THURSDAY, JULY 9, 1908.

AFRICAN NATURE NOTES.

African Nature Notes and Reminiscences. By F. C. Selous. With a foreword by President Roosevelt. Pp. xxx+356; illustrated. (London: Macmillan and Co., Ltd., 1908.) Price 10s. net.

MR. SELOUS has been well advised to commit to a book his recollections of natural history in connection with the big game of Africa. There is still a branch of zoological science which may be called by the nearly discarded title of "natural history" instead of biology; and although the latter is the more important type of research, biologists are probably the first to desire to couple with their knowledge of the body of the dead organism accurate information as to its life-habits; for this must evidently furnish the necessary explanation of peculiarity of structure while being frequently an additional aid to classification.

Mr. Selous has long been celebrated as one of the first among big-game hunters and collectors for a period of something like thirty years. He, and a few like him, have enormously increased our knowledge of the world's larger mammalian fauna. Unfortunately he has few compeers in proportion to the army of useless game-slaughterers who are devastating the world and destroying what remains of its notable birds and mammals.

The national collection in the British Museum is an eloquent testimony to the fact that many victims of Mr. Selous's unerring rifle have not died in vain, have not been killed uselessly. At the same time, his pursuit of big and small game in South and East Africa, Asia Minor, and in America has been accompanied by most careful note-taking as to the life-habits of the creatures he pursued—pursued very often not to kill, but to observe.

In the book under review, the two preliminary chapters call into question theories as to the protective coloration of mammals and birds, and the value of supposed recognition marks. President Roosevelt joins with Mr. Selous in somewhat decrying the cogency of theories in vogue. It would seem to the reviewer that both writers were a little querulous in their desire to differ from a number of established authorities on zoology (most of them field naturalists also).

The coloration and marking of living creatures—let us say for the moment beasts and birds—arises from such a complication of causes that it can only as yet be explained partially, and by a variety of reasons. One of these is that the greater magnificence of appearance in the male serves to attract the notice and compliance of the female. This has been contested by some writers, but it still remains a valid theory. The most important explanation, however, yet advanced for the colour or markings of the majority of animals is that their appearance is thereby adapted to their surroundings, and enables them either as pursuer or pursued to escape observation. It would seem to the reviewer that in the main few persons who have studied wild life can refuse to believe in the existence and practical value of protective or assimilative coloration.

Who, for example, that has seen a bittern amongst the reeds and tree stumps can refuse to believe that for some purpose best known to itself the creature is posing in such a way that its marking, colouring and attitude deceive the eye of everything that is not a bittern?

Even the magnificent crimson and blue-green bee-eaters of tropical Africa have a way of perching on bare bushes so that they exactly resemble large crimson flowers. The precise purpose in this deception is no doubt to attract insects on which they pounce. The reviewer has witnessed this deception repeatedly, thinking at a little distance that he was gazing at a magnificent example of an Erythrina shrub in full flower until the flowers flew away.

Mr. Selous repudiates the idea that giraffes can find any advantage in resembling tree trunks that have been blasted by lightning, as they do invariably when they are immobile and holding their necks very erect. The reviewer can aver that in Eastern Equatorial and South-west Africa he has been repeatedly deceived (although his sight is good enough to be compared with that of a negro) by this appearance of the giraffe sentries. They were old males or females, whose colouring at the distance seemed resolved into black and white, and they appeared remarkably to resemble the trunks of the acacia trees that have been blasted by lightning and stripped by storms.

Innumerable other cases of deception in coloration on the part of large and small game could be cited.

Mr. Selous asks what use it is, since the carnivora almost invariably hunt by scent and at night. He seems to forget that the most dangerous of all carnivores is man, predatory man, and that man has co-existed with most modern types of birds and beasts for hundreds of thousands of years, back to the end of the Tertiary period at any rate, quite long enough for giraffes, antelope, deer, and innumerable other beasts (and birds) to have developed a special aptitude and cunning for evading his observation. For man, since even before he was truly man, has invariably hunted by *sight*, and not by scent.

It is scarcely necessary to state that Mr. Selous's notes on the life-history of the lion, the spotted hyena, the Cape buffalo, and the rhinoceros are interesting, original, and obviously true. This is no second-hand information; a good deal of it, moreover, is quite novel. Mr. Selous discountenances the idea that the lion advances on his prey by tremendous leaps; rather (according to him) it comes rushing on all four legs as a dog might do, and uses its teeth for the death-stroke in preference to a blow or tearing with the paw and claws. The advantage of the curved claws and strength of limb would rather lie in their enabling the lion to hold on to his prey while the great canine teeth severed arteries and pierced brain cases or spinal columns. The lion, he thinks, developed its mane in the colder climate of Europe or

western Asia before it followed the big game into Africa (the last refuge of the latter before the advancing power of Neolithic man). But if protection from cold and wet be the inducement which led to the development of a mane in the male lion, how about the lioness? The more probable explanation is that the mane of the lion arose both as a male ornament and as a protection for the throat and chest in sexual combats with other males. Mr. Selous comments on the distinctly spotted limbs possessed by some adult lions and lionesses; he quotes the special name given to this type by Boer hunters. He will have been interested in the paper by Mr. R. I. Pocock in the Annals and Magazine of Natural History (November, 1907) on the significance of the pattern—the rosettes, spots and stripes—of the cubs of lions (and of pumas).

The author's notes on the fluctuations of the abundance and distribution of the tsetse fly and its correlation with the abundance or scarcity of the buffalo are important contributions to a subject of great economic importance. His remarkable sporting adventures are the more thrilling because of their obvious truth, and the quiet style of narration.

The last chapter in the book is as valuable as any in a work which is interesting from beginning to end. It is devoted to the Bushmen of South Africa—more especially the Masarwa dwelling on the verge of the Bechuana countries.

Mr. Caldwell's drawings are admirable (especially the study of galloping gemsbuck). Very interesting are the photographs and description contributed by an American sportsman, Mr. Max Fleischmann, of a rhinoceros being dragged under water (presumably) by crocodiles.

H. H. JOHNSTON.

WATER POWER.

Hydraulics and its Applications. By A. H. Gibson. Pp. xvi+757; with diagrams and illustrations. (London: Archibald Constable and Co., Ltd., 1908.) Price 18*s.* net.

IN this intensely practical age, science is chiefly exploited for utilitarian ends. The fascination of experimental research lies, as Cap'n Cuttle would observe, "in the application thereof." We seek to know, not for any mere pleasure to be derived from the acquisition of knowledge, but in order to bring that knowledge to bear upon everyday problems of life, labour, and economy.

There is something, therefore, particularly fitting and appropriate in the title of Mr. Gibson's book, "Hydraulics and its Applications," for hydraulics is an eminently practical branch of natural science. Moreover, it is a science difficult to define in that it has no fixed limitations. It embraces the study of all questions in hydro-mechanics in which the motion of water produces or is connected in any way with useful work. In a very special sense it lies within the province of the engineer and the manufacturer.

On its theoretical side, hydraulics presents a number of difficulties. Assumptions have to be made which are not strictly justifiable in reality; yet without them the solution of problems would be well-nigh impracticable. There is, therefore, something necessarily of the nature of compromise about the subject, and Mr. Gibson strikes this keynote at the outset of his work by explaining that the questions of hydraulics can only be discussed on the basis of the assumption that water is a perfect fluid (which it is not), absolutely non-viscous and inelastic, with the introduction of empirical constants to bring theoretical results into conformity with the records of actual observation.

Despite, however, the very practical suggestion of its title, Mr. Gibson's treatise must be set down as primarily a theoretical work. It postulates a knowledge of mathematics and mathematical processes which the ordinary practical man unfortunately rarely possesses. And while the operator, as distinct from the experimentalist, will no doubt fully appreciate the useful data contained in the volume and the information condensed into working formulæ, he will at the same time be inclined to regret that Mr. Gibson has not dealt a little more completely with the practical side of the subject, by describing in greater detail the remarkable variety of ways in which hydraulic machinery is utilised in commerce, manufactures, and the arts.

Commencing with two prefatory chapters on hydrostatics and the physical properties of water, in which such matters as capillarity and the laws of floating bodies are briefly discussed, the author introduces his main subject in chapter iii. by describing the experimental results obtained by Profs. Osborne Reynolds and Hele-Shaw in regard to stream line flow. The motion of fluids is then mathematically investigated and its phenomena explained in relation to pipes, bends, vortices, and orifices. This leads on to the laws of fluid friction and the resistance of ships, whence the author reverts once more to pipe and channel flow, and the various sources of loss of head and velocity. Chapter x. takes up the question of impact of jets and of pressure on submerged planes. It is not until chapter xi. is reached that the practical side of the subject comes under discussion, and then the various and well-known types of water-wheel are duly described and illustrated, including the Pelton motor. Chapter xii. deals with turbine forms, and chapter xiii. with the theory of turbine design. In chapter xiv. there is an account of the hydraulic reciprocating engine, with examples of the Brotherhood and Rigg machines. Chapters xv. to xvii. are devoted to pumps, including the hydraulic ram. The transmission of energy by means of pressure mains forms the subject of chapter xviii., while the final chapter contains a brief review of a number of important appliances: lifts, hoists, jacks, cranes, and jiggers. It is this latter portion of the book—the manipulative aspect of hydraulics—that one would have liked to see expanded, even, if necessary, at the expense of some of the earlier mathematical matter. The commerce of Great Britain is essentially maritime, and a very large proportion of port and harbour machinery is hydraulic. Dock gates, sluice penstocks, capstans, coal elevators and tips are worked in the great majority of cases by hydraulic power, and despite their

importance none of these appliances is illustrated in the book. Quay cranes also, a most important class, are not represented, though some of them are capable of dealing with loads up to 150 tons.

We think that in one or two cases the matter might have been arranged to rather better advantage, but, on the whole, we have no hesitation in saying that the book is an excellent contribution to the literature of the subject, and embodies the result of no little personal investigation and research. It is specially a student's book, and will appeal more particularly to those who are already equipped with some fundamental knowledge of hydraulics. The book is clearly printed and well illustrated.

THE DISCOVERY OF THE WEIGHT OF THE AIR.

Essais de Jean Rey, 1630. Édition nouvelle avec commentaire par Maurice Petit. Pp. xxvii+191. (Paris: A. Hermann, 1907.) Price 7 francs.

SHORTLY after Lavoisier had presented an account of his researches on calcination to the Academy of Sciences, the French chemist Bayen discovered in the Bibliothèque royale a small volume dated 1630, in which the discoveries and views of Lavoisier were seen to be anticipated by nearly a century and a half. This volume was the "Essays de Jean Rey sur la Recerche de la cause pour laquelle l'Estain et le Plomb augmentent de poids quand on les calcine," of which a translation in English was published some years ago under the auspices of the Alembic Club (1895). By a curious coincidence, the title of Lavoisier's memoir, "Sur la calcination de l'étain dans les vaisseaux fermés et sur la cause de l'augmentation de poids qu'acquiert ce métal pendant cette opération," was almost identical with that of Rey's essays; and it is remarkable that the study of the behaviour of the same metal, tin, when calcined, led both chemists to arrive at a correct interpretation of the nature of combustion.

The salient characteristic of Rey's work is that he concentrated his attention on the increase of weight of metals during calcination, and was thus led to recognise that the air has weight prior to the investigations of Torricelli in 1643 and of Pascal in 1648. The increase of weight was explained as follows:—

"Ce surcroit de poids vient de l'air, qui dans le vase a esté espessi, appesanti et rendu aucunement adhesif, par la véhémente et longuement continuée chaleur du fourneau; lequel air se mesle avecques la chaux (à ce aydant l'agitation fréquente) et s'attache à ses plus menuës parties."

The object of the new edition of Rey's works appears to be, not so much to direct attention to the part played by Rey as chemist and precursor of Lavoisier, but to put in a claim on his behalf as the discoverer of the weight of the atmosphere and as inspirer of the later work of Torricelli and Pascal. When's Rey's "Essays" were printed in 1630 at Bazas, in a form hardly likely to attain much publicity, a copy came into the hands of a certain Frichet, a lawyer of Bordeaux, who placed the results before a circle of learned friends who assembled weekly in the rooms of the Père Mersenne at the monastery of Les Minimes, in Paris. Père Mersenne became the correspondent of Jean Rey, and, it would appear, communicated the latter's investigations to Torricelli, Galileo, Descartes, and Pascal, with whom he was in constant correspondence. Thus Rey's book "loin d'avoir été un éclair de génie inconnu, ignoré, comme on l'a supposé jusqu'ici, devient le point de départ de cette mémorable campagne scientifique qui se termina par les victorieuses expériences de Rouen et du Puy-de-Dôme."

In support of these contentions a number of letters of Jean Rey and of Père Mersenne are published, and the relationship of Mersenne with his great contemporaries traced in detail. Frémy long ago expressed the conviction that the lack of appreciation of Rey's work as compared with that of Torricelli and Pascal was "one of the great injustices committed in the history of science." The editor of the new edition of the "Essays" aims at rectifying this injustice, so that Jean Rey may take rank not merely as a chemist and first discoverer of the part played by air in combustion, but as one of the founders of modern physics.

W. A. D.

OUR BOOK SHELF.

Plant Anatomy from the Standpoint of the Development and Functions of the Tissues, and Handbook of Micro-technic. By Prof. W. C. Stevens. Pp. xii+349. (London: J. and A. Churchill, 1908.) Price 10*s.* 6*d.* net.

ACCORDING to the axiom that the greater contains the less, there is justification for the title of the book, but so far as histology is distinguished from anatomy, the contents pertain rather to the domain of histology. This does not, however, correctly explain the nature of the subject-matter, as the author has followed the modern, and one has no hesitation in saying the best, practice of uniting the study of form and function; in fact, each chapter is devoted to a separate physiological problem. The arrangement is an excellent one for an elementary book, but it must be added that there is no attempt to rise beyond elementary facts. The difficulties of the stelar theory are avoided by reverting to the older conception of protoderm, procambium strands, and fundamental meristem. "Bast fibres," as here explained, also show a return to an older, though in this case less acceptable, definition, and the nicer subtleties of distinction between fibrous cells and wood fibres are omitted. The careful and detailed descriptions of such processes as the conduction of water and solutes through the stem will be fully appreciated, but in places the author shows but small regard for the intuitive perception of the student (*vide* figs. 56, 87, and 92). The practical examples quoted at the end of the chapters are useful, and the general presentation of the subject-matter is marked by clearness and coordination.

Following on the course of anatomy is a handbook of micro-technique. This science has been eagerly absorbed by American students sojourning in Europe, with the result that their experience has spread like leaven throughout the numerous colleges and universities in the United States. The instructions here conveyed represent the most modern and approved practice. In this country it is not the custom to push students into complex fixing and staining methods until they reach the advanced or research stage, so that it appears inconsistent to devote a third part of

an elementary manual to highly technical methods. The last three chapters, on reagents and processes, microchemistry of plant products, and detection of adulterations in foods and drugs, would, if published separately, provide a most useful and attractive summary for advanced students.

Elements of Angling. A Book for Beginners. By H. T. Sheringham. Pp. xvi+259. (London: Horace Cox, 1908.)

WE always open Mr. Sheringham's contributions to angling literature with the expectation of being beguiled by very pleasant reading, and, incidentally, of acquiring much useful information. In the case of his "Elements of Angling" we were in no wise disappointed. The book is primarily addressed to and intended for the young angler, that is, the angler young in his art, for our author will not acknowledge that any man is too old to begin; it is wide in its scope, but does not enter into so much detail as to be likely either to confuse or weary a prospective fisherman. If such a term may be excused, we would describe it as an elementary text-book of fresh-water fishing, and, like many other text-books, we think it is well worthy of study even by those well versed in the subject of which it treats.

The information and advice given are throughout of an eminently practical nature, and Mr. Sheringham is not above citing his own misfortunes as an example and warning to those whom he would instruct. Fishing for coarse fish, whether on the bottom or at the surface, is clearly and concisely dealt with, and much practical information as to gear and baits is given. The trout is discussed at somewhat greater length, and the differences in the tackle required for wet- and dry-fly fishing, together with the reasons for such differences, are clearly explained; the grayling has a chapter to itself, and, as in the case of the trout, a short but well-selected list of the flies of most general utility is given.

Exigencies of space prevent the salmon and salmon-fishing from being dealt with at great length, but this, we think, is right in the case of a fish the capture of which depends so much upon a thorough knowledge of the particular water to be fished. Care is, however, taken to direct attention to the differences between salmon and trout, whether as parr or adults, and to the difficulty which sometimes attends the recognition of a well-mended kelt and its distinction from a clean fish. While on the subject of specific distinctions, we notice that Mr. Sheringham regards the "bull-trout" as a distinct species (*Salmo eriox*), and states that it is found in the Tweed and in some rivers of the south and west; surely there is some confusion here that might well be cleared up in future editions. Last, but not least, there is an excellent index. L. W. B.

Elements of the Theory and Practice of Cookery. By Mary E. Williams and Katharine R. Fisher. Pp. xix+347. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1907.) Price 4*s.* 6*d.* net.

DOMESTIC science and art, so far as they relate to cookery, are here combined to produce an educational and practical course of work. The book is not merely a collection of recipes, but a guide to the experimental study of principles and their application in the selection and preparation of food. The instructions for experiments and other work are explicit, and much good advice is given as to the conditions of healthy living and intelligent housecraft. Unfortunately, as many of the terms used in describing the utensils and ingredients required are unfamiliar in British homes and schools, the book is at a disadvantage on this side of the Atlantic, though its merits are many.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Spectrum of the Radium Emanation.

A FEW months ago, through the generosity of the Academy of Sciences of Vienna, one of us was loaned a radium preparation containing about 250 mg. of radium. Observations were at once begun to purify the emanation produced by it, and to determine its volume. An account of these investigations was read before the Academy of Sciences of Vienna on July 2. It was found that the maximum volume of the emanation per gram of radium was in good accord with that to be expected from calculation (about 0·6 cubic mm.), and the initial volume was about one-tenth of that determined by Ramsay and Cameron (Journ. Chem. Soc., p. 1266, 1907). In the course of this work we have had occasion to test the purity of the emanation by the spectroscope, passing an electric discharge in the capillary in which the volume was measured. We have on four different occasions during the last two months determined the spectrum of the radium emanation by visual observations, using a direct-reading Hilger spectroscope, leaving a more accurate determination of its spectrum until the measurements of the volume had been completed. We have now photographed the emanation spectrum, using a prism of 2 inches base. Pure emanation, corresponding to the equilibrium amount from 130 mg. of radium, was condensed by liquid air in an exhausted spectrum tube of about 50 cubic millimetres capacity, provided with thin platinum electrodes. Two photographs were immediately taken, one giving about thirty of the more intense lines, and the other, with much longer exposure, showing more than one hundred lines. For a comparison spectrum a helium tube was used. The colour of the discharge in the tube was bluish. Visual observations of the spectrum were made during the exposure of the photographs.

When the emanation was condensed in a side tube by means of liquid air, the great majority of the lines vanished at the moment of condensation, which was readily noted by the phosphorescence of the glass. The colour of the discharge then completely changed, and became of a pale rose colour. At the instant of volatilisation, the emanation lines flashed out again. The hydrogen lines were visible in the spectrum, and these became much more brilliant when the emanation was condensed. In the electrodeless discharge of previous experiments, the hydrogen lines were never observed. Their occurrence in the present experiment was probably due to the platinum electrodes. By observations of the intensity of the phosphorescence when the emanation was condensed, it was noted that the amount of pure emanation in the tube gradually diminished with increase of time of discharge. The spectrum of the emanation, however, persisted until practically all the emanation had been driven into the walls of the tube. The phosphorescence on the walls of the tube showed that the occluded emanation was fairly uniformly distributed. This effect has been observed by us on several occasions.

The first determination of the spectrum of the emanation was made in 1904 by Ramsay and Collie, who determined the wave-lengths of about eleven lines by visual observations. As shown by them, the spectrum of the emanation is a bright line spectrum with sharply defined lines. We observed also visually a weak band spectrum in the yellow, which slightly decreased in intensity when the emanation was condensed. This, however, may not be connected with the emanation itself. The wave-lengths of the lines of the photographic plate were accurately measured, using a Kayser's measuring machine. The accuracy obtained is indicated by the agreement of the wave-lengths of some of the hydrogen lines with their known values. In most cases, for well marked lines, the error is not more than half an Angström unit. The following table gives the wave-lengths of the more prominent lines. The wave-lengths of the lines initially determined by Ramsay and Collie (marked R. and C.) are added for comparison.

Visual observations of three of the more prominent lines in the yellow and green are also given :—

Intensity	Observed λ	Remarks	Intensity	Observed λ	Remarks
5	5721	(Visual) (R. & C. 5725)	15	4350·3	
8	5589	(Visual)	7	4340·9	H=4340·66
3	5393	"	4	4225 8	
4	5084·3		10	4203·7	
4	4979·0	R. & C. 4985	7	4180·2	
10	4801·3	H=4861 49	20	4166·6	
4	4817·2		10	4114·9	
5	4721·5		2	4102·2	H=4101·85
10	4681·1	R. & C. 4690	4	4045·4	
10	4644·7	R. & C. 4650	15	4018·0	
8	4625·8	R. & C. 4630	12	3912·0	
7	4609·9		7	3957·5	
4	4604·7		4	3917·5	
7	4578·7		—	3888·9	H=3889·15
9	4509·0		6	3867 6	
10	4481·0		10	3 53·6	
8	4435·7		7	3739·9	
6	4391·8		10	3664·6	
4	4372·1		5	3622·2	

A more detailed list of lines will be published later. We understand that Sir William Ramsay showed a photograph of the spectrum of the emanation at the meeting of the Royal Society on June 25. It will be of interest to compare the two spectra.

E. RUTHERFORD.
T. ROYDS.

University, Manchester, July 4.

The Recent Nocturnal Glows.

THE peculiar light phenomenon at midnight on June 30, which was seen, according to the papers, on the northern part of the sky at Copenhagen, Königsberg, Berlin, Vienna, Biala, and other places, was also observed by me at Prague. At 1h. 30m. a.m. on July 1, I saw in the direction N.E. and N.N.E. a peculiar strong orange-yellow light over the horizon, the colour of which was more orange in its lower parts and more yellow in its higher parts. Its upper limit was lying twenty to thirty degrees above the horizon. The whole sky was cloudless. Other people saw it here at 11 p.m. on June 30.

It is reported that magnetic disturbances were experienced on the telegraphic lines, but I saw no trace of the characteristic auroral bands or columns. I may be allowed to add that, according to Arrhenius, this time of the year corresponds to the minimum of auroral display (activity). Interesting is the fact that a high barometric maximum was lying in the north, and that we had winds from that direction for a whole week.

BOHUSLAV BRAUNER.

Bohemian University, Prague, July 4.

A Long-lived Solar Halo.

THERE has been visible here to-day a solar halo remarkable both for its vivid intensity and for its protracted duration. It was first noticed by me at 12.35 p.m. It then formed an unbroken ring, of which the most intensely luminous portion was to the south of the sun, and the least luminous portion to the west-north-west. Half an hour later the southern and northern quadrants of the circle were equally bright, but the northern appeared the more compact and definite; meanwhile, the eastern and western portions continued comparatively feeble, more especially the latter. *These conditions remained unchanged for fully 1½ hours!* After 2.15 p.m. the northern segment of the halo was alone conspicuous, and after 3.30 p.m. the ring was never again complete, though two mock suns (to the southward and eastward respectively) still testified to the original configuration. By 4.50 p.m. nothing remained but a diffused, pale rainbow-coloured mock-sun to the north of the sun; but after 5.15 p.m. this became less indefinite, and by 6 p.m. fully a semicircle of a halo was again traceable above the sun, but this faded gradually, nothing surviving after about 6.20 p.m. The unusually strong tone of rusty orange colouring, and the conspicuous darkness of the region enclosed, made the halo an unusually striking object when at its best (12.30 to 2 p.m.).

Throughout the day cirrus cloud has strewn the sky in most interesting disorder and variety of forms. Telescopic observation of the sun's image showed (in the features of atmospheric distortion of the sun's limb) the existence of two distinct drifts of the atmosphere, viz. an upper current, *of great velocity*, passing over from the south-east above the drift from north-north-east that alone affected the local weather-cocks and chimneys' smoke. I may add that my experience as an observer of halos (both solar and lunar) has led me to the conclusion that cirrus clouds, or the conditions conducive to the formation of cirrus cloud, do not in themselves constitute the whole cause of the formation of halos, but that these are further the outcome of *cross-currents* in the region of cirrus formation.

CATHARINE O. STEVENS.

10 Woodstock Road, Oxford, June 30.

P.S.—Portions of solar halos were also seen here intermittently during July 1 and 2, thus giving a record of three successive days of halo formation.

Genial June.

THE month just past has fully upheld its character, as it did in the Jubilee year, 1887, and on other occasions.

There were a great number of dates suitable for observation (sixteen out of the last seventeen), but I found shooting stars rare.

The nights before June 29 were, I thought, unusually dark, the stars and Milky Way being beautifully bright and distinct; but on June 30 the firmament was abnormally luminous, with a very strong glow all over the north at midnight. Few stars could be seen, and the Milky Way was hardly distinguishable. On July 1 the phenomena of the previous night were repeated in rather a different aspect. There were many clouds of various tints, and the light was again intensely strong, the northern sky being involved in a brilliant aurora. I have never seen June nights so dark, and the Milky Way so gorgeously displayed in the heavens, as this year to June 28, nor have I ever noticed the sky so bright as it appeared on the nights of June 30 and July 1.

The aurora offered so vivid a spectacle that on the dates mentioned the shades of night may be said to have been quite dispersed, for even at midnight the reflected light from sky and cloud was so strong that terrestrial objects could be seen just as at dusk, say at about 10 p.m. on an ordinary June night.

W. F. DENNING.

Bristol, July 2.

THE DARWIN-WALLACE JUBILEE CELEBRATION AT THE LINNEAN SOCIETY.

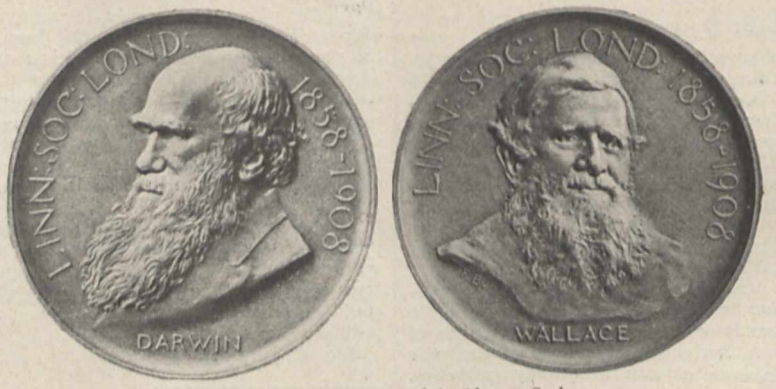
ON July 1, 1858, Sir Charles Lyell and Dr. J. D. Hooker communicated to the Linnean Society a remarkable paper entitled "On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection," by Mr. Charles Darwin and Mr. Alfred Wallace. The history of this paper is familiar to every student of biology. Darwin had for many years been studying the question of natural selection and its bearing upon the origin of species, but, although his views were well known to several intimate friends, he had refrained from publishing them, and was still occupied in the collection of evidence when he received from Wallace a manuscript essay "On the Tendency of Varieties to Depart indefinitely from the Original Type," in which the same ideas were set forth. At the request of the author this manuscript, after perusal, was forwarded by Darwin to Sir Charles Lyell, with the added suggestion that the essay should be published as soon as possible. After consultation with Hooker, Darwin was induced to allow an extract from his own work on the subject to be published simultaneously.

The reading of this joint paper at the Linnean Society formed the starting point of a revolution in scientific thought the effect of which it would

be impossible to overestimate, and the Society has duly recognised the importance of the occasion in the commemoration which took place last week.

A peculiarly gratifying feature of the proceedings was the presence at the afternoon meeting of Dr. Wallace and Sir Joseph Hooker, and the fellows of the society and their guests thus had the remarkable privilege of hearing an account of the great event of fifty years ago from the lips of two of the principal actors therein. The society is also to be congratulated on the very cordial response made to their invitation by the numerous universities, academies and learned societies to which it was sent, the gathering being in all respects a thoroughly representative one.

The afternoon meeting was held in the large meeting room of the Institution of Civil Engineers at Westminster, and was attended by about three hundred and fifty fellows and guests. The proceedings were opened by the president, Dr. D. H. Scott, F.R.S., who explained the purpose of the meeting and welcomed the delegates and guests in a short speech. The Darwin-Wallace medal, of which we give an illustration, was then presented by the president to the seven representatives of biological science who had been selected for the honour, viz. Dr. Alfred Russel Wallace, Sir Joseph Dalton Hooker, Prof. Ernst Haeckel, Prof. Eduard Strasburger, Prof. August Weismann, Dr. Francis Galton, and Sir E. Ray Lankester, the copy given to Dr. Wallace being in gold and the others in silver. Each medallist was addressed by the president in an appropriate speech in which his claims to the distinction were duly set forth, and all were received by the audience with great enthusiasm.



The Darwin-Wallace Medal of the Linnean Society.

Dr. Alfred Russel Wallace, in replying, spoke of the actual relations between Darwin and himself, and of the share which each had contributed to the theory of natural selection. With characteristic modesty he laid stress upon the fact that the idea had occurred to Darwin nearly twenty years before it occurred to himself. In endeavouring to explain why the same solution of the problem of the origin of species had occurred to both of them, he pointed out that a closely similar course of events had led up to the same result in each case. Both Darwin and Wallace had the passion for collecting, and both in early life had been ardent beetle-hunters. Thus they had been led to take an intense interest in the mere variety of living things and to seek for an explanation thereof. Later on both become travellers, collectors and observers in some of the richest and most interesting portions of the earth, and had forced upon their attention all the strange phenomena of local and geographical distribution, with the numerous problems to which they give rise. Then, finally, at the critical period when their minds were freshly stored with information and reflection upon the problem to be solved, both had their attention directed to the system of positive checks expounded by Malthus in his essay on population. "The effect of this," continued Dr. Wallace, "was analogous to that of friction upon the specially-prepared match, producing that flash of insight which led us immediately to the simple but universal law of the 'survival of the fittest,' as the long-sought *effective* cause of the continuous modification and adaptation of living things."

Sir Joseph Hooker, in his address, dwelt upon the considerations which determined Mr. Darwin to agree to the proposal of his friends for the joint publication of his own and Mr. Wallace's theories by the Linnean Society. He also pointed out that at the meeting Mr. Darwin was unable to be present, being himself very ill, and with scarlet fever and diphtheria raging in his family. The meeting was the last of the session, and was unusually late owing to the death of the great botanist Robert Brown, otherwise the Darwin-Wallace paper would have had to wait for at least four months, until the beginning of the next session. The paper was actually read by the secretary of the Society. Sir Charles Lyell and Dr. Hooker said a few words to emphasise the importance of the event, but although intense interest was excited, no discussion took place—"the subject was too novel and too ominous for the old school to enter the lists before armouring."

Prof. Haeckel and Prof. Weismann were unfortunately unable to be present. The medals were received on their behalf by a representative of the German Embassy, and a short address from Prof. Haeckel was read by the Zoological Secretary. Prof. Haeckel laid stress upon the importance of the theory of organic evolution, and described the foundation by himself of a new phyletic museum at the University of Jena.

Prof. Strasburger dwelt upon the influence of the Darwinian teaching upon his own career and that of Haeckel, and Dr. Francis Galton replied briefly to the president's speech. Sir E. Ray Lankester addressed the meeting at greater length, and struck a fresh and appropriate note in emphasising the share taken by Huxley in the great controversy to which the Darwin-Wallace theory gave rise. He concluded by expressing the opinion that at the present day "not only do the main lines of the theory of Darwin and Wallace remain unchanged, but the more it is challenged by new suggestions and new hypotheses the more brilliantly does the novelty, the importance, and the permanent value of the work of these great men to-day commemorated by us, shine forth as the one great and epoch-making effort of human thought on the subject."

The presentation of the medals was followed by the reception of the delegates of corporate bodies. Of the colleges and schools connected with the early training of Darwin and Wallace, Christ's College, Cambridge, was represented by the master, Dr. Peile; Shrewsbury School by Mr. C. J. Baker, chief science master, and Hertford Grammar School by Mr. G. W. Kinman, headmaster. The other bodies represented were the University of Oxford (Dr. Warren, Prof. Poulton and Dr. Church); the University of Cambridge (Dr. Francis Darwin); the University of St. Andrews (Prof.

Scott Lang); the University of Glasgow (Prof. J. G. Kerr); the University of Aberdeen (Lieut.-Col. Prain); the University of Edinburgh (Prof. I. B. Balfour); the University of Durham (Prof. M. C. Potter); the University of London (Sir W. T. Thiselton-Dyer); the University of Manchester (Prof. Weiss); the University of Wales (Prof. Phillips); the University of Birmingham (Sir Oliver Lodge); the University of Liverpool (Prof. Herdman); the University of Leeds (Prof. Blackman); the University of Sheffield (Prof. Denny); University College, Nottingham (Prof. Carr); University College, Bristol (Prof. Lloyd Morgan); the Royal Swedish Academy of Sciences (Prof. Lönnberg); the Royal Society (Sir Archibald Geikie); the Society of Antiquaries (Lord Avebury); the Royal Irish Academy (Dr. Scharff); the Manchester Literary and Philosophical Society (Mr. C. Bailey); the Royal Society of Edinburgh (Prof. D'Arcy Thompson); the Geological Society of London (Prof. Sollas); the Cambridge Philosophical Society (Dr. Harmer); the Royal Astronomical Society (Mr. Newall); the Zoological Society (Mr. Boulenger); the British Association (Sir David Gill); the Entomological Society of London (Mr. Waterhouse); the Royal Microscopical Society (Lord Avebury); the Chemical Society (Dr. Horace Brown); the Malacological Society (Mr. Byrne); the British Academy was represented by Sir E. Maunde Thompson.

Dr. F. Darwin and Sir W. T. Thiselton-Dyer spoke on behalf of the universities and schools, and Prof. Einar Lönnberg and Sir Archibald Geikie on behalf of the academies and societies represented. Prof. Lönnberg announced that his gracious Sovereign, His Majesty King Gustaf of Sweden, had ordered him to convey to the Linnean Society his hearty greetings and sincere felicitations on this occasion. He also presented a very beautifully illuminated address from the Royal Swedish Academy of Sciences, and a silver copy of the Linnean medal of the Academy struck in commemoration of the Linnean celebrations of last year. Several other addresses were also presented by the delegates.

The concluding speech of the afternoon was delivered by Lord Avebury, who described, in an extremely interesting manner, his own intimacy with Charles Darwin, laying especial emphasis upon his peculiarly amiable personal character and upon the devotion shown by Mrs. Darwin to her husband and children. He referred to the quiet life at Down, and told the delightful story of one of Mr. Darwin's gardeners, who thought it was such a pity that his master had not got something to occupy him, for he wandered about the garden doing nothing, and would stand for as much as ten minutes at a time gazing at a flower!

After the afternoon ceremony, ninety of the fellows and their guests dined together at the Princes' Restaurant, the party including Sir George and Lady Darwin, Dr. F. Darwin and Mr. W. E. Darwin, while foreign biologists were represented by Profs. Hubrecht, Lönnberg, Strasburger and Warming. There were no speeches, and at nine o'clock the company adjourned to the rooms of the Linnean Society at Burlington House, where a reception was held by the president and Mrs. Scott. Two short lantern lectures were delivered during the course of the evening, one by Prof. Seward on "The Jurassic Vegetation of the World: a Study in Plant-migration," and the other by Dr. Smith Woodward, on "The Evolution of Mammals in South America." Various exhibits especially appropriate to the occasion were also shown in the library. Amongst these were a beautiful series of insects from the Hope collections in the Oxford University Museum, exhibited by Prof. Poulton and Mr. J. C. Moulton, in illustration of the phenomena of mimicry and variation. Other collections of insects illustrating special points connected with the theory of evolution were exhibited by Dr. Dixey, Col. Manders, and Dr. Longstaff; while Mr. R. A. Rolfe exhibited some beautiful flowers of natural hybrid odontoglossums with their parents.

We believe the Linnean Society intends to publish a full account of the proceedings, together with the addresses and speeches, which should form an extremely interesting record of a very impressive and memorable occasion.

A. D.

THE DAYLIGHT SAVING BILL.

IF anyone is in search of an object-lesson in the necessity for the introduction of some science into general education he will do well to give his attention to the proceedings in connection with the Daylight Saving Bill. He will probably find therein so much confusion of thought that he will feel some training in clear thinking to be imperatively demanded, though there is an off chance that he will be depressed beyond recovery by the contemplation of the report of the Select Committee on the bill which appeared in the newspapers on July 3.

To begin with the original short title—the Daylight Saving Bill—it will be conceded that no action of Parliament will produce any effect upon daylight. One may save gas or electric-light, and make more use of daylight, but to talk of "saving daylight" is metaphor intelligible enough for ordinary purposes, but not suitable for legislation. When a legislative act begins with metaphor it is not matter for wonder if it eventuates in allegory, and sooner or later that must be the end of the bill.

It would conduce to greater clearness if we knew exactly what is "the principle of the bill." It is designed to make every item in "the trivial round and common task" happen an hour earlier in the summer months than in the winter, but it does not propose that. It proposes the ingenious and apparently simple expedient of moving the clocks on an hour in April and back again in September, and it is assumed that the other will be a natural consequence. Whether the purpose or the proposal of the bill constitutes its principle has never been stated. The confusion of ideas is most insinuating; a person who approves of earlier hours in summer is quite likely to find himself committed to the "principle of the bill." When the Astronomer Royal was under examination before the Committee the confusion was most evident to the looker-on. The witness was definitely opposed to any alteration of the clocks, and yet seemed to suggest that the proposal of the bill should be referred to working men. The question that he wished referred was whether they desired to be made to get up an hour earlier in the morning than they do now—there is no such proposition in the bill—not whether the designation of a particular hour of the day should be five or six—but that is in the bill and nothing else.

Cross-examination by members of the Committee turned largely upon this confusion about the principle of the bill, and upon a further confusion of ideas between having different time standards in different geographical localities and different time standards in the same locality at different times of the year. The reasoning which implies that if the one is found to be practicable objection to the other must be merely indolence or conservatism would be really worth analysis at any time of the year except the dog days. Take an example under the bill. Standard Greenwich time is to be kept for astronomical and for navigation purposes, and standard Irish time is also to be un-

disturbed; but "local" time is to be established in Great Britain and Ireland an hour in advance of standard time. A steamer is announced to leave Dublin at half past twelve every night, Sundays excepted. What will the announcement mean?

There are already two interpretations. Only experience can tell whether it means 12.30 or 12.55 a.m. G.M.T.; but with the permission of the bill there will be four times which will be legal tender for this denomination, viz. 11.30 p.m., 11.55 p.m., 12.30 a.m., 12.55 a.m., G.M.T., and any one of them may be understood or misunderstood in the circumstances.

The tone of the Select Committee's report indicates that it thinks confusion between these four times will be obviated with a little practice, and if not, the number of people who travel from Dublin is so small compared with the number of those who do not that they can be disregarded.

Some ingenious advocate of the bill has endeavoured to justify it by a confusion of ideas which finds an analogy between the zone adjustment of standard time for longitude and changing the nominal hour of noon as an adjustment for latitude. The double-edged nature of the false analogy appears to have been overlooked. If sunrise is earlier, sunset is later, and if 11 should be called 12 on account of the earlier sunrise, *ex equali* 1 should also be 12 on account of the later sunset; this kind of argument, hollow as it is, has misled a newspaper, generally intelligent, into the grave error of accusing Scottish clocks of "lying" because the time of sunset in the far north, as recorded by them, differs by an hour from the scheduled time of sunset for Greenwich! What sort of clock would the leader writer of the *Westminster Gazette* prescribe to tell the truth in latitude 70°, where at certain times of the year there is no sunrise and at others no sunset?

There is a further delightful confusion about the bill not being compulsory which enables its advocates to ride away from all sorts of difficulties by explaining that if you find it inconvenient you can use Greenwich time as now. In the report they dispose in that way of the difficulties of American business as well as those arising in connection with astronomical, nautical, and scientific work. Any occupation which uses self-recording instruments can also be disposed of quite easily by calling it scientific and allowing it the liberty which, according to the promoters, is not infringed by the act.

What does this liberty mean? By establishing "local" time without compulsion, are either or both local time and Greenwich time to be legal? And if so, at whose option? May the North-Western Railway adopt the act and the Midland decline? And must the option be exercised once for all at 2 a.m. on the third Sunday in April? or can any person change his mind afterwards? Can anyone legally claim to go to business by Greenwich time and then revise his opinion and demand to leave by local time? Possibly the advocates of the bill are acting upon the assumption that the convenience of the new time will assert its own compulsion as Greenwich time has done, in every town in Great Britain except the ancient city of Canterbury. If it does it will be for some other reason than that which has been so effective in the case of Greenwich time.

The confusion is worse confounded by the report of the Select Committee. The new time is to be called local time, and the short title of the bill is changed; it is now called the "Local time (Great Britain and Ireland) Bill." What kind of confusion are we in now! We thought we knew what local time meant. But between the third Sunday in April and the third Sunday in September we are to have the option (there is no compulsion in the bill) of keeping our clocks at local time, and then 5 p.m. as by law "established" will be, we suppose, five hours after local noon, or should it be five local hours after noon and four, or is it six, hours after Greenwich mean noon? Local time must not be confused with middle European time, though the figures will be identical; that is disapproved by the report.

After an elaborate inquiry, which included a prolonged consultation with the Astronomer Royal, the Committee seems to have lost sight of the fact that local time has already a perfectly definite meaning, and connotes a time measurement based on "local noon," which is late on Greenwich noon, not an hour in advance of it, as the revised bill declares, for nearly all places in Great Britain and Ireland.

It seemed incredible at the outset that serious men of business should really confuse themselves between altering the clocks, which was the proposal, and altering the time of occurrence of events, which was the purpose. It seems more certainly incredible that after prolonged inquiry the Committee should have failed to understand that local time has already a meaning, and cannot, even by Act of Parliament, be made to connote middle European time during the summer months. Yet that is the effect of the bill in its revised form.

If this new definition of local time is final, the report, which originated with metaphor, cannot, after all, be more than allegory; but what lesson the allegory is intended to convey is still a mystery.

What has tickled the fancy and captivated the imagination of the advocates of the measure is that since the introduction of telegraphs and standard time the control of clocks from Greenwich is so completely organised that its very existence is unknown to, perhaps, ninety-nine people out of a hundred, who have come to regard clocks as final timekeepers instead of Greenwich mean time. If this control, which works so smoothly and so surely, were modified so as to make clocks skip an hour in April, every subsequent event would be made an hour earlier, and yet we should be using the same Bradshaw and the same Postal Guide. The apparent simplicity and the completeness of the operation are very attractive. But one would suppose that the operation would at least require the connivance and active assistance of the controllers of all the clocks, certainly those of all the public clocks in Great Britain and Ireland. That the promoters know to be impossible, so, by the bill, the change is imagined to take place—it cannot actually take place—in the deadest of the dead of night, when there will be practically nobody to see that the clocks are not moved. This, again, is curious in an Act of Parliament. To prescribe that a certain operation shall take place at a time which has been selected because presumably there will be fewer people in a position to carry out the order than at any other time, is fine allegory but bad legislation.

Herein is further confusion of ideas arising from the notion that if an order is given to alter the clocks subsequent events will be thereby accelerated. Subsequent events may be accelerated, but it will be in pursuance of orders to accelerate them. It is inconceivable, for example, that such a body as that which controls the North-Western Railway will be content to alter the clocks in the dead of night and expect all subsequent events advanced an hour without express orders given to everybody concerned to accelerate by an hour whatever he has to do on Sunday, or for the large majority on Monday morning. In that case it is clear that the operative cause lies in the orders given, and not in the alteration of the clocks, which is a mere trivial circumstance, and might be omitted with-

out any diminution of the effect of the orders. In like manner you may inform a post-office official that you are going to alter his clock to-morrow morning, but unless you make it clear to him at the same time that he has got to be at work an hour earlier he will certainly regard your time-keeping with aloof interest. Anybody who has the real authority to order the day's work to begin earlier will not care much about altering clocks.

Nor is it likely, as the Committee seems to think, that because Parliament may decide to change the denomination of the hours they will thereby change the meaning of all the statutes in which hours are mentioned. To assume that public houses will regard themselves as closed an hour earlier because the clocks are moved leaves out of account the ingenuity of those who are affected. Our lawyers have not altogether lost their cunning; indeed, the bill might have been promoted by one of that profession, for there will be delightful opportunity for argument as to whether 12.30 a.m. "local" time (=11.30 p.m. G.M.T.) is to-day or yesterday, and as to which of the two 12.30's is in the forenoon. What, indeed, shall we do with such appendages as noon, a.m., and p.m.? Will the denominations run 11 a.m., 12 a.m., 1 noon, 2 p.m., and so on? If so, 12.15 a.m. might become quite an interesting time for a lawyer.

Into this whirl of confusion of ideas it seems hardly safe to entrust a few timid scientific considerations. That we should have a system of keeping time under which, in spite of all principles of continuity of measurement, the numbers between 2 a.m. and 3 a.m. on the third Sunday in September will be travelled over twice, and the same numbers will have different meanings, would be roughly brushed aside by the remark that as nothing happens between 2 and 3 on the third Sunday in September it does not matter. It is the bold assurance of knowledge of the important and the unimportant which strikes the cautious scientific observer with a cold shudder. On the staircase leading to the committee room where this document has been evolved there is an inscription to the effect that copies of the imperial standards of length and weight are built into the wall to make sure that they shall never again be lost through fire. Reading this in passing, one carries away an impressive idea of the sanctity of standards, to find that in the committee room such an idea is regarded as quite early-Victorian. If it would make things more comfortable for a majority of the electors to have an inch off the standard yard, why not have it off? The yard is there; you have only to dig it up. There is no difficulty about it. Those people who would be inconvenienced can use the old yard if they like, and, anyway, they do not count.

What is true of the immured standards, the result of prolonged labour of a Royal Commission, is equally true of the time standard which represents generations of eminently successful work at the Royal Observatory. Yet how can one convey to legislators that a fluctuating standard is unscientific, and that by scientific one means suitable for general acceptance, and for permanent use, and not merely suitable for a few persons of special occupation and training? Are they only to be convinced by the method of trial and failure, the crudest, the most childish of all methods, that the relations of science and practical life are indescribably numerous; that if they adopt a scheme of time designation that has no scientific basis it must result in failure, however bold its promoters may be in rejecting eighths or neglecting quarters: that the advance from the "local" time of fifty years ago to "standard" time of to-day was a step well thought out, and one that cannot be reversed by the introduction of a new and really nondescript time under the old name?

Of course, there remain the great salient objects, the earlier hours of work in summer combined with the undisturbed Bradshaw and the continuity of the Postal Guide. Compared with these the continuity of time measurement is dismissed as a slight matter of no importance to practical people, a piece of scientific pedantry. But let it be remembered that the whole structure which Bradshaw and the Postal Guide represent has been reared upon the basis of an unalterable standard time, and that not even the most experienced legislator can follow out the consequences of taking out the corner-stone of that structure.

In the meantime there is plenty of room for the activity of reformers in the direction of earlier hours. It may be noticed that a large majority of workers, both in town and country, whose work does not depend upon facilities for correspondence, already commence work at 6 a.m., and for them noon is the central hour of the day. The latest people are the office people, who wait for their letters to be sorted. In these days of competition, if there is an early worm anywhere the early bird will not be very far off, and attendance is governed by facilities. It is a curious fact that, although early train facilities are so plentiful and so cheap, except on Sundays, that many clerks come to London in advance of their business hours because they can take advantage of them, there are only two post offices in the London area open for the transaction of telegraphic business before 8 a.m. on Sundays and barely a dozen on week days; in the country districts there are none. Early telegraphic facilities are formulated upon quite the opposite principle from that of workmen's trains; they are very expensive. Yet anyone blessed with a neighbour who is engaged in having his house built, altered, repaired, or painted will be aware that 8 a.m. is a very belated shot at the commencement of the working day. The conclusion that one comes to is that the number of people for whom postal and telegraphic facilities are matters of business, and who therefore keep late hours, are relatively few. To change the hour of work for the millions who begin at six in order to give the thousands that begin at 10 an extra hour of daylight, which is already theirs if they like to use it, seems no more reasonable than to disregard the requirements of Continental correspondence, as the Committee does, because it is only one-eighth of the whole.

Finally, there is another quite interesting confusion of ideas about the purpose of the bill. Its promoters are sanguine that when it is passed there will be longer use of daylight for outdoor sports and exercise with the same time for work, recreation and sleep as before, and yet the day is to remain twenty-four hours. For most people the days are pretty full already. "Six days shalt thou labour and do all that thou hast to do" is a commandment which many people find it very hard to keep. To put in an extra hour's occupation in the day would not be possible for them. To make up for the light hour saved, a dark hour ought to be cut off.

When the bill is in operation there will be exactly the same interval between leaving off work and the commencement of the "halls" as before. If the workers take advantage of the extra hour of daylight for open-air recreation, which comes to them as a sort of free gift by a manipulation of the clocks, it is much to be feared that there will arise a strong temptation to crowd the day, already so overcrowded that no time is left for such an occupation as reading, with an additional hour of glorious life reckless of the loss of

health and strength that, in the long run, follows insufficient sleep. In spite of the prolonged inquiry, the Committee's proposal, although it is ostensibly an appreciation of daylight, appears to many persons, and those not all indolent or conservative, to be nothing more or less than a proposal for a leap in the dark.

WOMEN AND THE FELLOWSHIP OF THE CHEMICAL SOCIETY.

THE women, like the Peris at Heaven's Gate, have knocked at the door of the Chemical Society and have asked to be let in. Their request, as will be seen from the correspondence which we print below, has been referred to the whole body of the fellows, and there are those among them who are much perturbed in consequence. The more excited ones, we understand, are all for banging, barring and bolting, unmindful of the portents that a banging, barring and bolting policy is nowadays a bit discredited. Others, and we trust, for the fair fame and credit of the society as a scientific organisation, that they are the majority, are of opinion that the time has come when its fellowship should be rendered accessible to women. At least, so say the 312 fellows (including 10 past presidents, 12 vice-presidents, and 29 members of council, past and present), among whom are 33 Fellows of the Royal Society, and the heads of the chemical departments of nearly all the most important universities and colleges in the kingdom, who have now moved the council, by the most influentially signed memorial that body has ever received, to consent to the referendum.

It is difficult to know on what grounds the admission of duly qualified women to the society should be refused. Those who desire admission have been adequately trained in science, and most of them are graduates. They are, as pointed out by Sir Henry Roscoe in a letter to the *Times* of July 3, *de facto* chemists, engaged either as lecturers or demonstrators of chemistry in various schools or colleges throughout the country; some of them act as research assistants to professors of chemistry, or cooperate with them in the work of original inquiry; one or two are employed as works-chemists. The objects of the Chemical Society are defined to be the promotion of chemistry, and of those branches of science immediately connected with it, by the reading, discussion, and subsequent publication of original communications. It cannot be denied that women have contributed their fair share of original communications. Indeed, in proportion to their numbers they have shown themselves to be among the most active and successful of investigators. The society consents to publish their work, which redounds to its credit. Why, then, should the drones who never have done, and never will do, a stroke of original work in their lives be preferred to them simply because they wear a distinctive dress and are privileged to grow a moustache?

The women-chemists will doubtless smile at the futility of the adverse arguments which appear above the names of the two honorary secretaries of the society. They will have their own opinion concerning the arduous nature of chemical work, about which they know quite as much as those who profess so tender a solicitude for them. As to their chances of success in life, they have shown that they are quite able to hold their own, in spite of the alleged "overcrowded state of the profession." Overcrowded state of the profession, forsooth! With a delicious but wholly unconscious *naïveté*, the banging, barring and bolting people have herein revealed the true inwardness of their opposition. It is the argument of the weak-kneed—of persons whose *Zunftgeist* has warped their judgment and disturbed their mental balance. We trust the main body of the society will treat the argument with the contempt it merits. It is astonishing how unscientific some so-called scientific persons can be. Apparently they fail to perceive that this request on the part of qualified women to be permitted to share the benefits and material advantages which arise from the cooperation of scientific workers in a common calling is the natural and logical result of affording women facilities for the cultivation of science in practically every university in the country. The study of science, even professionally, is no longer the exclusive prerogative of men. It was inevitable that among the many hundreds of women who are now passing through these universities, or through colleges in close association with them, there should be some who are attracted to science as a calling, or who should find in its pursuit a congenial occupation. They are surely entitled to make their own choice of their life's work. Why, then, should obstacles be thrown in their way? They ask for no favour—only for fair play and fair treatment, and it is the banging, barring and bolting people who, from unworthy motives, would deny them both.

A perusal of the correspondence which we publish below, and especially of the significant letter of the past presidents of the society accompanying the memorial addressed to the council which they have caused to be distributed to the fellows of the society, indicates pretty clearly to what lengths certain individuals are prepared to go in resisting the claims of the women. The memorial, it will be seen, expressed the personal opinion of the 312 signatories that the time had come when the fellowship should be rendered accessible to women, but that weighty fact is not mentioned in the letter which appears above the names of the secretaries. This was neither fair to those who signed the memorial nor to the women whose cause they had taken up. It is possible that this *suppressio veri* was unintentional, nor is it likely, we imagine, that there is any *arrière pensée* in the redundant words to which the past presidents direct attention and which serve only to confuse the issue. But those who drafted the letter and the accompanying ballot-paper must at least be held responsible for the bungling, maladroit manner in which the matter was presented to the fellows. It is a question for the society whether its true interests would not be better served by the transference of its secretarial business to more competent and more judicious hands.

Letter from the Secretaries of the Chemical Society to the Fellows.

BURLINGTON HOUSE,
PICCADILLY, W.
June, 1908.

DEAR SIR,

The Council of the Chemical Society have received a petition praying for an inquiry as to the views of the Society as a whole on the question of admitting women to the Fellowship.

Accordingly, the Council invite very careful consideration of the following brief statement of the chief arguments which have been used both for and against the admission of women.

It is proper to point out that the Council were advised on a former occasion by Counsel that there is some doubt whether, under the existing Charter, women are admissible as Fellows; it is also well to remember that if admitted to this status, women would be eligible, like other Fellows, for a seat on the Council and to hold office.

Those who support the view that steps ought to be taken in order to provide for the admission of women to the Fellowship point out—

(1) That the petition has been signed by 312 Fellows (including 10 Past Presidents, 12 Vice-Presidents, and 29

Members of Council, past and present), among whom are 33 Fellows of the Royal Society and the Professors of Chemistry or Heads of Chemical Departments of nearly all the most important Universities and Colleges in the country.

(2) That a number of women are now devoting themselves to the science of Chemistry, the study of which it is the chief object of the Chemical Society to promote. It is shown that they are capable of independent work by the facts stated in the petition; moreover, in the Transactions from January to May this year there are four papers by women authors independently of others in which they appear as joint authors.

(3) The Chemical Societies of Berlin and America and the Institute of Chemistry admit women to full privileges of membership. The Chemical Society itself has placed the name of Madame Curie among those of its Honorary Members.

(4) A small number of women chemists attend the meetings of the Society regularly as visitors, and no inconvenience has arisen from their presence. They ask that they should be admitted in order that, in addition to exercising the voting powers, they may use the Library and receive the publications of the Society on the same terms as Fellows; at present they have to pay the higher price of publication charged to the general public.

(5) The Society numbers more than 2800 Fellows, while the number of women desiring admission at the present time is about 20; this number will probably increase as time goes on, but judging by the experience of other Societies, it is not likely greatly to exceed that number in the present generation. Should the number rise to as many as 50, their numerical strength would remain wholly insignificant in regard to the conduct of the Society's affairs; consequently, any fear that female influence might hereafter dominate the Council, or even that one woman might be elected to the Council except only in recognition of her scientific ability, is not worth consideration. As to the undesirability of substituting one sex for another in offices of employment, little argument can be based on such a consideration so long as men continue to hold many of the teaching posts in women's colleges.

(6) There is reason to believe that in the event of a decision in favour of applying for a supplemental Charter, the cost, or a large part of it, would be borne by the women chemists and their friends.

On the other hand, those who are unwilling to admit women to the Fellowship of the Chemical Society urge that—

(1) The expense, probably amounting to several hundred pounds, which would be incurred by the Society if a supplemental Charter is necessary, is not justified by the small number of new Fellows likely to seek admission.

(2) It may be gravely doubted whether the deliberate encouragement of women to enter the chemical profession would not operate unfavourably on women themselves in view of the arduous nature of chemical work.

(3) Although it is true, as urged by supporters of the petition, that the number of women seeking admission is small, it is also claimed as a reason for admission that the volume of chemical work contributed by women is increasing rapidly. So long as the women who desire admission remain in such disproportionate minority, there will be an inevitable—although, of course, involuntary—tendency to overestimate their contribution to chemical knowledge and practice. An illustration of this principle may fairly be drawn from the petition itself, where figures are adduced to show that during the past thirty-five years women have been associated with 103 Papers contributed to the Transactions of the Society, but it is not stated, though equally true, that while the total number of Papers printed during that period exceeds 3400, only twenty-three are in the names of women alone.

(4) Even assuming that these 23 contributions were independent of masculine inspiration, it may be questioned whether women have, as a group, shown marked aptitude for chemical pursuits, particularly when it is recalled that the authors in question have worked almost exclusively in collegiate institutions.

(5) Moreover, by being welcomed as guests to the Society, women have been able to enjoy that chemical atmosphere and intercourse which Fellowship of the Society involves.

(6) As regards the admission of Madame Curie to Honorary Membership, it must be borne in mind that Honorary and Foreign Members have no voting powers, and are not eligible for office.

(7) Briefly stated, the position of those unfavourable to the admission of women is that, whilst gladly offering to those women who already have become chemists measures which would give them the benefits derived from attendance at the meetings, they deem it inexpedient publicly to encourage women to adopt chemistry as a professional pursuit, since such a course would tempt them into a career in which they may ultimately not find employment in view of the already over-crowded state of the profession.

Other minor considerations might be mentioned on both sides, and rejoinders to all the above statements are generally obvious. The Council therefore hope that every Fellow will carefully consider the arguments on both sides, and give them the weight which each, respectively, appears in his judgment to deserve.

You are requested, after making the necessary deletion, to return the enclosed ballot paper to the Secretaries in the accompanying envelope, which envelope must be endorsed with your signature. *Unsigned envelopes and signed ballot papers will be invalid.*

The ballot will close on the first day of October next.

We are, Sir,
Yours faithfully,
M. O. FORSTER,
ARTHUR W. CROSSLEY.
(*Hon. Secretaries.*)

Letter from Past Presidents communicating the Memorial to the Fellows.

OXFORD,
1st July, 1908.

DEAR SIR,

In the letter, which has been sent by the Secretaries of the Chemical Society to every Fellow, on the question of admitting Women to the Fellowship, reference is made to a petition received by the Council. We think it desirable that the petition itself, which is not only a petition but a declaration of opinion on the part of a large body of the Fellows of the Society, should be made known generally, together with the names of those by whom it was signed. Accordingly we enclose herewith a copy of the petition as presented to Members of the Council.

Before the issue of the voting papers the attention of the Secretaries was called to an ambiguity which is due to the introduction of the words "the full rights and privileges of." We suggest that those Fellows who are in favour of the admittance of women to the Fellowship, and not only to "the full rights and privileges of the Fellowship," should strike out these words. It would clearly be possible, however unreasonable, to create a class who, though not actually Fellows, were admitted to all the rights and privileges of the Fellowship. That such a class should be created is not the question which the Council were asked and consented to put.

We are, Sir,
Yours faithfully,
(*Signed*)
WILLIAM ODLING.
WILLIAM CROOKES.
A. VERNON HARCOURT.
HENRY E. ROSCOE.
HUGO MÜLLER.
W. J. RUSSELL.
T. E. THORPE.
J. EMERSON REYNOLDS.
WILLIAM A. TILDEN.
R. MELDOLA.
ALEX. CRUM BROWN.

Memorial addressed to the President and Council of the Chemical Society.

GENTLEMEN,

We, the undersigned Fellows of the Chemical Society, being of opinion that the time has come when the Fellowship of the Society should be rendered accessible to women,

request the Council to take such steps as may appear desirable to ascertain the wishes of the Society as a whole in regard to this question.

We understand that there is now an appreciable and increasing number of women of University training engaged in advanced teaching, and in original investigation in chemistry, who desire admission to the privileges of the Fellowship, and as the Chemical Society was founded for the advancement of Science, it seems to us neither just nor expedient that a body of highly qualified workers should be excluded solely by reason of sex.

From the following table, compiled from the Society's journal of the past 35 years, it will be seen that the number of Papers contributed either alone, or jointly, by women is increasing rapidly:—

	No. of papers published in Proceedings	Transactions
1873-82	2	2
1883-92	7	7
1893-02	45	33
1903-07	66	61

We may further point out that not only have women contributed original memoirs to these publications, but they have rendered valuable service to the Society as abstractors and in the compilation of the Indexes.

As is well known, the Chemical Societies of Berlin and America, the Society of Chemical Industry and the Faraday Society, admit women on the same terms as men, and our Society has found a place for Madame Curie among the Honorary and Foreign Members: we consider, therefore, that the restriction should be removed under which the Chemical Society denies to women chemists the advantages extended to them by the sister Societies at home and abroad.

We are, Gentlemen,

Your obedient Servants.

Here follow the names of the 312 Fellows (including 10 Past Presidents, 12 Vice-Presidents and 29 Members of Council, past and present), among whom are 33 Fellows of the Royal Society and the Professors of Chemistry or Heads of Chemical Departments of nearly all the most important Universities and Colleges in the country.

NOTES.

IN connection with the celebration of the tercentenary of the birth of Evangelista Torricelli, an exhibition will be held at Faenza from August 15 to October 15. Included in the programme, and associated with an international section for physical apparatus, in celebration of Torricelli, a prize of 2000 lire is offered for an instrument in connection with meteorology or physics of the earth. The instrument must be exhibited, and show real novelty, either in its principle or in its application of a principle already known. For further particulars application should be made to Dr. W. N. Shaw, F.R.S., Meteorological Office, 63 Victoria Street, London, S.W.

FROM July 1 the morning hour of observation in the British Isles for the Daily Weather Report of the Meteorological Office has been changed from 8 a.m. to 7 a.m., and that of the midday observation from 2 p.m. to 1 p.m. At only two of the twenty-nine stations have the earlier observations been found impracticable. Simultaneously, arrangements have been made for the transmission of the telegraphic reports from all the stations, except one, at which the early observations are made, and for attendance at the office in Victoria Street at the same hour to receive the messages. It is anticipated that the revised arrangements, by which the observations in this country become synchronous with those of France, Belgium, Holland, Germany, Denmark, Iceland, Norway, and Sweden will lead, when fairly established, to a considerable acceleration of the morning reports.

BRILLIANT sky-glows were observed in many different parts of the United Kingdom on the night of June 30 and on several succeeding nights, the phenomenon being apparently at its maximum intensity on the night of July 1. The whole of the northern part of the sky, from the horizon to an altitude of about 45°, and extending to the west, was suffused with a reddish hue, the colour varying from a pink to an Indian red, whilst to the eastward of north the colouring was distinctly a pale green. No flickering or scintillation was observed on the reddened sky, nor was there any tendency to the formation of the streamers or luminous arch characteristic of auroræ. Cirro-stratus clouds near the horizon were tinged with the same colour as the surrounding sky. A special feature in connection with the phenomenon was the prolongation of twilight, extending almost to the following daybreak, and from the experience cited by many observers in various parts of Great Britain the light at midnight was sufficient to allow of fairly small print being read without any aid from artificial light. These nocturnal glows were preceded by a drought extending in London, as well as in several other parts of England, to about sixteen days, and it was followed by severe thunderstorms on the night of July 3 and on the succeeding day. The fine weather in many parts of the country has, however, remained unbroken, so that no relation between the display and disturbed weather can be claimed. Miss C. O. Stevens, who describes a long-sustained solar halo in our correspondence columns, made observations of the coloured skies on the nights of June 30, and July 1 and 2, until daybreak obliterated them. She says:—"The naked-eye evidence favours the view that the phenomenon was due, in part at least, to auroral display, both in the brilliant white and delicate green patches of light that were of rather inconstant brilliance, and in the spreading of the rosy light into the far south and south-west at 1.45 a.m. on July 1." We are informed, however, that spectroscopic observations failed to give any evidence that the phenomenon was auroral in character.

THE death is announced, at the age of eighty-four, of Prof. J. V. Barbosa du Bocage, director of the Zoological Institute at Lisbon.

THE death is announced, in his seventy-third year, of Prof. C. Schrader, the leading authority in Germany on the Assyrian language and Assyrian civilisation.

THE prize of 10,000 francs (400*l*.) offered by M. Armengaud to the first aëroplane to remain in the air for a quarter of an hour was won by Mr. Farman on Monday, at a competition held at Issy-les-Moulineaux, under the auspices of the Aéro Club. Mr. Farman made a flight with his apparatus which lasted 20m. 20s. according to the official timing. He covered a distance of about eleven miles.

COUNT ZEPPELIN last week made a remarkably successful flight in his new airship. The airship started on its voyage from Friedrichshafen at 8.30 a.m. on July 1, and headed for Switzerland. After executing evolutions over Lake Constance, the airship proceeded in the direction of Lucerne, where it was seen at 12.30 p.m. The return northwards was over lakes Zug and Zürich, and the airship was observed over the town of Zürich at 2.20 p.m. The airship's floating shed on Lake Constance was reached at 8.30 p.m. The distance covered is estimated at 250 miles, and the journey lasted twelve hours. The greatest height reached by the airship's own engine-power is stated to be some 750 metres, and the highest speed 15·3 metres per second. It will be remembered that the previous record

voyage of Count Zeppelin was in September last, when the airship was in the air for eight hours and a half. We notice that Count Zeppelin has received a telegram of congratulation from the German Emperor.

THE Institution of Electrical Engineers has bought the unexpired lease of seventy-six years of the Medical Examination Hall, on the Victoria Embankment, from the Royal College of Physicians and the Royal College of Surgeons. The purchase price agreed upon is 50,000*l.*, the annual ground rent being 220*l.* The Institution of Electrical Engineers will take possession of their new premises on June 1, 1909. It is expected that the building will provide adequately for the needs of the institution, and afford suitable accommodation for its library.

THE Antarctic Expedition, which is to leave shortly under the leadership of Dr. Jean Charcot, has, according to the *Globe*, been granted a subsidy of 24,000*l.* by the French Government. Dr. Charcot's vessel, the *Pourquoi Pas*, has been specially built for ice work. The party will include a biologist, a meteorologist, two astronomers, and several naval officers. Dr. Charcot expects to be away two years. Coal will be taken in at Punta Arenas, and the base of the operations in case of need will be the island of Port Charcot, where the leader spent a year in 1903. It is interesting to note that it is intended to take two motor sledges on the expedition.

A REUTER telegram states that Commander Peary left in the *Roosevelt* on his expedition to the North Pole on July 7. The *Roosevelt* has been provisioned for three years, although her commander hopes to accomplish the journey to the Pole and back in half that time. At Whale Sound Commander Peary will take on board twenty-five Eskimo hunters and dog drivers with their families, making between forty and fifty persons. The expedition will require from 200 to 250 dogs. Commander Peary hopes to accomplish the object of the expedition and return by October, 1909. For winter quarters he will endeavour, a *Times* correspondent states, to force the *Roosevelt* to the same point on the north shore of Grant Land that he occupied in the winter of 1905–6. Commander Peary only lacks 1000*l.* of the 10,000*l.* needed to equip the ship adequately for a two years' voyage.

THE first international congress concerned with questions of the production of low temperatures and their application to industrial and sanitary purposes is to be held in Paris from October 5–10 next. The congress is being assisted by the French Government, by several municipalities, by commercial companies, and other bodies. The programme which has reached us shows that the business of the meetings will be transacted in six sections, dealing respectively with the following subjects:—section i., low temperatures and their general effects, president, Prof. d'Arsonval; section ii., freezing mixtures and machines, president, Prof. H. Leauté; section iii., application of low temperatures to foods, president, M. A. Gautier; section iv., application of low temperatures to other industries, president, M. E. Tisserand; section v., applications of low temperatures to commerce and transport, president, M. Levasseur; and section vi., legislation, president, M. J. Cruppi. The sections are subdivided somewhat minutely, and the specialist will have every opportunity of acquainting himself with modern views of every aspect of the subject. The general president of the congress is M. André Lebon, and the general secretary M. J. de Loverdo, 10 rue Denis-Poisson, Paris (17e).

IN the House of Commons on Monday, Sir E. Sassoon asked the President of the Board of Trade whether his attention had been directed to the issue of the report of the Select Committee on the Daylight Saving Bill, and, if so, whether the department had expressed any opinion relative thereto. In reply, Mr. Churchill said:—"I have read the report of this committee with much interest and with a lively recognition of the advantages which the Bill in question appears at first sight to offer to all classes, and especially to the working classes. I have arranged for the whole subject to be carefully examined by the Board of Trade in consultation with representatives of trade, labour, and transport interests. Pending the result of this examination it is not possible for me to express an opinion." We refer elsewhere in the present issue to some of the objections to this proposal to juggle with time-keepers. In rural industries the hours of work are adapted to hours of daylight at different seasons of the year, and this is also the case with workers in building and engineering trades. The proposal to legislate for national self-deception in time reckoning because of the late hours now kept in cities is as unscientific as it would be unworkable. It would be just as reasonable for Parliament to decide that a temperature of, say, 50° should be called 40° in summer and 60° in winter.

THE death is announced, from Berlin, of Prof. Oskar Liebreich, the pharmacologist, in his seventieth year. We learn from the *Times* that Prof. Liebreich early devoted himself to the study of technical chemistry under Fresenius at Wiesbaden. At the age of twenty-seven he was appointed to the department of the Pathological Institute by the late Prof. Virchow, who formed a high opinion of his abilities. In 1872 Dr. Liebreich became director of the Pharmacological Institute in Berlin. His name will always be associated with the introduction, in 1872, of hydrate of chloral as a therapeutic agent, which has since been used widely as an anodyne and narcotic. He was an authority on the treatment of lupus, and published a number of works and special articles on this and other questions of therapeutics.

THE seventh International Congress of Applied Chemistry is to be held in London from May 27 to June 2, 1909, under the hon. presidency of Sir Henry Roscoe, F.R.S., he himself being the acting president. It is hoped that the Prince of Wales will open the congress. The meetings will be held in the University Buildings, in the Imperial College of Science, and in the Central Technical College. The special sections and their presidents will be as follows:—analytical chemistry, Dr. T. E. Thorpe, C.B., F.R.S.; inorganic chemistry and allied industries, Dr. Ludwig Mond, F.R.S.; (*a*) metallurgy and mining, Sir Hugh Bell, Bart., (*b*) explosives, Sir Andrew Noble, Bart., K.C.B., F.R.S.; organic chemistry and allied industries: (*a*) organic products, Prof. W. H. Perkin, F.R.S., (*b*) colouring substances and their uses, Prof. Meldola, F.R.S.; industry and chemistry of sugar, Mr. Richard Garton; starch industry: (*a*) starch industry, Dr. Horace T. Brown, F.R.S., (*b*) fermentation, Mr. John Gretton, M.P.; agricultural chemistry, Lord Blyth; hygiene, medical and pharmaceutical chemistry—bromatology, respectively, Sir J. Crichton Brown, F.R.S., Mr. N. H. Martin, and Mr. R. R. Tatlock; photographic chemistry, Sir W. de W. Abney, K.C.B., F.R.S.; electrical and physical chemistry, Sir John Brunner, M.P.; and law, political economics, and legislation with reference to chemical industries, Lord Alverstone. The provisional programme has been drawn

up; it comprises the opening meeting in the Albert Hall, a conversazione at the Natural History Museum, a banquet at the Crystal Palace, and lectures by Profs. Haller, Otto Witt, and Nasini, and by Sir Boverton Redwood. Committees have been formed in foreign countries to organise the work of the sections, and an executive committee has charge of the arrangements at home. It is anticipated that the congress will be largely attended; meetings in Paris, Berlin, and Rome were attended by about 3000 chemists. The honorary secretary is Mr. William Macnab, of 10 Cromwell Crescent, S.W.

DR. LUIZ CRULS, whose death we recorded in our issue of July 2, was born at Diest, in Belgium, in the year 1848. The early years of his manhood were devoted to the military service of his country as an officer in the Engineers. In 1881 he accepted the post of director of the observatory at Rio de Janeiro, and from that date he took a prominent part in scientific work in Brazil. In addition to the directorship of the observatory, he held the post of professor of geodesy and practical astronomy in the military academy. He was also the head of many scientific commissions appointed by the Brazilian Government, among others of that for the exploration of the central plateau of Brazil, and the report of this commission forms an important part of his scientific work. His remaining contributions to scientific literature were of an astronomical or meteorological nature. One of the most important was a report on the observations of the transit of Venus, made at Punta Arenas in 1882. Numerous other astronomical papers appeared in the *Comptes rendus* of the Academy of Sciences of Paris. A detailed discussion of the climate of Rio de Janeiro calls for special mention among his meteorological works.

AMONG the list of new fungi determined by Mr. G. Massee, and recorded in the current number of the *Kew Bulletin*, there is a notable species from Grenada, *Nectria theobromae*, a parasitic fungus that forms "bleeding" wounds on the bark of cacao trees. From Old Calabar was received an edible agaric, *Volvaria esculenta*, that grows on coffee pulp. *Boletus curtipes* furnishes the first record for the genus from South Africa.

WHEN visiting the German colonies in tropical Africa, Dr. W. Busse paid special attention to the effects of the grass fires periodically kindled by the natives, and has summarised his observations in the *Mittheilungen aus den deutschen Schutzgebieten* (vol. xxi., part ii.). The original motive would be to clear the land for cultivation, or by burning the old stems to induce a fresh growth of young shoots, and occasionally to drive the wild game for a battue. The general result has been to produce, as in Togoland, the "steppe" vegetation where originally forests existed. Although directly and indirectly the consequences are in the main disastrous, it is noted that by the destruction of dangerous insects fires may serve to check such evils as the "surrah" disease.

A SUBSTANTIAL account of the Fucaceæ, prepared by Mr. K. Yendo and published in the Journal of the Royal College of Science, Tokio (vol. xxi., article 12), forms a welcome addition to algal literature. With regard to distribution, it is noted that species of Fucus and Pelvetia are confined to the north, Cystoseira to the Loochoo Islands, and a boundary between cold and warm sea forms can be set at Kinkwasan Island on the east and Ojika peninsula on the west. Sargassum is the largest genus, with forty-one out of fifty-nine recorded species, and six species are assigned to Cystophyllum. *Coccophora Langsdorfi* is an interesting species with a perennial knotty stump, from which arise two distinct kinds of branches; similar differentiation is noted for an alga that is made the type of a new genus, Ishige. A series of fine illustrations adds to the value of the critical notes on the various species.

AN interesting contribution to the cytological structure of cœlenterates is made by Mr. H. B. Bigelow, who has studied the cell divisions in *Gonionemus murbachii*, and has published his results in the Bull. Mus. Comp. Zool. at Harvard College (vol. xlvii.). The nuclei possess in somatic cells about twenty-four chromosomes, and the nucleolus is regarded as consisting of a peripheral shell of chromatin enclosing a non-chromatic substance. During the reductions, suggestive stages were made out recalling the observations made by Korschelt on Ophryotrocha. The chromosomes arise by stages closely resembling those seen in a somatic mitosis. There is, however, an early synapsis-like ("pseudosynapsis") appearance which Bigelow interprets as an artefact. The modified spireme forms a reticulum, which then breaks up into about twenty-four spherical chromatin masses. This fact is remarkable, inasmuch as there are twenty-four somatic chromosomes, but in the preceding spermatogonial mitoses each of these arises by the coalescence of two "chromomeres." The author regards, on grounds which do not seem to us to be conclusive, the twenty-four chromatin spheres, not as the equivalents of somatic chromosomes, but as chromomeres, and hence concludes that a reduction has already occurred. But it seems at least as probable that we are really dealing with a belated pairing, to form the pseudochromosomes, and this would bring the process into line with some cases of the sort already known elsewhere. The details given of the maturation of the egg seem not to be opposed to such a view. The author is excessively cautious in drawing conclusions, and whilst this is a wise position to adopt for the present, it is to be hoped he will continue his observations so as to enable him to put forward his interpretation with more confidence.

IN 1811 the Spanish Viceroy of Mexico addressed to the authorities in California a series of questions designed to procure information regarding the Indian population attached to the Missions, their manners and customs, religious beliefs, and social condition, and the results produced on them by missionary teaching. The original replies to this series of interrogatories, prepared by the authorities of the leading missions, now form part of the Bancroft Library at the University of California, and have been translated and published as the first Bulletin of the eighth volume of their Transactions, with excellent annotations by Mr. A. L. Kroeber. The replies are naturally of varying degrees of value. Some exhibit a good knowledge of the people among whom the authors worked; and they generally display a spirit of tolerance towards non-Christian beliefs, thus forming an interesting picture of native society before it had been much influenced by Europeans, and long before the period of scientific ethnology. In particular, the accounts of the vulture sacrifice as a mode of commemorating the dead, the feathers of the bird being used as a dress of a boy who danced before the community; and the use of jimson-weed (*Datura meteloides*) as a means of producing the ecstatic condition in youths at the initiation ceremony, when they saw visions, and were instructed in the religious beliefs and practices of the tribe, deserve special notice.

IN an address delivered before the National Geographic Society of America, published in the May number of the

National Geographic Magazine under the title of "An American Fable," Mr. Gifford Pinchot, chief of the United States Forest Service, raises the question of the exhaustion of the national resources, a subject which has recently been discussed by President Roosevelt. The growth of the forests at present is, he states, but one-third of the annual consumption, and the timber will last only twenty years at the existing rate of expenditure. For a country so largely dependent on wood for building and fuel, the result of the wasteful policy of the last half-century will be disastrous, and Canada, the only available source of supply, will soon need all her timber for her own use. The anthracite coalfields, again, are said to be in danger of exhaustion in fifty years, and the bituminous coal will fail early in next century. Some of the older oilfields are already worked out; the natural gas has been wasted, burning night and day in many townships. Iron deposits grow less every year. The ranches in the west feed only half the cattle which they would produce under intelligent management, and the prices of meat are rapidly rising. The present, he observes, is one of the most critical epochs in the national history, and disaster is sure to occur unless a policy of conserving these resources is enforced. The only practical remedy, he suggests, for this dangerous state of things is the appropriation of the vast supplies of water power for the production of electrical energy to take the place of coal for machinery, heating, and illumination. If these fall into the hands of trusts the prospect is gloomy in the extreme. "We are no more exempt from the operation of natural laws than are the people of any other part of the world."

THE new Bernese Alpine Tunnel and the Lötschberg Railway are discussed in an article by Dr. C. Koppe in *Himmel und Erde* for April. In pointing out the hindrance caused by the Bernese Alps to the utilisation of the Simplon Tunnel route, Dr. Koppe emphasises the great commercial advantages, not only to Bern and north-west Switzerland, but also to the western Rhine district, which would follow the construction of a railway connecting Brieg, at the northern end of the Simplon Tunnel, with Bern. The first part of the line, from Spiez to Frutigen, has been constructed for several years, and it has been decided to continue this line to Brieg, a tunnel being pierced through the Bernese Alps at Lötschberg. The building of the lines from Brieg and Frutigen to the south and north of the tunnel entrance will be commenced in the summer of 1908, and the whole international railway, Bern, Lötschberg, Simplon, should be completed in five years. The Bernese Alpine Railway Company was formed in July, 1906, and the work of triangulation carried out in the autumn of the same year, accurate data being obtained for fixing the length and direction of the tunnel. The three mountains situated on the line of the tunnel, First, Immenengrat, and Wildelsiggrat, were used as bases for the survey. Boring was commenced in the spring of 1907, electric power being derived from works at Spiez and Gampel. Dr. Koppe gives a detailed description of the proposed line from Frutigen, through Mitholz and Kandersteg, to the tunnel entrance, and also of the line from Goppenstein to Brieg, noticing the numerous small tunnels and viaducts which will be required.

WE learn from the *Bulawayo Chronicle* that at a meeting of the Rhodesian Scientific Association on May 19, the Rev. Father E. Goetz, S.J., read a useful paper on the rainfall of Southern Rhodesia, based on observations at about fifty stations, reduced to the period 1888–1907. Among the principal results we note that Mashonaland, as a whole, has an annual average of more than 30 inches; the eastern range of high altitudes has 40 inches and upwards, while on the slopes towards the Zambesi and Limpopo the average is between 25 and 30 inches. Matabeleland is much less favoured; along the watershed the average is 25 east of Bulawayo and 20–25 west of that place. Between April and October not more than an inch of rain falls on an average in Rhodesia, west of the eastern range of high altitudes; from October to March 90 to 98 per cent. of the year's rainfall takes place. Reference must be made to the original paper for many very interesting details in connection with the *régime* of the rainfall and the influence of wind direction. With regard to the question of cycles the author states that, although there are only ten years' barometer observations available, his inquiries show that investigation on the line of a 19-year variation in the barometer and of a corresponding variation in the rainfall might perhaps be continued with profit.

PROF. SILVANUS P. THOMPSON'S "Kelvin Lecture," delivered to the Institution of Electrical Engineers on April 30, has been issued as a separate pamphlet by Messrs. Spon. It consists of a sketch of the life and work of Lord Kelvin, and gives within its short compass a more vivid picture of the great master than have several more lengthy accounts.

THE Sanitas Electrical Co., Ltd., of New Cavendish Street, London, W., has sent us a profusely illustrated and conveniently arranged catalogue, running to 338 pages, dealing with electromedical apparatus which the company is prepared to supply. The catalogue provides remarkable evidence of the numerous applications in medical and surgical science of the Röntgen and other rays. Incidentally, the appliances described in the catalogue serve to illustrate the debt of gratitude which mankind owes to the men of science upon whose work, often little recognised, these remedial measures are based.

M. P. VILLARD exhibited before the Société Française de Physique on May 4 an experiment in which the Aurora Borealis was produced artificially (see NATURE, September 5, 1907, vol. lxxvi., p. 481), and a complete description of the method used is given by M. Villard in the June number of the *Journal de Physique*. A large exhausted flask is placed between the poles of an electromagnet, and a stream of kathode rays is shot into the flask in a direction oblique to the magnetic field. In these circumstances the rays become a luminous spiral with its axis directed towards one of the poles of the magnet. At a point near this pole the path of the ray is nearly reversed, and the spiral proceeds towards the other pole, at which the reversal is repeated. Owing to the axes of the spirals being slightly inclined to the lines of the field, they generate a spheroidal surface coaxial with the field with a circular piece cut out at each pole. According to the theory which this experiment at once suggests, in our observation of the aurora we are looking at the edge of one of these openings from underneath, the spirals coming nearest to the earth's surface at these points and being most luminous.

MESSRS. LEITZ, of Wetzlar and London, have submitted for our inspection one of their prism binoculars of improved design. Like the majority of modern instruments of this type, these are constructed on the principle of Porro's erecting prisms, but several additional patents on details enable special points of excellence to be claimed. The tubes are provided with focussing arrangements and inter-

pupillary adjustment. For the former, the focussing is done separately for each eye by rotation of the eye-pieces, controlled by a scale for future setting. Although at first this may appear more inconvenient than the usual double screw motion of both tubes, this is not found to be the case during continued usage, and the makers are enabled to introduce the very desirable feature of making the prism cases quite dust and moisture proof, which is almost impossible when sliding tubes are employed. As issued, the magnifying power is 6, and the field of view about 7°. With respect to the varying opinions as to the best arrangement of the object-glasses for stereoscopic effect, Messrs. Leitz have decided that the advantages of placing them further apart than the pupillary distance are questionable, and so the object-glasses are fitted at the same interval as the eye-pieces. The binocular is made of a specially strong light metal, the weight being only 12 oz. without case. We can without hesitation speak very highly of the optical performance of this instrument. The definition is remarkably crisp, and the image very achromatic and quite sharp up to the edge of the field of view.

A GENERAL index to the annual volumes, sixteen in number, published by the Geological Survey of Canada since 1884, has been compiled by Mr. Frank Nicolas and issued at Ottawa by the Geological Survey. The index runs to 1014 pages, and contains about 180,000 references. It should prove of great service to investigators anxious to refer expeditiously to the annual volumes of the Canadian Survey. The present catalogue, combined with the index previously published, and dealing with the publications from 1863 to 1884, forms a complete means of reference to the English edition of the volumes issued by the Geological Survey of Canada.

OUR ASTRONOMICAL COLUMN.

RADIAL VELOCITIES OF NINETY-NINE STARS.—The largest single contribution to line-of-sight work yet made appears in No. 5, vol. xxvii., of the *Astrophysical Journal* (pp. 301–24, June). The results were obtained by Prof. Küstner and Dr. Zurhellen, at the Bonn Observatory, during the years 1903–7, and include the provisionally determined velocities of ninety-nine stars of the second and third spectral types down to the fourth visual, or fifth photographic, magnitude.

A three-60°-prism spectrograph by Töpfer, giving a well-defined spectrum between λλ 4150 and 4500, was employed, the temperature being automatically controlled by electric means; at Hγ the linear dispersion is such as to give 15·2 tenth-metres per millimetre.

Although the present values for the radial velocities are only provisional, it is expected that they will not be greatly modified in the final definitive results. In addition to fifteen previously known variable velocities, the ninety-nine sets of results include those for three other stars, δ Tauri, ε Böotis, and μ Pegasi, the radial velocities of which are suspected to be variable. The comparison spectrum employed in each case was that of the iron arc, Kayser's values of the wave-lengths being taken; Rowland's values were taken for the stellar lines. As the observations included some 7500 complete measures of about forty-four different stellar lines, Prof. Küstner expects that their discussion will provide good exact values for the relative wave-lengths of the latter, and also indicate their dependence on the type. In discussing the determination of the constant correction, due, first to the absolute errors of the wave-lengths adopted, and, secondly, to the personal and instrumental errors, Prof. Küstner considers as invalid the control usually obtained from plates exposed on the sun, moon, or larger planets. He believes that a source of light, of precisely known radial velocity and *as similar as possible to the star*, should be observed, and suggests the employment of the brightest minor planets or of Jupiter's satellites for this purpose. After many experiments, and at Dr. Zurhellen's suggestion, he employed spectrograms of the bright isolated peaks seen at the moon's terminator, and found the results to be satisfactory. These indicate that a small negative correction of about −1·0 km. should be applied to the results now published. Of the constant radial velocities determined, that of η Cephei, −85·98 km., is the largest.

THE OBSERVATION OF COLOURED STARS.—In No. 4252 of the *Astronomische Nachrichten* (p. 57), Herr Osthoff discusses at some length the changes of the colour perception of the eye, and shows that these changes depend upon the physiological condition of the observer as well as upon the intensity of the colour of the observed object and upon the instrument used. A table containing the results of his own observations between January, 1894, and November, 1898, shows the variation of the difference between his estimates of colour and the catalogue colour of the stars observed; other tables show the variation of the eye's colour-perception for red and yellow stars respectively, and it appears that the eye is more uncertain in estimating the red than the yellow. The importance of this fact in observing the magnitudes of coloured variable stars is pointed out. There is some indication of a periodical change in the individual eye, but the observations are not sufficiently numerous to establish this.

PHOTOMETRIC OBSERVATIONS OF EROS.—During the period September, 1907, to January, 1908, Dr. Paul Guthnick made a number of photometric observations of Eros at the Berlin Observatory, and now publishes and discusses the results in No. 4249 of the *Astronomische Nachrichten* (p. 1, vol. clxxviii.). From his discussion he is unable to establish with certainty the existence of any short-period light-variation. On plotting the light-curve, taking into account the phase-variations, and trying periods of 5·24h., 5·28h., and 5·32h., he obtained a negative result. It appears certain that during the greater part of the opposition any short-period variation was imperceptible.

THE PHOTOGRAPHY OF VERY FAINT SPECTRA.—The expedient of slightly fogging plates on which it is proposed to photograph faint objects is generally known, but is apparently not so generally adopted. Having recently employed this procedure very successfully in the photography of faint spectra, Mr. R. W. Wood, of the Johns Hopkins University, describes his method and results in No. 5, vol. xxvii., of the *Astrophysical Journal* (p. 379, June). The curve representing the action of light on a sensitised plate is at its commencement flat, but after reaching a certain point it begins to rise much more rapidly; Mr. Wood's supplementary exposure carries the darkening of the plate to this point, so that the radiations he is wishing to photograph commence their action at that part of the curve where a given exposure is much more effective in producing density than if it were applied alone. By a judicious use of the method he has succeeded in reducing the exposure, necessary to produce a certain density, by one-half. The preliminary exposure needed is very small; with a gas flame turned down until the yellow tip was but 3 mm. or 4 mm. high, four seconds at a distance of about two metres was found to be sufficient.

JULY AND AUGUST METEORS.

THE meteoric season of July has again returned, bringing with it all the interesting associations attached to this period in previous years. Early Perseids will now be occasionally seen with their rapid flights, and leaving streaks upon their paths, but they will be directed from the southern region of Cassiopeia instead of from the place 45°+57°, as at the maximum epoch on August 11–12. Many long-pathed and slow-moving Aquarids will also be noticed from the point about 339°−10°, and this display generally develops its richest features near the end of July, on about the 28th to 30th.

A few years ago I sifted all my observations at the July and August periods with a view to find the most active radiants determined at Bristol, and the number of meteors recorded from them. Omitting Perseids, the following is a list of the principal systems:—

Radiant R.A.	Dec.	Periods: July 20–Aug. 16 meteors	Aug. 19–25 meteors
°	°		
7	+11	31	26
9	+39	44	5
24	+42	35	23
30	+36	43	12
47	+43	59	25
61	+48	21	26
271	+48	32	9
291	+60	44	69
292	+52	72	9
304	−12	31	—
312	+12	30	9
315	+48	38	10
315	+78	24	6
333	+48	53	6
333	+28	37	8
333	+71	50	31
339	−10	237	20
348	+50	52	17
345	+ 1	28	29

The complete table of showers, rich and feeble, appeared in *Astronomische Nachrichten*, No. 3874. About eighty-five systems in all were displayed between July 16 and August 20.

It would be interesting if some of these streams could be re-observed during the oncoming return of the Perseids and their radiant points re-determined. The positions given in the table may be relied on as accurate to within 2° of probable error, but some of the radiants are more exact than others, the centres having been more sharply defined. In the case of showers of swift, streaking meteors, the intersecting points of the flights can generally be ascertained with great precision.

Special attention seems necessary to be given to the period about July 11–12, when the first signs of the Perseids decidedly begin to be manifested.

This year moonlight will seriously interfere with observations for about a week near July 13 and August 12. The maximum display of Perseids will be partially overpowered by the radiance of our satellite, but some brilliant meteors will be observed at about the epoch August 9–13 should the skies be clear. W. F. DENNING.

MAGNETIC RESOLUTION OF SPECTRAL LINES.

PROF. P. ZEEMAN, continuing his investigations on the occurrence of asymmetric separation of spectral lines in a magnetic field (see NATURE, April 30, vol. lxxvii., p. 615), describes a series of observations on asymmetrical triplets (*Konink. Akad. Wetens. Amsterdam*, p. 566, March 27). As a method giving independent confirmation of the previous work was desirable, he decided to investigate the new series by means of the Fabry and Perot interferometer, using the *étalon*—that special form of the instrument in which the distance between the silvered surfaces is kept constant, about 5 mm. The variations of wave-length may in this case be determined either by continued measurements of the same interference ring or by the method of coincidences, regulating the magnetic force in such a manner that a ring which expands by increasing magnetic intensity coincides with a contracting ring. The system of rings was formed in the focal plane of a small achromatic lens of 18 mm. aperture and 12 cm. focus. This focal plane coincided exactly with the plane of the slit of a one-prism spectroscope, the width of the slit being so reduced that the rings produced by the two yellow mercury lines at λλ 5791 and 5770 could be observed separately.

Reproductions of the appearances presented with magnetic field off and on are included with the paper, made from enlarged negatives. The measurements given indicate conclusively that the positive results concerning asymmetric resolution in strong fields have a real significance, and a very interesting discussion of the results is appended. Taking Lorentz's equation for determining e/m, and accepting J. J. Thomson's value of $e = 1{\cdot}1 \times 10^{-20}$ electromagnetic units, the number of electrons per unit volume causing the radiation of the yellow mercury line 5791 in a vacuum tube appears to vary from 8×10^{16} to 4×10^{16} with magnetic fields varying from 29,220 to 9130 Gaussian units. In these experiments the temperature of the vacuum tube was between 100° C. and 120° C.; the corresponding vapour pressures of mercury, according to Hertz, would be 0·29 mm. and 0·78 mm. respectively, and it is calculated that the number of electrons participating in the emission of line λ 5791 is of the same order of magnitude as the number of atoms present.

A number of observations made by Mr. Jack in the physical laboratory at Göttingen are also recorded, showing the asymmetrical separations of lines of wolframium and molybdenum. The paper concludes with a question as to the possibility of the wave-length of the central line of a triplet being changed by the action of the magnetic field as compared with the unmodified line, and some observations made with an echelon appear to indicate that some lines undergo in strong fields displacements of the order of six or ten thousandths of an Angström unit, in most cases towards the red. This is to be further treated in a subsequent paper.

SOCIAL ANTHROPOLOGY.

PROF. J. G. FRAZER has made a good start in the work of his chair at the University of Liverpool by his opening address on "The Scope of Social Anthropology." It is characterised by all the lucidity of exposition and grace of style which we are accustomed to expect from the author of "The Golden Bough." His main object is to plead for the systematic study of savages, who represent an arrested, or rather retarded, stage of social development. They are, he is careful to point out, primitive only in a relative, not in an absolute, sense; that is, they are primitive in comparison with ourselves, not in comparison with primæval man, of whom we know nothing, and, so far as we can see at present, are likely to learn nothing.

The province of social anthropology falls into two departments, one embracing the customs and beliefs of savages, the other including such relics of these as have survived in the thought and institutions of more cultured peoples. The first department may be called the study of savagery, the second the study of folk-lore. The government of mankind, he goes on to show, is always and everywhere essentially aristocratic, that is to say, the dull-witted majority always follows the keener-witted minority. In the mental, no less than in the physical sphere, the struggle is internecine; but in the end the better ideas, which we call the truth, carry the day. Hence, even in a civilisation like our own, we find the lower classes still following magical and other primitive practices of the same kind. Not that schemes for the regeneration of society form part of his programme. The study of the past must throw light upon the problems of the present, but the exploration of schemes of social reform is the business of the sociologist, not of the social anthropologist.

Dr. Frazer closes a remarkable address by an impassioned appeal for the more careful study of that savagery which is so rapidly disappearing. "How shall we of this generation look when we stand at the bar arraigned on a charge of high treason to our race, we who neglected to study our perishing fellow-men, but who sent out costly expeditions to observe the stars and to explore the barren ice-bound regions of the poles, as if the polar ice would melt and the stars would cease to shine when we are gone?"

RECENT RESEARCHES IN THE STRUCTURE OF THE UNIVERSE.[1]

II.

Localisation of the Stars in Space by a Sorting Process.

THE method may be best explained as a *sorting* process. The process was not actually followed; it would have been too laborious, and would have met with some difficulty.[2] But the difference is immaterial, and the present description has, I think, the advantage in point of clearness. Let each of the stars of the second, third, &c., to the eighth magnitudes be represented by a little card on which are inscribed the apparent magnitude and the apparent proper motion of the star. Then imagine three sets of boxes.

Fig. 1.

Classification according to Magnitude.

1st Set.—Apparent magnitude boxes represented in Fig. 1.—In the box for the second apparent magnitude, as many cards are put as there are stars of the second magnitude in the sky. The total numbers of stars for each magnitude are inscribed on the lid. We thus see that there are in the whole of the sky forty-six stars of the second magnitude, 134 of the third, and so on.

According to Magnitude and Proper Motion.

2nd Set.—Magnitude-motion boxes (Fig. 3). The stars in each of the former series of boxes are re-distributed over a series of boxes, each of them containing stars of a determined apparent motion. By way of an example, Fig. 3 shows this new classification for the stars of the *fifth* apparent magnitude. There is, of course, another such series for each one of the apparent magnitudes. Those for the *fifth* have been distributed over twenty-eight new boxes. In the first have been collected the cards representing the stars with a proper motion of 0″ to 1″ per century. The average motion is 0·5, and this has been inscribed on the lid. The little arrow indicates that this number represents a motion. The number 5 surrounded by a star refers to the fact that we have exclusively to do with stars of the fifth apparent magnitude. The second box contains the stars with proper motion between 1″ and 2″ per century, &c. For the larger motions the limits have been taken somewhat wider. In the eleventh box the motions 10″ to 15″ are contained, in the thirteenth those between 20″ and 30″, and so on. The number of star-cards in each box has been inscribed on the lower right-hand corner of the lid. The figure thus shows, for instance, that there are in the sky ninety stars of the fifth magnitude having a proper motion between 0″ and 1″ per century. We have thus arranged the stars according to both the rough criteria of distance at our disposal; for we know perfectly well that in a very general way the fainter the stars and the smaller their apparent motion the further they must be away.

For each of the groups thus obtained we are now able, according to what has been said before, to derive the *mean* distance. This determination being made, we obtain the mean distances expressed in light-years which have been inscribed on the lid with the letter MD prefixed. Already we may see now how incorrect it is to imagine all the stars of the fifth magnitude to be placed at one and the same distance, as Struve did. According to the numbers in our figure, the distance varies from 1670 light-years for the stars of the first box to eleven light-years for those of the last. It is true that just the data for these extreme boxes are the most uncertain; still, it is evident that even in these mean distances there must be an enormous range.

But to proceed. The eighty-six stars in our sixth box (see Fig. 3) are at an average distance of 248 light-years.

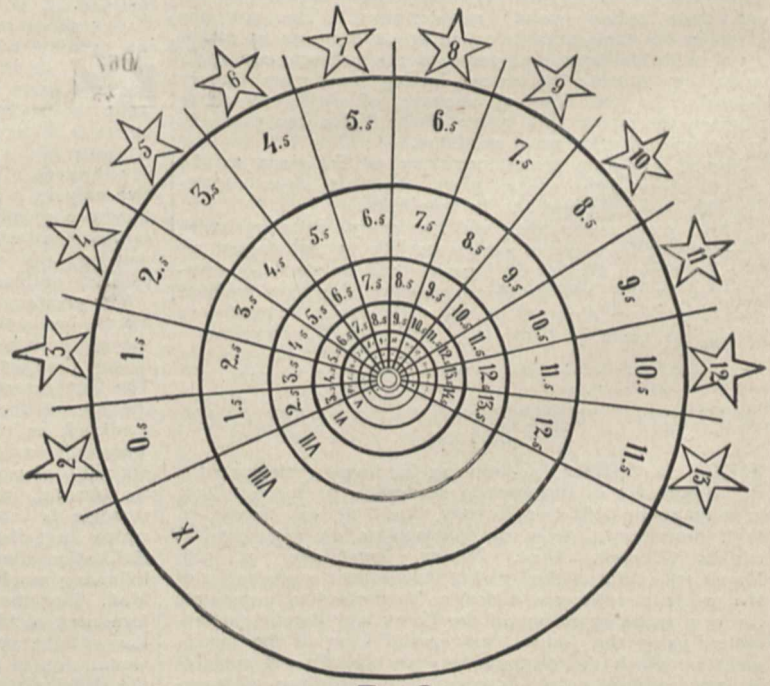


Fig. 2.

Are we compelled to stop here and to *assume* that the real distance of *all* the individual eighty-six stars is 248 light-years? If it were so we would *surely* still have gained a considerable advantage over Struve. For, owing to want of other data, he saw himself compelled to treat all the stars of the fifth magnitude, that is, the whole of the twenty-eight groups in our boxes, as if they were all at the mean distance of the whole. But yet there would remain in our solution a defect *of the same kind*, and it

[1] Discourse delivered at the Royal Institution on Friday, May 22, by Prof. J. C. Kapteyn. Continued from p. 212.

[2] For many of the stars used the proper motion is still not known. What is known, however, is the percentage of the stars of each magnitude having a determined proper motion. This knowledge enables us to put in every box the required *number* of cards showing a determined proper motion, and this is all that is wanted in what follows.

would be impossible to say in how far the results definitively to be obtained would be influenced. Happily there is an escape.

For our last classification, the classification in the distance-boxes, it is of no particular advantage that every individual star gets in its proper distance-box. It will be sufficient to know how many stars will finally be found in each distance-box. If this result is obtained, we shall presently see how easy it becomes to study the problem put at the beginning of this lecture. Our aim will be evidently reached if we can find out *how many per cent.* of the stars in any one box have such and such a distance. Now, in order to determine these percentages, it will be sufficient to investigate *a sample* of our stars.

Stars of Measured Distance taken as a Sample.

Happily there is the possibility of taking a sample that will help us out of the difficulty, for, as we know, there are in the sky a hundred stars of which astronomers have succeeded in determining the individual distance with some accuracy. We take these as our sample. They are distributed over a great many of our boxes.

We take them all out, having a care to note for all of them the mean distance of the stars in the box to which they belong. For all the hundred stars we now compare their mean distances to their true distances, and thus find out how many per cent. of them have true distances between *two* and *three*, *four* and *five tenths*, and so on, of the mean distance.

3rd Set.—Distance boxes. These percentages are all we want for our last distribution, the distribution over the distances. It is true that our sample is a somewhat undesirably small fraction of the whole; it shows besides some other weak points, but it appears happily *a posteriori* that even rather considerable uncertainties in these percentages have but an unimportant influence on the results. We are thus at last enabled to distribute our star-cards according to the true distances. I made the distribution over the spherical shells shown in Fig. 2.

The dimensions of these shells have been so chosen that if a star is removed from one shell to the next further one, the observer at the centre will see the star grow fainter by just one magnitude, that is, it will grow very nearly $2\frac{1}{2}$ times fainter.

The figure is not well fitted for bringing out the details of our results. The shells become too narrow towards the centre, and the more central ones do not allow of the insertion of sufficiently clear figures. For this reason I constructed Fig. 4. The numbers valid for the several spherical shells have here been entered in equally broad horizontal rows. The drawing does not therefore show the real dimensions, but these as expressed in light-years, which may be read off on the right-hand side of the drawing. We thus see that the central sphere extends to a distance of twenty-one light-years, that the second spherical shell extends from twenty-one to thirty-three years, and so on. In these rows a last set of boxes is placed. There is a box for each apparent magnitude in each of the rows. The stars of the boxes of Fig. 3 are thus, of course, all contained in the vertical row of boxes, corresponding to apparent magnitude five in Fig. 4.

Distribution according to Distance Illustrated by Example.

In order to illustrate by an example how the stars of the boxes in our Fig. 3 are distributed over our different shells, that is, over our *distance boxes* of Fig. 4, take the seventh box. It contains seventy-seven stars at a mean distance of 220 light-years. Our countings on the sample showed that about *one-fifth* of the stars have *true* distances which are between 37 per cent. and 59 per cent. of their *mean distance* (derived from their apparent magnitude and proper motion). Therefore about one-fifth of our seventy-seven stars must have true distances between 37 per cent. and 59 per cent. of 220 light-years, that is, between eighty-two and 130 light-years—or, finally, fifteen stars of our box must find their place in the fifth shell of Fig. 4, that is, in the box corresponding to the fifth apparent magnitude in that shell. In precisely the same way I find that twenty-one of them must be placed in the sixth shell, eighteen in the seventh, ten in the eighth, and so on.

If, after that, we repeat the process for all the remaining boxes of Fig. 3, we get, for the fifth apparent magnitude, the numbers inscribed on the lower side of the boxes corresponding to that magnitude in Fig. 4.

Further than for the eleventh shell no numbers have been entered. They become too uncertain. As, however, we know the *total* number of stars of each apparent magnitude, we know the aggregate number which remains to be distributed over the whole of the further shells.

What has here been explained for the stars of the fifth magnitude has been also done for the other magnitudes between the second and the eighth. The whole of the results are shown in our Fig. 4.

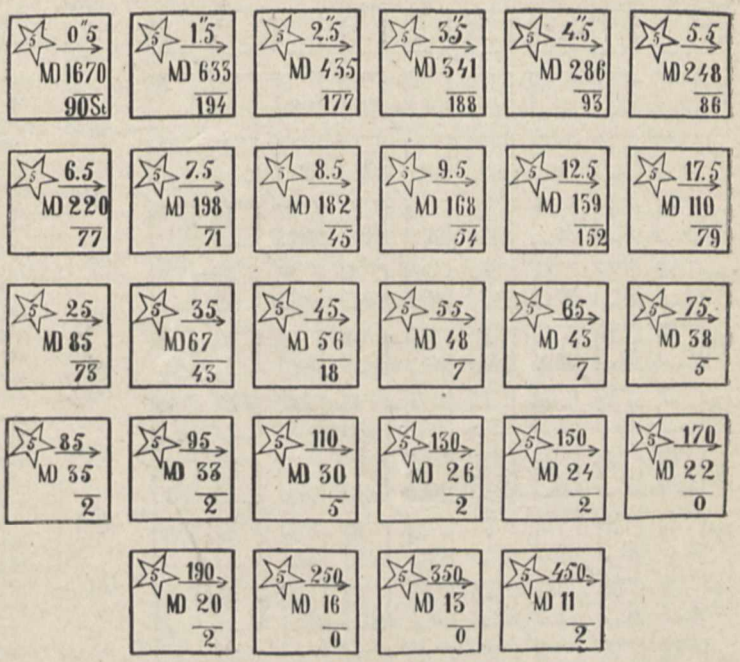


Fig. 3.

Stars of Equal Luminosity brought together.

The main result of the investigation is embodied in these numbers—and *first*, in every box stars have now been brought together of equal absolute magnitude—that is, of equal luminosity. For as the stars in each box are at the same distance, and as, at the same time, they are of equal *apparent* brightness, they must, of necessity, be of equal total light-power, that is, according to our definition, of equal luminosity or absolute magnitude. For the absolute magnitude of a star I have taken the magnitude the star would show if placed at a distance of 326 light-years. The choice of just this number is simply a matter of convenience, and need not be explained here.

As a consequence, the stars at a distance of 326 years, which to us appear as stars of the fifth magnitude, will have also the absolute magnitude five. Those of the same apparent magnitude, but at a distance of 517 light-years—that is, just one shell further—must have the absolute magnitude four in order to show us the same brightness, notwithstanding the greater distance. Now our eighth shell lies just between these limits of distance. In the middle of this shell, therefore, the stars of apparent magni-

tude five must have absolute magnitude 4·5. In the box, therefore, belonging to the fifth apparent magnitude, eighth shell, all the stars are of absolute magnitude 4·5. In the ninth shell a star must already have the absolute magnitude 3·5 in order to shine as a fifth apparent magnitude at this greater distance, and so on. In this way the absolute magnitudes were found which in our figure have been inscribed on the lids of the boxes.

We are now able to derive at once the *mixture law, i.e.* the proportions in which stars of different absolute magnitude are mixed in the universe. For in one and the same shell (eleventh) we find two stars of absolute magnitude −1·5, as against three of magnitude −0·5, fifteen of absolute magnitude 0·5, seventy-six of absolute magnitude 1·5, &c.

That is, our results for the eleventh shell furnish us with the proportion in which stars of absolute magnitude −1·5, −0·5, &c., to 4·5, are mixed in space. The tenth shell gives the proportions for all the absolute magnitudes between −0·5 and 5·5, and so for the rest. All the shells together give the proportions for the absolute magnitudes

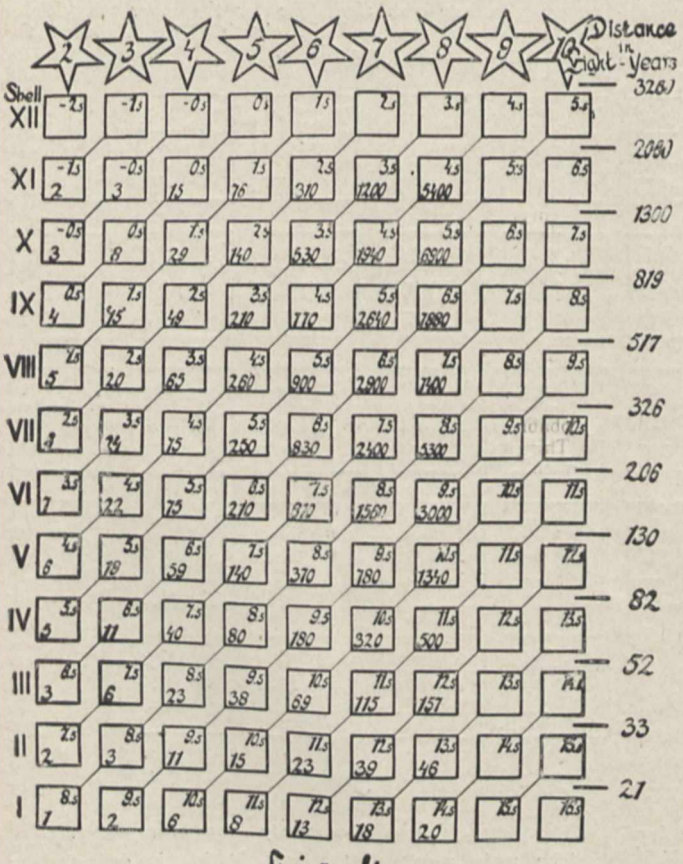


Fig. 4.

−1·5 to 14·5, that is, for a range of not less than sixteen magnitudes. Not only that, but most of the proportions are determined independently by the data of quite a number of shells. So, for instance, the proportion of the stars of absolute magnitude 4·5 to those of absolute magnitude 5·5. Each of the six shells from the fifth to the tenth furnishes a determination of this proportion. All of them are not equally trustworthy. If we take this into account, we find that the agreement of the several determinations is fairly satisfactory. By a careful combination of all the results, a table representing the law of the mixture of the stars of different absolute magnitude was finally obtained. Rather than show you the direct result, however, I will first replace the absolute magnitudes by luminosities expressed in the total light of our sun as a unit. This will have the advantage of presenting a more vivid image of the real meaning of our numbers.

By photometric measures it was found that the sun, placed at a distance of 326 light-years, would shine as a star of magnitude 10·5. In other words, the sun's absolute magnitude is 10·5. A star of absolute magnitude 9·5 will, therefore, have 2·5 times the light-power—that is, 2·5 times the *luminosity* of the sun. A star of absolute magnitude 8·5 will again have a luminosity which is 2·5 times greater, and so on.

Such results evidently enable us to transform our absolute magnitudes into luminosities. Thus translated, I found the results shown in the following table.

Luminosity Table.

Within a sphere having a radius of 555 light-years, there must exist :—

1 star	10,000	to	100,000	times	more	luminous	than the sun
46 stars	1,000	,,	10,000	,,	,,	,,	,,
1,300 ,,	100	,,	1,000	,,	,,	,,	,,
22,000 ,,	10	,,	100	,,	,,	,,	,,
240,000 ,,	1	,,	10	,,	,,	,,	,,
430,000 ,,	0·1	,,	1	,,	,,	,,	,,
650,000 ,,	0·01	,,	0·1	,,	,,	,,	,,

This table represents what, up to the present time, we know about the mixture law.

The fainter the stars, the more numerous.

The rate at which the numbers increase with the faintness is particularly noticeable for the very bright stars.

Passing to the fainter stars, this rate gradually diminishes, and it looks as if we must expect no further increase in number for stars the luminosity of which falls below one-hundredth of that of the sun. Meanwhile, this is simply a surmise. For stars of this order of faintness data begin to fail. Here, as in nearly every investigation about the structure of the stellar system, the want of data for stars below the ninth apparent magnitude makes itself very painfully felt.

But let us come back to our Fig. 4. I will *first* remark that, knowing the mixture law, we can predict the number of stars that we shall get in the empty boxes belonging to the ninth, tenth, &c., magnitude, as soon as continued astronomical observations will permit us to include these stars in our discussion. For the mixture law, as derived just now, shows that in our universe the stars of absolute magnitude 5·5 are 3·5 times as numerous as the stars of absolute magnitude 4·5.

Now as in the eleventh shell the number of stars of the absolute magnitude 4·5 is 5400 (see Fig. 4), there must be 3·5 times 5400, that is, 18,900 stars of absolute magnitude 5·5 in this shell. These belong all in the box of the ninth apparent magnitude of this shell. In the same way we obtain the number of stars to be expected in the boxes of the tenth, eleventh, &c., apparent magnitude for all our shells down to the eleventh. There is exception only for the boxes belonging to the lower shells, for which the absolute magnitude would exceed 14·5.

It is evident, however, that the number of stars in these exceptional boxes must be small, and for what follows they are of little importance.

Star-density.

In the second place, our boxes now also lead to the determination of the *star-densities*. For the volumes of the consecutive shells are perfectly known; they are in the proportion of 1 : 3·98. For the sake of convenience, let us say that the volume of each shell is exactly four times that of the next preceding one. Now, to take an example of the determination of the densities, consider the ninth and tenth shells (see Fig. 4). In the ninth there are forty-nine stars of absolute magnitude 2·5. Therefore, if in the tenth the stars were as thickly crowded as in the ninth, there would occur in this shell four times forty-nine, that is 196 stars of this absolute magnitude 2·5.

In reality we find but 140 of these stars. The conclusion evidently must be that the star-density in the tenth shell is about 140/196, that is, about two-thirds of that in the ninth shell. A similar conclusion is obtained by

comparing the number of the stars of absolute magnitude 3·5 in the two shells. The values obtained from the magnitudes 0·5 and 1·5 may be neglected. Owing to the exceedingly small number of stars, they must necessarily lead to untrustworthy results. From all the rest I found that the density in the tenth shell must be about 64 per cent. of that in the ninth shell. The proportion between the densities in the other shells was determined in exactly the same way.

A slight defect in our results was then discovered. We should exceed the limits of the time allowed for this lecture by entering into a consideration of this defect. It must be sufficient to state that it was not difficult to remove it. After that it appeared that the density in the first six of our shells is nearly the same. The density in these shells, that is, in the neighbourhood of our sun, is such that about 2000 stars of a luminosity exceeding one-hundredth that of the sun must be contained in *a cubic light-century*. After the sixth shell the density diminishes gradually at such a rate that in the eleventh shell the density has fallen to about 30 per cent. of what it is in the vicinity of the solar system.

In what precedes we tried to give a solution of the problem put at the beginning of this lecture—a solution, however, which embraces only that part of the universe which is contained within a distance of about 2000 light-years from our solar system. Is there no possibility of getting beyond this distance?

I think there is, but, of course, you will not be astonished to find that the certainty of our conclusion diminishes as we get deeper and deeper into the abysses of space.

One of the reasons why the method thus far applied breaks down beyond the eleventh shell is that our data about proper motion are not refined enough to determine this motion with sufficient accuracy as soon as it is below 1″ in a century. Even the somewhat greater motions are rather uncertain. The proper motions thus cannot help us much beyond a certain distance. But we have still one valuable element for the solution of our problem. This element is the total number of stars separately for the apparent magnitudes. Thanks mainly to the photometrical researches at the Harvard Observatory, it has become possible to determine with considerable accuracy the total number of stars of the first, second, &c., to the eleventh magnitude; with a fair degree of accuracy even those for the magnitudes down to the fourteenth (inclusive).

The density in the shells beyond the eleventh, not only for the stars down to the eighth apparent magnitude, but, according to what has been said a moment ago, also for the apparent magnitudes of nine, ten, &c., to fourteen, has to be determined in such a way that the addition of all the numbers in any one vertical column of Fig. 4 produces just these totals for the corresponding apparent magnitudes.

It can be proved that after the eleventh shell the density must, on the whole, continue to diminish. If we assume that this diminution is gradual and proportional to the increase in distance, it becomes very easy to determine the rate of this diminution, and consequently the distance at which the density becomes *zero*, that is, the distance at which we reach the limit of the stellar system. We cannot enter into fuller particulars here. It must be sufficient to say that in this way we are led to conclude that the further diminution of density must be slow, so slow that in the assumption made above the limit of the system is only reached at a distance of some 30,000 light-years.

Hypotheses Underlying the Results.

In conclusion, a few words on the question, In how far are the results now obtained to be considered as established?

The answer must be, They can be considered to be established only in so far, and no further, than we can trust the truth of the hypotheses which still underlie our reasoning.

For future consideration there thus remains the question, In how far can we test the validity of these hypotheses?

These hypotheses are the following:—

(1) The mixture was assumed to be the same at greater and smaller distances from the solar system.

(2) The same was done for different distances from the galaxy.

(3) The universe was assumed to be transparent, that is, it was assumed that the absorption of light in space is *zero*.

Can we get rid of these hypothetical elements?

I think we can, at least to a very great extent.

As to the *first*. Our Fig. 4 already goes far in enabling us to judge whether it is true or not. For evidently both our sixth and our ninth shell give the nature of the mixture, at least of the stars of absolute magnitude 3·5 to 6·5. Therefore, so far as these stars are concerned, we are able to see whether or not the mixture is the same at the distance of 650 light-years as it is at the distance of 170 light-years. Likewise, the figure enables us to make the comparison in other cases. As soon as we possess the necessary data for a longer range of apparent magnitudes, say down to the fourteenth or fifteenth, we shall be able to dispense to a very large extent with our first hypothesis.

As to the second, the possible variation of the mixture with the distance from the Milky Way, it is largely only the question of treating the stars in different galactic latitudes separately. So far as I can see, there are no particular difficulties in the way of such a separate treatment, at least not since the nature of certain anomalies in the distribution of stellar motions has been elucidated.

Absorption of Light in Space.

Last, not least. Is the universe really absolutely transparent? There are reasons which make this seem very doubtful. A couple of years ago I obtained some evidence in the matter which shows that the absorption of light in space, if it exists to an appreciable amount, must at least be so small that over a distance of a hundred light-years not more than a few per cent. of the light can be lost. To determine so small an amount to within a small fraction of its total value will be a difficult task indeed. Still, we can even now see definite ways, which, given the necessary data for very faint stars and nebulæ, will probably enable us to overcome this last difficulty.

This want of data for very faint stars, which, in the present investigation, makes itself felt at every step, has led a number of astronomers to concerted action.

The express purpose of their cooperation is to collect data of every kind for stars down to the faintest that can practically be reached. As complete observation and treatment of these numberless stars is out of the question, the plan is confined to a set of samples distributed over the whole of the sky.

Conclusion.

If, at the end of this lecture, somebody summarises what has been discussed by saying that the results about the structure of the universe are still very limited and not yet free from hypothetical elements, I feel little inclined to contradict him. But I would answer him by summing up in another way, viz.:—

Methods are not wanting which, given the necessary observational data obtainable in a moderate time, may lead us to a true, be it provisionally still not very detailed, insight into the real distribution of stars in space.

I think this time need not exceed some fifteen years. They to whom such a time may still seem somewhat long may be reminded of the fact that we shall have finished our work before any but a very few of our nearest neighbours in space can be aware of the fact that we have begun, even if we could send them a message now by wireless telegraphy travelling at the speed of light.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ST. ANDREWS.—Besides the gifts of Diplodocus to the British Museum and to the museums of Paris and Berlin, Dr. Andrew Carnegie has, at the instigation of Dr. Holland, presented a neatly mounted example (cast) of the hind limb of Diplodocus to the University Museum, St. Andrews—another of the very munificent donations which mark the period of office of the late Rector of the University.

As the contributions toward the re-endowment of Oxford University have reached a total of more than 100,000*l.*, the second donation of 10,000*l.* promised by Mr. W. W. Astor has now been received by Lord Curzon of Kedleston, the chairman of the fund.

ON July 10 the administrative staff of the technological branch of the Board of Education will remove from South Kensington to the new offices of the Board in Westminster. All correspondence on and after July 9 should be directed to the secretary, Board of Education, Whitehall, with the exception of letters for the Victoria and Albert Museum, the Royal College of Art, and the Solar Physics Observatory, which should continue to be addressed to the offices of the Board of Education, South Kensington.

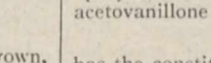
ON Tuesday, July 7, the King, accompanied by the Queen, opened the new buildings of the University of Leeds. In the course of his reply to an address presented by the Vice-Chancellor, the King said :—" My interest in the great cause of education is well known, and I note with gratification the ever-widening basis of the instruction now undertaken by our great educational institutions. The high standard of moral and intellectual discipline for which our schools and universities have been distinguished has not been lowered, nor has the pursuit of literary and historical studies been checked by the inclusion in the university curriculum of those scientific studies, and especially of those branches of applied science for which such ample provision has now been made. I rejoice to think that the opportunities open to the young men of our great industrial communities of acquiring a knowledge of subjects of commercial utility in an atmosphere of academic culture are being so greatly increased, and I find it difficult to express my appreciation of the manner in which the great responsibilities which rest with the authorities and teachers of a university such as this have been discharged. It is a source of pleasure to me to know that you have provided also for the study of the theory and practice of agriculture, for I am convinced that the best possible results cannot be derived from the industry and natural ability of our farmers unless they are properly instructed in the scientific aspects of their work." When the University was founded, the Privy Council stipulated that a building fund of 100,000*l.* should be formed, and this amount has now been raised. The new buildings include a number of independent blocks, namely :—(1) extension of main buildings, providing accommodation for arts subjects, zoology, and botany, including new botanical and zoological laboratories; (2) extension of present engineering laboratory in a separate large wing at the rear of the main building; (3) large new block of buildings for electrical engineering; (4) large new block of buildings for mining, fuel, and metallurgy; (5) large temporary building for physical laboratory and organic chemistry laboratory. Increased support from the Treasury is needed if the work provided for in these new buildings is to be carried on efficiently. We hope to give an account of the new buildings in our next issue.

SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, June 3.—Mr. H. Rowland-Brown, vice-president, in the chair.—*Exhibits.*—H. St. J. **Donisthorpe**: Pseudogynes of *Formica sanguinea*, caused by the presence of the beetle *Lomechusa strumosa* in the nest, from the New Forest.—H. J. **Turner**: Living larvæ of *Coleophora maritimella* on *artemisia*, and also a species of Asilidæ and its prey.—C. J. **Gahan**: (1) Living specimens of a " leaf-insect " from the Seychelles, bred in England by Mr. St. Quentin, probably *Pulchriphyllium crurifolium*, S.; (2) some Lampyridæ of considerable interest collected by Mr. E. E. Green in Ceylon, and including both sexes of the genera Lamprigera and Dioptoma, the females of which had hitherto been unknown, those of both genera being larviform. Attention was directed also to the existence in China, Ceylon, and the Malay Peninsula of remarkable larviform females greatly resembling in form the females of the American group Phengodini, and being somewhat similarly provided with rows of luminous points.—G. C. **Champion**: Specimens of *Dromius angustus*, Brullé, and *Cryptophagus lovendali*, Ganglb., recently recorded by him from Woking and the New Forest respectively; also two species of the Staphylinid genus Leptotyphlus and one of the Curculionid genus Alaocyba, the exhibitor mentioning that these extremely minute blind insects were much smaller than any known British representatives of the S. European groups in question.—Colonel C. **Swinhoe**: Several boxes of butterflies taken during the present year (1908) in the Canary Islands, chiefly from Grand Canary and Teneriffe. Colonel Swinhoe observed that, with the exception of *Lycaena webbianus*, all the species met with suggest a foreign origin.—*Papers.*—Notes on the value of the genitalia of insects as guides in phylogeny: W. **Wesché.**—Certain Nycteribiidæ, with descriptions of two new species from Formosa: Hugh **Scott.**—Further studies of the Tetriginæ (Orthoptera) in the Oxford University Museum: Dr. J. L. **Hancock.**—Mimicry in tropical American butterflies: J. C. **Moulton.**—Heredity in *Papilio dardanus* from Natal, bred by Mr. G. F. Leigh, of Durban: Prof. E. B. **Poulton.**—New species of Hesperiidæ from Central and South America: H. H. **Druce.**

Royal Meteorological Society, June 17.—Dr. H. R. Mill, president, in the chair.—The Hong Kong typhoon of September 18, 1906: L. **Gibbs.** Judged by anemometer records, the typhoon was by no means a severe one, as the highest average hourly wind velocity was seventy miles. —An elementary explanation of correlation, illustrated by rainfall and depth of water in a well: R. H. **Hooker.**

Chemical Society, June 18.—Sir W. Ramsay, K.C.B., F.R.S., president, in the chair.—The thermal decomposition of hydrocarbons, part i., methane, ethane, ethylene, and acetylene: W. A. **Bone** and H. F. **Coward.** The results of a systematic investigation of the modes of decomposition of the four hydrocarbons at temperatures between 500° and 1200° were described, and it was shown that methane, which is by far the most stable of the four hydrocarbons, and a principal product of the decomposition of the other three, decomposes for the main part directly into carbon and hydrogen. The methane formed during the decomposition of the other three hydrocarbons can be explained on the supposition that " residues " such as $:CH$ and $:CH_2$ are directly " hydrogenised " in an atmosphere rich in hydrogen.—The rusting of iron: W. A. **Tilden.** It was shown that (1) oxygen or air with liquid water are alone necessary to produce rusting of iron; (2) that water alone attacks iron slowly, producing a film of what is probably ferrous hydroxide; (3) that iron rust always contains ferrous oxide; and (4) that rusting is due in the first instance to electrolytic action, promoted in all ordinary cases by the existence of carbonic acid in water exposed to the air, and by the presence in iron of various compounds of carbon, silicon, phosphorus, and sulphur.—Studies on zirconium: E. **Wedekind** and S. J. **Lewis.** —The constituents of Canadian hemp, part i., apocynin: H. **Finnemore.** The principal constituent of the root of *Apocynum cannabinum* is identical with the crystalline apocynin of commerce, which is identical with the acetovanillone obtained by Tiemann from *iso*eugenol, and has the constitution  .—A new synthesis of apocynin: H. **Finnemore.** The author has synthesised this substance from vanillin by an application of the Grignard process.—The constitution of diazonium perbromides: F. D. **Chattaway.**—Cholestenone: C. **Dorée** and J. A. **Gardner.** Cholestenone produced by the oxidation of cholesterol reacts with ozone, giving an ozonide which probably has the formula $C_{27}H_{44}O.O_7$. This, when decomposed by water, gives carbon dioxide and a keto-monocarboxylic acid, $C_{26}H_{42}O_3$, identical with that obtained by Windaus. Cholesterol on similar treatment gives an ozonide, $C_{27}H_{46}O.O_3$, which also evolves carbon dioxide on treatment with water.—Solubility of silver chloride in mercuric nitrate solution: B. H. **Buttle** and J. T. **Hewitt.** Morse's view that when mercuric nitrate is present in large excess, chlorine occurs only as $HgCl_3$-ions, is confirmed.—The relation between absorption spectra and chemical constitution, part ix., the nitroso- and nitro-

groups: E. C. C. **Baly** and C. H. **Desch.**—Benzeneazo-2-pyridone: W. H. **Mills** and Miss S. T. **Widdows.**—The electrolytic chlorination of the salts of some organic acids: J. K. H. **Inglis** and F. **Wootton.**—The action of nitrous gases on di*cyclo*pentadiene: A. **Rule.** The gaseous products from the action of nitric acid on arsenious oxide bring about the formation of a mixture which on separation by means of alcohol was found to consist of the ψ-nitrosite and the dinitro derivative of the hydrocarbon. —An alternative structure for the supposed stereoisomeric α-osazones: F. D. **Chattaway.**—The formation of 4-pyrone compounds from acetylenic acids, part ii.: S. **Ruhemann.** —The fluorescence of platinocyanides: L. A. **Levy.** Barium platinocyanide exists in two forms identical in crystalline form, but which exhibit a remarkable difference in physical properties. One variety is golden-yellow, and only very slightly fluorescent, the other being bright green and very fluorescent. The two forms have the same chemical composition, and are isomeric modifications. Similar phenomena are exhibited by the calcium salt, and to a certain extent by the cerium salt.—The preparation of disulphides, part ii., the action of alkalis on sodium alkyl thiosulphates: T. S. **Price** and D. F. **Twiss.** The interaction between alkalis and sodium ethyl and benzyl thiosulphates in aqueous solution has been studied. The chief organic product of the action in each case is the corresponding disulphide, the main step of the reaction being probably represented by the equation

$$R.S_2O_3Na + NaOH = RS{-}{+}Na_2SO_3 + {-}OH.$$

—Note on the formation of lead ethoxide: F. M. **Perkin.** When thin sheets of lead are boiled in alcohol or suspended in the vapour of boiling alcohol no action takes place, but if they are suspended over absolute alcohol and ozone is bubbled through it, in a short time the surface of the lead becomes tarnished, and then assumes a brownish-yellow colour due to the formation of lead ethoxide, $Pb(OEt)_2$.—Some reactions of phenylhydrazine with metallic cyanides and other salts: R. de J. F. **Struthers.** Phenylhydrazine in alcoholic solution combines with cuprous cyanide in ammoniacal solution to form an insoluble compound, $2CuCN,3C_6H_5.NH.NH_2$. Cobalt cyanide exerts a powerful catalytic action on phenylhydrazine, 0·03 gram to 0·04 gram sufficing to determine the decomposition of 5 c.c. or 6 c.c. of phenylhydrazine with almost explosive violence. Nickel cyanide has a similar but less powerful action.—The formation of polyiodides in nitrobenzene solution, part iii., the chemical dissociation of the polyiodides of the alkali metals and ammonium radicals: H. M. **Dawson.** —The hydrolysis of amygdalin by emulsin, part ii.: S. J. M. **Auld.** It is shown that amygdalin is derived from an αβ-disaccharide, the β-dextrose residue being attached to the benzaldecyanohydrin nucleus. Mandelonitrile glucoside is formed as an intermediate product during the hydrolysis of amygdalin by emulsin, the biose ether-linking breaking preferentially.—A new form of potash bulb: A. E. **Hill.** This is figured in the Proc. Chem. Soc., xxiv., 182.

EDINBURGH.

Royal Society, June 15.—Dr. R. H. Traquair, vice-president, in the chair.—The reducing action of electrolytic hydrogen on arsenious and arsenic acids when liberated from the surface of different metals: W. **Thomson.** The hydrogen liberated from the five metals lead, zinc, cadmium, tin, and silver converted arsenious acid ions into arseniuretted hydrogen with about equal velocity. The reaction could be measured during small intervals of time, and the velocity of reaction was practically that of a unimolecular reaction. Arsenic acid was much more difficult to reduce than arsenious acid. Lead, however, converted it into arseniuretted hydrogen with a velocity nearly equal to that with which it reduced arsenious acid. Zinc, with a higher supertension equivalent, reduced it at only about a third of the velocity, whilst silver reduced none at all under the conditions of the experiment.—The theory of the microbarograph, and on some observations with the Dines-Shaw instrument: Prof. **Chrystal.** The mathematical theory, which was an application of the laws of viscosity of gases, showed that with external pressure increasing at a steady gradient the microbarograph tended to a maximum, that a wave-like variation of pressure was recorded on the instrument with the crests and troughs preceding in time the corresponding rounded crests and troughs in the external variation, but that with a sharp, abrupt change in the rate of change of the pressure the corresponding pinnacles and troughs on the instrumental record occurred simultaneously with the external changes. Observations had been made at three stations in the neighbourhood of Lochs Tay and Lochearnhead with the object of measuring the rate of progression of rapid oscillations of pressure across the district. It was found that the majority of these were from the west, in this respect resembling cyclonic depressions, and that their speeds of progression also varied within much the same limits which characterised the progression of cyclones.—The effects of chloroform on the metabolism: Prof. Noel **Paton.** The object of the paper was to study the conditions under which late chloroform poisoning occurred. From a series of experiments on the administration of chloroform to dogs by the respiratory passages, by the stomach, and under the skin, the conclusions were drawn that when given by the mouth and hypodermically chloroform acted as a poison, decreasing the activity of the liver, but that when administered through the respiratory passages it increased the disintegration of the protein in the body and stimulated the liver. The reason of this was demonstrated in a second paper, by Miss Dorothy **Lindsay** and Prof. **Paton,** in which it was shown that chloroform given by the lungs was rapidly taken up and rapidly eliminated, but when administered by the other methods it was slowly taken up and slowly eliminated, and got fixed to the liver in large quantities.—Asteroidea, Ophiuroidea, and Echinoidea of the Scottish National Antarctic Expedition: Prof. **Koehler.** Of the ninety-four species collected, seventy-six were records from Antarctic and sub-Antarctic regions, including forty-one new species and two new genera.—Holothuroidea of the Scottish National Antarctic Expedition: Dr. Clement **Vaney.** Of the thirty-four species described twenty-one were new. Nearly all the new species are from very high southern latitudes, and from depths of 1400 to 2600 fathoms. Both these papers were communicated by Dr. W. S. Bruce.

PARIS.

Academy of Sciences, June 29.—M. Bouchard in the chair.—Observation of the partial eclipse of the sun of June 28, 1908, at the Observatory of Paris by various observers: B. **Baillaud.** Observations were made of the contacts and length of the common chord of the two discs, and numerous photographs were taken. The observers were MM. Bigourdan, Schaumasse, Chatelu, Popoff, Puiseux, and Baillaud.—Decomposition of the alcohols under the catalytic influence of wood charcoal (braise de boulanger): Georges **Lemoine.** Details are given of the products obtained by the catalytic decomposition of methyl, ethyl, normal propyl, isopropyl, and isobutyl alcohols in presence of charcoal. The results varied somewhat with the nature of the charcoal employed, but the main reaction was the production of hydrogen and the aldehyde, differing from the reaction with purified animal charcoal, the latter giving chiefly water and the corresponding olefine. The temperatures at which the decompositions took place were considerably lower than those at which the alcohol was decomposed in the absence of charcoal.—A new mineral species and the minerals which accompany it in the tourmaline layers of Madagascar: A. **Lacroix.** The new mineral is a silicate of aluminium, calcium, beryllium, magnesium, lithium, sodium, and potassium, the formula proposed from the analyses being

$$10SiO_2,8Al_2O_3,5{\cdot}5(Ca, Be, Mg)O,1{\cdot}5(Li, Na, K)_2O,7H_2O,$$

and for which the name bityite is proposed.—A new rheograph designed for the projection of the curves of alternating currents: Henri **Abraham** and J. **Carpentier.** The instrument is on the lines of one described in 1897, and is distinguished by the fact that its moving parts are relatively heavy, and capable of carrying a mirror of large surface. A demonstration of the apparatus was given before the academy.—Electrocapillary measurements by the method of large drops: M. **Gouy.** The capillary electrometer giving only relative figures, the present paper is concerned with absolute measurements. The drop of

mercury must be rigorously hemispherical, and this was secured by carrying it in a glass vessel, optically worked, of 40 mm. radius. Results are given for solutions of sulphuric acid, sodium sulphate, hydrochloric acid, and the iodide and bromide of potassium.—The action of metallic oxides on the primary alcohols: Paul **Sabatier** and A. **Mailhe.** The oxides examined fall into four groups:—(1) not undergoing reduction, and exerting no appreciable effect on the primary alcohols under 400° C.; (2) those rapidly reduced by the alcohol to the metal or lower oxide; (3) those which are not reduced, but decompose the alcohol catalytically into aldehyde and hydrogen, or ethylenic hydrocarbon and water; (4) oxides slowly reduced, exerting a catalytic action. The detailed results will be given in a later paper.—Observations on the sun made at the Observatory of Lyons during the first quarter of 1908: J. **Guillaume.** Observations were made on forty-one days, and the results are given in three tables showing the number of spots, their distribution in latitude, and the distribution of the faculæ in latitude.—Ruled surfaces: A. **Demoulin.**—The canonical products of infinite genus: Arnaud **Denjoy.**—The partial differential equation of vibrating membranes: M. **Sanielevici.**—The existence of spark lines (enhanced lines) in flames at various temperatures, and on the modifications which they undergo: G. A. **Hemsalech** and C. **de Watteville.** The intensity of numerous iron lines has been studied by the authors' method in flames of different temperatures (air-coal gas, oxygen-coal gas, and oxygen-hydrogen), and it is found that the spark lines are most marked in the coolest flame, air-coal gas, and hence it is concluded that the action of the temperature cannot be considered as the fundamental factor in the production of the enhanced lines.—The preparation of the alkaline chloroiridites: M. **Vèzes.** A claim for priority against M. Marcel Delépine.—The molecular weights of the phosphoric acids determined by cryoscopy: H. **Giran.** The molecular weights found in acetic acid solution fall with the age of the solution; the true molecular weight for each acid at the moment of solution is deduced from a time curve. The formula deduced from these experiments for metaphosphoric acid is $5(HPO_3)$, for pyrophosphoric acid $3(H_4P_2O_7)$, and for orthophosphoric acid $2(H_3PO_4)$.—The magnetic oxides of chromium: Ivan **Shukoff.** From the magnetic properties of the mixture of oxides obtained by gently heating chromic anhydride, there would appear to be a magnetic oxide of chromium of the composition Cr_4O_9.—The tellurides of arsenic and bismuth. The cryoscopic constant of tellurium: H. **Pélabon.**—The mechanism of the synthesis of the cyclic nitrogen compounds: L. J. **Simon.**—The method of Messinger and Vortmann for the estimation of some phenols. The separation of salicylic acid: J. **Bougault.** By the action of iodine and an alkali upon salicylic acid, a red, insoluble substance is produced, which can be used for the quantitative determination of salicylic acid.—Three new primary alcohols resulting from the condensation of sodium benzylate with propyl, butyl, and isoamyl alcohols: Marcel **Guerbet.**—Researches on *bis*-azoic compounds: H. **Duval.**—The products of condensation of *ortho*- and *para*-nitrobenzyl chloride with acetylacetone: M. **Mech.**—The origin of the colouring matter of red grapes and other vegetable organs: J. **Laborde.**—The oxidation of eugenol by the oxidising ferment of fungi and by perchloride of iron; the preparation of dehydroeugenol: H. **Cousin** and H. **Hérissey.** Oxidation of eugenol both by ferric chloride and by the biochemical method gives a new phenol, dehydrodieugenol, the acetic and benzoic esters of which are described.—The influence of certain combinations of iron compared with the peroxydases in the catalysis of hydriodic acid by hydrogen peroxide: J. **Wolff** and E. **de Stœklin.**—The influence of the temperature of sterilisation of must and that of fermentation on the bouquet of wines: A. **Rosenstiehl.** Both the temperature of sterilisation and of fermentation of must can be lowered with advantage to the quality of the wine produced.—The comparative development of tubercles and roots: G. **André.**—The development of the notochord in the bony fishes: Louis **Roule.** From a study of the development of the notochord in the common perch (*Perca fluviatilis*), the author comes to the conclusion that there is not a complete homology between the notochord of Vertebrates and Tunicates.—Bul[illegible]lar epistasy of nasal origin: Pierre **Bonnier.**—The geology of eastern Corsica: Pierre **Termier** and Eugène **Maury.**—The rameal origin of ulodendroid cicatrices of *Bothrodendron punctatum*: Armand **Renier.**—Report of the committee appointed to consider the distribution of the Bonaparte fund for 1908.

New South Wales.

Linnean Society, April 29.—Mr. A. H. S. Lucas, president, in the chair.—A revision of the Australian species of Adelium (Coleoptera): H. J. **Carter.** When Blessig reviewed the Australian Heteromera in 1862, fifteen species of Adelium were recognised. In the meantime, the number of described species has increased to eighty. The opportunity of comparing his collection with types in the British Museum and in the Paris and Brussels Museums during a recent visit to Europe had enabled the author to submit the species to a critical revision, the outcome of which is a proposed reduction of the number to fifty-four, by the reference of ten species to other genera, and the omission of synonyms. It is also noted that the so-called species of Adelium of New Zealand and New Caledonia belong to different genera, so that it is probable that the genus Adelium is confined to Australia and Tasmania.—A revision of the Thynnidæ (Hymenoptera) of Australia, part ii.: R. E. **Turner.** Part ii. of the revision deals with the genus Thynnus. The species are very diverse in appearance and structure, but it is thought to be best, in the present state of knowledge, to group them in subgenera rather than to propose an excessive number of new genera, some of which might have to be sunk when additional material is available. The Australian species number 213, and fall into ten subgenera.

CONTENTS.