATION BUREAUX (at Lady Margaret Hall, Oxford). (For Progamme see Nature, Sept. 12.)

SEPTEMBER 20 TO 27.

INSTITUT INTERNATIONAL D'ANTHROPOLOGIE (at Paris).—Sections: Morphological Anthropology and Study of Races; Human Palæontology and Archæology; Eugenics and Heredity; Psychosociology and Criminology; Ethnography, Folklore, and Human Geography.

SEPTEMBER 23 TO 25.

INSTITUTION OF MINING ENGINEERS (at Manchester).

SEPTEMBER 23 TO 26.

INTERNATIONAL CLIMATOLOGICAL COMMISSION (at Innsbruck).

SEPTEMBER 23 TO 30.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (Centenary Meeting).

Wednesday, Sept. 23, at 3 (in the Royal Albert Hall).—Installation of President.
At 9 P.M. (in Central Hall).—Genl. Smuts: The Scientific World-Picture of To-day (Presidential Address).

Thursday, Sept. 24, at 10 A.M.—Sir J. J. Thomson: The Growth in Opportunities for Education and Research in Physics in the past Fifty Years (Presidential Address to Section A).
Brig.-Genl. Sir Harold Hartley: Michael Faraday and the Theory of Electrolytic Conduction (Presidential Address to Section B).
Prof. J. W. Gregory: Presidential Address to Section C.
Prof. E. B. Poulton: A Hundred Years of Evolution (Presidential Address to Section D).
Prof. A. R. Radcliffe-Brown: Presidential Address to Section H.
Sir Charles Grant Robertson: Educational Development; 1831-1931: A Centenary Retrospect and a Forecast (Presidential Address to Section L).
At 2.—Sir Arthur Smith Woodward: Geology as a Subject for Local Societies (Presidential Address to Conference of Delegates of Corresponding Societies).
At 9 P.M.—Prof. W. A. Bone: The Photographic Analysis of Explosion Flames (Evening Discourse, in Royal Geographical Society's Hall).
Sir P. Chalmers Mitchell: Zoos and National Parks (Evening Discourse, in Royal College of Music).

Friday, Sept. 25, at 10 A.M.—Prof. E. Cannan: The Changed Outlook in regard to Population, 1831-1931 (Presidential Address to Section F).
Sir John Russell: The Changing Outlook in Agriculture (Presidential Address to Section M).
At 10.15 A.M.—Sir Halford J. Mackinder: The Human Habitat (Presidential Address to Section E).
At 5.—Sir Alfred Ewing: Presidential Address to Section G and Bramwell Trust Lecture.

Saturday, Sept. 26, at 9 P.M.—Sir Arthur Keith: The Construction of Man's Family Tree (Evening Discourse, in Royal Geographical Society's Hall).
Sir Oliver Lodge: A Retrospect of Wireless Communication (Evening Discourse, in Royal College of Music).

Monday, Sept. 28, at 10 A.M.—Dr. H. H. Dale: The Biological Nature of Filtrable Viruses (Presidential Address to Section I).
Dr. C. S. Myers: The Nature of Mind (Presidential Address to Section J).
Prof. T. G. Hill: The Advancement of Botany (Presidential Address to Section K).
At 3.30.—Dr. A. Macrae: Guidance in the Choice of an Occupation (Public Lecture, at London School of Economics).

Tuesday, Sept. 29, at 8.30 P.M.—Dr. G. Thilenius: Some Biological Viewpoints in Ethnology (Huxley Memorial Lecture of the Royal Anthropological Institute).
At 9 P.M.—Sir James Jeans: Beyond the Milky Way (Evening Discourse, in Central Hall).
Dr. S. Kemp: Oceanography in the Antarctic (Evening Discourse, in Royal Geographical Society's Hall).

SEPTEMBER 24 TO 27.

SWISS SOCIETY OF NATURAL SCIENCES (at La Chaux-de-Fonds and Le Locle).
Prof. A. Piccard: Ascent into the Upper Atmosphere in a Sealed Car attached to a Balloon (Lecture).
Dr. C. Perret: Film on the Life of Bees.
Prof. P. Arbenz: The Geological History of South Africa and Its Camp Sites (Lecture).
Prof. Pérez: Rhizocephalods Parasitic on Hermit Crabs (Lecture).