THURSDAY, DECEMBER 24, 1885

THE LOAD-LINES OF SHIPS

THE regulation of the depth of loading of ships is a matter that has received the attention of scientific men and practical seamen during many years. It has been hotly discussed in various quarters, and numerous disputes have arisen over the attempts of the Board of Trade to carry their views respecting it into practice. A long series of debates and disputes culminated in the appointment of a Committee by Mr. Chamberlain, the late President of the Board of Trade, to report upon the question.

That Committee, now well known as the late Load-line Committee, had Sir E. J. Reed, K.C.B., M.P., for its Chairman, and reported to the President of the Board of Trade in August last. The Report was unanimous; and was conclusive as to the practicability of framing general rules concerning freeboard which will prevent dangerous overloading without unduly interfering with trade. The Committee's rules have been accepted by the Board of Trade and Lloyd's Register Society; and at the same time they have received the general approval of ship-owners.

Like many answers that are given to questions, the Committee's Report states the opinions that were arrived at, but does not give the reasons for them. This natural omission has been supplied by a paper read before the Society of Arts on the 11th inst., by Prof. Elgar, of Glasgow University, who was a member of the Committee. Prof. Elgar said:—

"It is necessary to understand the causes of the differences between the various types of vessels. It must be obvious that no simple rule of a given number of inches per foot of depth of hold, can now be applied with equal fairness to all vessels alike. Each requires to be judged of separately, and to have its special characteristics adequately appreciated. The problem of framing a general scheme for regulating the freeboards of the principal types of ships involves, firstly, the consideration of how freeboards should vary in vessels belonging to any given type, according to size, proportions, and form; and, secondly, the consideration of how the freeboards of vessels of similar sizes, proportions, and forms, but of different types, should be regulated relatively to each other."

He went on to show how the elements of size and relative proportions are dealt with in the Committee's tables, and also how form is taken into consideration by means of approximate coefficients of fineness.

The effects of differences in sheer and round of beam are separately investigated, and also the influence of deck-erections—such as forecastles, poops, midship houses, and others—upon seaworthiness. The whole question of allowances for deck-erections of various kinds is one which cannot be brought within the scope of exact different treatment; and it is a point upon which the Committee appear to have been guided more by the opinions of seamen and by the recorded experience of successful ship-owners than by any other considerations.

Among the chief scientific questions connected with the safe loading of ships are those of structural strength and stability. Prof. Elgar describes as follows the manner in which these have been treated by the Load-line Committee:—

"Flush-decked steamers of the 100 A class in Lloyd's Register, which are of full strength to the upper deck, are, it is known, amply strong enough to bear loading to the freeboards given in the tables. Spar and awning deck-vessels, which are of less strength, may become unseaworthy through excessive straining action at sea if loaded to the same depths as the vessels above-named. And there are instances of vessels of those types having been severely strained at sea, and of some which have probably foundered in consequence, when loaded unduly deep. The principle which the Committee has adopted in dealing with these and other vessels that are inferior in strength to those of the 100 A class of full scantling ships in Lloyd's Register, is to fix approximately the limits at which the stress upon the material of the hull shall not exceed that of the stronger class of the same proportions, form, and moulded depth, when loaded to the freeboard required by the tables. In our present state of knowledge of how to calculate exactly the relative stresses upon the materials of ship's hulls, it is impossible to rely upon absolute accuracy of comparison, but the principle is a sound one. It can be applied with a fair degree of accuracy in many cases, and it is only to be expected that the present deficiencies in this branch of science will be made good in time. In thus adopting Lloyd's 100 A class as a standard of strength, the Committee must not be supposed to indorse Lloyd's Rules in any sense. They are merely taken by the Committee as being the best, or, indeed, the only recognised standard we now have.

"The question of stability is one that has often been raised in connection with the regulation of freeboards. Stability is, however, so intimately associated with stowage that it is only possible to deal with it by defining how ships of various proportions and types are to be stowed. The Load-line Committee did not feel called upon to deal with an independent problem of such magnitude and such great complexity as this. Stability need not ordinarily enter into the determination of the load-line, except for the purpose of insuring to ships of great proportionate depth the necessary stability at sea when employed in the carriage of grain, or other cargoes that are approximately homogeneous. If properly qualified persons are intrusted with the assignment of load-lines, they will readily distinguish between vessels in which stability is likely to be a question of importance and those in which it is not. In cases where vessels will obviously admit of being loaded so as to become unstable at sea, the owners should be looked to for particulars of the stability, and for furnishing proof that, so far as stability is concerned, the vessel may be safely laden with her intended cargoes to the load-line given in the tables, or to such a reduced draught as may be considered proper. The responsibility of providing stability, or of showing that sufficient is provided, must be left with ship-owners. Stability is regulated by stowage; and no mere provision of freeboard, height of platform, or strength of structure, can make a ship safe if her stability is not secured by proper stowage. The regulation of stowage has but little more to do with freeboard tables than has the regulation of steam-power, bulkhead division,

manning, and other essential elements of safety. Each of these points requires to be separately and fully dealt with."

Great importance is rightly attached by the Load-line Committee to the administration of the freeboard tables. The most perfect tables that can be framed must necessarily be incomplete in many particulars, and must leave much to the discretion of those who have to use them. The mere tables only apply to existing types of vessels; and out of those existing types they can only apply to vessels of high class which are in good condition. In the administration of the tables great discretion and knowledge are necessary, in order to use them with reasonable modifications, in view of changes in the types of ships, or of improvements in ships, that the continuous progress of naval architecture is certain before long to cause. The same discretion and knowledge are necessary in dealing with vessels which, by reason of age, structural defects, more or less rapid deterioration, or of anything that may be observed in their condition, cannot safely or fairly be loaded as deeply as vessels which are in first-class condition. The great majority of the members of the Committee are of opinion that, in order to give useful and satisfactory effect to the tables, the scientific staff of the Board of Trade should be strengthened, and should be made capable of dealing with all questions of such a nature that may arise, in a manner likely to command the confidence of ship-owners and of the public. They also think it essential that this work should be done under the superintendence of a representative body, which should consist not only of officials but also of ship-owners, naval architects, seamen, and perhaps underwriters.

Sir E. J. Reed said, "The Load-line Committee, in the inquiry which they undertook, had a very difficult task to perform. The origin of that Committee was this: the Legislature having placed the obligation of stopping the overloading of ships on the Board of Trade, that Department tried to do so, but failed to succeed, their interference being resisted by ship-owners. Thereupon Mr. Chamberlain conceived the idea of forming a Committee of gentlemen for the purpose of thoroughly investigating the subject, and seeing what answers could be given to the questions which had been referred to in the paper. The best proof that the Committee had done its work with a fair measure of success was to be found in the fact that no one had that evening complained of the results at which they arrived, which would not have been the case had mistakes been committed, as ship-owners never hesitated to defend themselves. Prof. Elgar had shown how necessary it was to supplement the labours of the Committee by further knowledge and investigation touching other elements of the safety of ships at sea. He believed ship-owners came out exceedingly well in the inquiry, both in the evidence they laid before the Committee and in the manner in which they applied their knowledge and experience to the investigation; and he should feel it his duty, when he saw Mr. Chamberlain, to point out to him that nothing could have been more fair-minded, more open or thorough, than the manner in which they co-operated with the other members of the Committee in bringing about the result which had been attained."

The public are indebted to the Load-line Committee for the satisfactory manner in which they performed a most difficult task; and especially to the Chairman, Sir E. J. Reed, to whose ability and good judgment the success of their labours may very largely be attributed.

THE WANDERINGS OF PLANTS AND ANIMALS

The Wanderings of Plants and Animals from their First Home. By Victor Hehn. Edited by James Steven Stallybrass. (London: Swan Sonnenschein and Co., 1885.)

THE title of this book is somewhat misleading, since it treats only of domesticated animals and cultivated plants, and of these solely in relation to European civilisation. The subject is treated as almost entirely a philological one, the origin of the several species and varieties being deduced from a study of their names in different countries and from a critical examination of the earliest references to them in ancient writers. The author's point of view is thus clearly stated in the preface:—

"The purely scientific man will judge chiefly by the suitability of soil and climate. If he finds a plant flourishing pretty abundantly in Greece or Italy now, and knows of no climatic or geologic changes that would exclude its having flourished there 5000 years ago, he will at once pronounce it indigenous, and scout the notion of its having been imported. But now listen to the scholar, and he may tell you that Homer never mentions such a plant; that later poets speak of it in a vague way as something very choice and very holy, and always in connection with some particular deity: they may have tasted its fruit, may have seen the figure of its flowers (probably conventional) in emblematic painting or carving, but have not the faintest notion of its shape or size, whether it be a grass, a shrub, or a tree; till at last, in the time of Darius or Alexander, the plant itself emerges into clear visibility. Your inference will be that it came to Greece within historic times."

In this way he claims to have shown "that the flora of Southern Europe has been revolutionised under the hand of man; that the evergreen vegetation of Italy and Greece is not indigenous, but is mainly due to the sacred groves planted round the temples of Oriental gods and goddesses; that in this way the laurel has followed the worship of Apollo, the cypress and myrtle that of Aphrodite, the olive that of Athena, and so on." But this very wide statement seems hardly to be justified by the evidence adduced in this volume.

As a good example of our author's mode of treatment we may refer to his account of the domestic cat. This animal, he shows, was quite unknown to the Greeks and Romans of the classical age. In the Batrachomyomachia the mouse tells the frog that he fears above all things the hawk and the weasel, but most the weasel, because it creeps after him into his holes. In "The Wasps" of Aristophanes a domestic story begins: "Once upon a time there was a mouse and a weasel"—just as we say to children, "There was once a cat and a mouse." In the fable of the City mouse and the Country mouse as related by Horace, the latter is frightened, not by a cat, but by the barking of dogs. In the original fables of Æsop, of Babrius, and of Phædrus, the cat is never mentioned, the weasel always occupying the place the former animal

now fills in the house. No remains of cats have been found in Pompeii, though the bones of horses, dogs, and goats have been discovered, and some writers have imputed this to the superior intelligence and foresight of the former animal, which made its escape in time, whereas its absence is due to the fact that there were no cats in the city at the period of its destruction.

The cat was first domesticated in Egypt, and appears to have been introduced into Europe in the fifth or sixth century of the Christian era. It is first mentioned under its distinctive name, *Catus*, by Palladius, and somewhat later by the ecclesiastical historian, Evagrius Scholasticus. The author believes that the introduction of the cat followed the migration of the rat, *Mus rattus*, from Asia into Europe, where it seems to have been altogether unknown in classical times.

As an illustration from the vegetable kingdom we may take the discussion on the origin of the eatable chestnut. The name is traced to Asia Minor, and that it was not indigenous to Europe is shown by the fact "that neither Greeks nor Romans had an individual name for the chestnut-tree and its fruit." It is further argued that, "If the Greeks had found the chestnut-tree existing in their future country when they first arrived, they would certainly have mentioned the fruit in their legends. But we only hear of the acorns of the *drus*, the esculent oak; and the aborigines, such as the wild Arcadians in their mountains and woods, are always called *acorn-eaters*, even by the oracles. When Hesiod describes the blessings of peace and justice, the earth bringing forth fruits, the oak bearing acorns, the bees furnishing honey, and the sheep yielding its fleece—would he have forgotten to mention the chestnut, if it had then grown on the mountains, bestowing sweet fruit on mankind? And would the Latin poets, when describing the Golden Age, have limited themselves to mentioning arbutus-fruit, strawberries, cornel-berries, blackberries, and acorns? That the regions south of the Caucasus, and the northern seaboard of Asia Minor, bring forth all kinds of nuts and chestnuts in great abundance, is proved by the unanimous testimony of travellers, ancient and modern. . . . From these regions chestnuts came overland through Thrace, Macedonia, and Thessaly to Eubœa, after which island they were called Eubœan nuts at Athens."

The chief faults of this book are due to the want of any acquaintance with systematic natural history on the part of either author or editor. This has led to many errors of nomenclature and a most confusing arrangement of subjects. Beginning with a chapter on the horse, we pass on to the vine, fig, and olive, and then back to asses and mules. Then comes "stone architecture," followed by "beer" and "butter." After a number of vegetables, trees, fruits, and flowers are discussed, we come to fowls, pigeons, and other domestic birds; then more fruit-trees; then the cat and the buffalo, followed by the hop and grain-bearing plants. As illustrations of the want of some technical knowledge of natural history we have the prickly *Ruscus aculeatus*, instead of the glossy-leaved *Ruscus racemosus*, given as the Alexandrian laurel; the *cytisus* of the ancients, a shrub used extensively as fodder for cattle, and rightly identified as the *Medicago arborea*, confounded with the laburnum, an ornamental tree of a totally different character. The Virginian creeper (*Ampelopsis hederacea*) is confounded with another American plant, the fox-grape (*Vitis labrusca*), while the Lombardy poplar, a native of Western Asia, is said to have been brought from the Mississipi Valley.

Being evidently quite unacquainted with the discoveries of Darwin, the author greatly exaggerates the changes produced by man in the flora of Europe, considering it to offer a parallel case to that of St. Helena, where the indigenous vegetation has been almost wholly extirpated and replaced by plants from other countries. The incapacity of archaic insular forms to compete with the dominant races developed in the great continents is supposed to obtain equally in a portion of one of these ancient continental areas; and thus, the extensive development of certain useful or ornamental cultivated plants in Southern Europe is mistaken for the substitution of a new flora of a totally distinct type. That this is his belief is shown by the following passage:—

"Almost everything that strikes the northern traveller on crossing the Alps as novel and agreeable—the quiet plastic beauty of the vegetation, the characteristic forms of the landscape and animals, nay even the geological structure (in so far as it has become exposed by changes in its organic covering, and has then felt the effects of light and atmospheric agencies)—is a product of civilisation brought about by manifest transformations during long periods of time."

Notwithstanding a few blemishes such as those now indicated, the student of philology and of the early history of domesticated animals and cultivated plants will find this volume full of curious information; while there is so much discursive matter touching upon the primitive history of nations, their manners and customs, their arts and literature, and even their religion and philosophy, that the book will be interesting to a wide circle of general readers.

ALFRED R. WALLACE

EUROPEAN BUTTERFLIES

European Butterflies. By W. F. de Vismes Kane, M.A., M.R.I.A., Memb. Ent. Soc. Lond., &c. 8vo. Pp. i.-xxxi., and 1-184, with plates. (London: Macmillan and Co. 1885.)

IT has long been a standing reproach to British entomologists that they are mainly divided into two classes, those who collect or study British insects only, and those who, with little knowledge of the productions of their own country, are profound regarding exotics. In other words, continental Europe is a blank to the majority of them. And the purely "British" entomologist, as a rule, is supposed to look upon anything continental as unclean; yet nevertheless prizes any unusual species if captured on our shores, and uses every argument to prove that it may possibly be a true native, and not an immigrant, for if the latter there must be a certaint taint attached to it. The "purely British" entomologist is also supposed to endeavour to maintain his conservative ideas by refusing to enter into correspondence and interchange with his continental brethren, because everything not British is unclean. He retains a peculiar method in the preparation of his materials that renders them not only practically useless for purposes of study, but prevents them from being serviceable if by any chance they should fall into the hands of "foreigners." The writer has often

been compelled to hear and to bear very strong expressions from his continental friends on this point. The writer has a book on *Lepidoptera* before him, and as nine-tenths of "British" entomologists confine their attention to *Lepidoptera*, the term "British entomologist" is here used in its narrow sense.

The time *will* arrive when we can safely say "*Nous avons changé tout cela.*" According to what we have observed during an experience of nearly thirty years, it is in rapid progress towards arrival, and that progress has been vastly accelerated recently. Many of our entomologists are expanding their ideas by continental travel, and latterly we have had from their pens several important indications that it is possible for British entomologists to know something about the productions of continental Europe, and even to endeavour to teach and lead their fellow-countrymen in the same direction. The thin end of the wedge naturally consists in popularising the subject.

The thin end of the wedge has been inserted, and it is being driven deeper to an extent that must create alarm amongst "British" collectors. There was a time when they had a nomenclature almost their own, and resented any attempt to upset it. Even this pet has been rudely insulted in the eyes of the most conservative in their number.

We have said that nine-tenths of our entomologists are probably Lepidopterists. The most attractive *Lepidoptera* are butterflies, and it is in this direction that the thin end of the wedge is being specially inserted. Almost within a year three works by British writers concerning European (as including British and continental) *Lepidoptera* have made their appearance. There are Lang's "Butterflies of Europe," and a re-issue of Kirby's "European Butterflies and Moths." Now we have before us Kane's "Handbook of European Butterflies." We welcome all as constituting the thin end of the wedge.

Mr. Kane's book differs in its plan from the works mentioned in connection with it. The only parallel to be drawn is with Kirby's "Manual," published nearly twenty-five years ago. Mr. Kane has produced a portable book that can, and should, go into the pocket of every entomological tourist. With no disparagement of the praiseworthy attempts of other writers to insert the thin end of the wedge, we incline to think this work will give it a sharper edge. So far as any work of the kind can be called a "handbook," this seems to be to the point. It is limited to the butterflies of Europe (geographically). The arrangement is that of Staudinger. The plan is to give concise descriptions of each species (in which abbreviations are freely, but intelligibly, used), notes on habits if known, and a copious list of localities; the latter is especially full for Switzerland, the south of France, and the Pyrenees, but wants enlarging for some other countries. When following Staudinger, the author should not have committed the error of wrongly designating *Papilio podalirius;* he overlooked the fact that Staudinger thought proper to correct himself in this case. It is not for us to compare the abbreviated descriptions with the insects; they bear the impress of being good. The introductory remarks are well considered: the endeavours to differentiate a butterfly from a moth might well have been modified; the distinctions have become so subtle as to rest more on intuition than anything else. Our author judiciously advocates the practice of placing the captured specimens in *papillottes* in the first instance, and fully explains the process. He does not appear to have remembered a suggestion by Dr. Jordan, to the effect that when the collector is *en voyage* a dozen specimens of the smaller butterflies may be placed in a pill-box, and both time and space be thereby economised (this would not answer in the case of exotic collectors). Our author evidently writes from personal experience, and is enthusiastic in his description of some of his excursions. His enthusiasm even carries him too far, for when he says: "Such days as these rise upon the memory like a reminiscence of Paradise, fraught with glories of colour, odour, light, and life," we are tempted to marvel [why he again became mortal! The plates form almost a new departure in the method of illustrating works of this kind. There are 15, on which are about 130 figures. They are adapted from a peculiar photographic process. We have seen other attempts in this direction. Nothing can exceed the beauty and faithfulness of some of the figures in Mr. Kane's book; and here arises the difficulty: they are unequal, and so we fear will remain all attempts to apply photography where particular colours or shades are involved.

The author is responsible for the remarks on "preparation" that here precede the notice of the book itself. He avows himself personally in favour of setting his specimens flat (justly complaining of the imperfections of some of the pins used on the Continent), but advocates only half measures—a comparatively short pin on which the insect is to be set "half-way." This is a decided advance, and the practice is now often followed for British insects by the less conservative; but English pins (of the required length and not open to the objections stated) can be had, and on them the insects should be set in the continental fashion. Or continental pins would do equally well if used of a stronger size than is often done. The stronger the pin (up to a certain point) the more durable the specimen. The subject of pinning and preparation was thought not unworthy of forming the substance of the address of a recent President of the Entomological Society. Whether it was appreciated or not we cannot say, but if (as we believe was so) the writer of that address sought to destroy one of the greatest barriers that exists between British Lepidopterists (always excluding the thoroughly conservative irreconcilables) and scientific fraternity with the rest of the world, the subject was worthy of the occasion. R. McLACHLAN

ANALYTICAL GEOMETRY

A Treatise on the Analytical Geometry of the Point, Line, Circle, and Conic Sections, containing an Account of its most recent Extensions; with numerous Examples. By J. Casey, F.R.S. (Dublin: Hodges, 1885.)

DR. CASEY, by the publication of this third treatise, has quite fulfilled the expectations we had formed when we stated, some months since, that he was engaged upon its compilation. It is a worthy companion of those which have preceded it. It possesses many points of novelty, *i.e.* for the English mathematician. He has, from the first introduction of certain recent Continental discoveries in

geometry, taken a warm interest in them, and in the purely geometrical treatment of them has himself given several beautiful proofs, and has added discoveries of his own, as we have already pointed out in our notice of the last edition of his "Sequel." We may here note that this last work has met with a very warm welcome in France and Belgium. The author himself has added so much in years now long past to several branches of the subject treated of in the volume under notice—the equation of the circle (and of the conic) touching three circles (three conics), and other properties—that he is specially fitted, by his intimate acquaintance with it and by his long tuitional experience, to write a book on analytical geometry.

The divisions are into eight chapters, the first of which, in four sections, treats of the Point, three sections being taken up with Cartesian and polar co-ordinates and the transformation of co-ordinates; the fourth section gives a brief account of Complex Variables, introduced by Cauchy in 1825, and extended by Gauss: "the introduction of these variables is one of the greatest strides ever made in mathematics." The second chapter, on the Right Line, treats it (§ 1) by Cartesian, then (§ 2) by trilinear, and (§ 3) by point and line co-ordinates; this last comparison is taken from Clebsch's "Vorlesungen der Geometrie." In Chapter III. four sections are devoted to the circle, § 2 being devoted to a system of tangential circles, § 3 to the "trilinear" forms of equations to the old circles and to all the recent circles; § 4 is devoted to tangential equations. Chapters IV., V., VI., VII. treat of, respectively, the general equation of the second degree, the parabola, ellipse, and hyperbola. Chapter VIII. (miscellaneous investigations) discusses many matters of novelty and interest: § 1 is on contact of conic sections; § 2, similar figures, gives a good *résumé* of results connected with Brocard's points and circles, Neuberg's circles, M'Cay's circles, and Kiepert's hyperbola (if upon the three sides of a triangle ABC similar isosceles triangles be described, the triangle formed by their vertices is in perspective with ABC, and the *locus* of their centre of perspective is an equilateral hyperbola); in § 3, on the general equation in trilinear co-ordinates, Aronhold's notation is "now published for the first time in an English treatise on conic sections"; the remaining six sections are occupied respectively with Envelopes, Projection, Sections of a Cone, Homographic Division, Reciprocal Polars, and Invariants and Covariants. An idea has now, we trust, been conveyed to the reader of the ground covered by Dr. Casey: a good deal of it is, of course, well-worn ground, but even this has been adorned by his touch, and much relating to the new circles has never before been introduced into our books. These circles must soon become as familar to our junior students as the nine-point circle, whose properties are by this time nearly exhausted.

The examples are exceedingly numerous, and a good feature is that most of the results obtained in them are numbered consecutively with the important results of the text: this enables the author to refer to them with facility. They exceed 600 in number.

There are several minor typographical inaccuracies which are easily corrected, but there are besides incorrect references to back articles and pages, which cause the reader some little annoyance in using the book: these can be easily rectified in a second edition (one on p. 150 gave us trouble, for Art. 23 read 21, p. 33).

It remains only to say that the expenses of the publication have been defrayed by the liberality of the Committee of the "Dublin University Press Series."

TWO YEARS IN THE JUNGLE

Two Years in the Jungle: the Experiences of a Hunter and Naturalist in India, Ceylon, the Malay Peninsula, and Borneo. By William T. Hornaday, Chief Taxidermist, U.S. National Museum, late Collector for Ward's Natural Science Establishment. (London: Kegan Paul, Trench, and Co., 1885.)

THE author of this somewhat ponderous volume was sent to India by "Professor" Ward, the well-known purveyor of natural history specimens at Rochester, New York, for the purpose of collecting various zoological desiderata, and especially skins and skeletons of the larger mammalia, and of crocodiles. The importance of this kind of collecting is greater than would be supposed by those who have no experience of its difficulty, and the task of securing specimens, and of preserving them so as to render them useful for scientific study, demands no inconsiderable amount of courage, perseverance, and knowledge. The majority of the skins and skeletons of the larger mammalia in European museums are derived from the specimens, generally dwarfed in stature, and very often diseased, obtained from menageries, and if these are to be replaced by the spoils of wild individuals, hunters who have a considerable knowledge of taxidermy must be engaged to collect. Many of the largest and most remarkable mammalia of the world are being rapidly exterminated, and before they share the fate of the dodo and *Rhytina* it is to be hoped that good skeletons, at all events, may be rescued for the study of future generations.

Mr. Hornaday is evidently an enthusiast in his art, and having greatly enjoyed both the sport of shooting wild animals and the process of converting elephants, tigers, orang-utans, crocodiles, and other formidable denizens of forest and swamp into useful museum specimens, he proceeds in the present work to give a full account of his wanderings and adventures during two years and nine months, the greater portion of which was spent in very wild parts of South-Eastern Asia and some of the neighbouring islands.

On the whole, and despite many shortcomings, both literary and scientific, the book is an agreeable account of an interesting journey, and scattered through the volume are many useful zoological notes. Amongst the most important of these are those referring to orang-utans, of which Mr. Hornaday obtained forty-three specimens, the majority shot by himself. He gives a series of measurements, which are particularly useful, of these and of several of the other mammalia which he obtained. He also describes the "nests," or rather resting-places, made by orangs, though the figure which he gives of one is unfortunately taken from an artificial imitation set up by him in the Museum at Washington and not from nature. The figure in question looks more like a gigantic crow's nest than the rough platform described at p. 403, and

does not agree with the description. The curious proboscis monkey, *Semnopithecus* (*Nasalis*) *larvatus*, the Bornean gibbon, and several Indian and Ceylonese monkeys also furnish occasion for interesting notes, some of which are novel.

The greater part of the work is however devoted to descriptions of shooting wild animals, such as may be found in dozens of sporting books, or to accounts of the ordinary incidents of travel, and the book is prolonged by dissertations on the habits of animals, and on specific characters. Here the author is fairly beyond his depth. Chapter XX., for instance, is occupied with an account of the habits of the Indian elephant. Nearly the whole is compiled from Sanderson and other writers, and some of the statements thus copied are of very doubtful accuracy. Thus Schlegel's view that the Ceylon elephant is the same as the Sumatran, and distinguished from that of India by the number of ribs and dorsal vertebræ—a view long since shown by Falconer to be untenable—is stated as if it were an undoubted fact. Before, however, one has read much of Mr. Hornaday's work, it is manifest that the author's zoological knowledge is superficial and imperfect. At p. 14 the limestone of which the pyramids are built is said to be "full of nummulites, little flat echinoderms;" and at p. 72 we read, "unlike all other antelopes, the female gazelle possesses horns." Of course the author meant to write, unlike all other *female* antelopes, but this does not prevent the statement being a gross error; it might have been expected that any one writing on mammalia would be acquainted with such conspicuous instances of horned female antelopes as are offered by the eland and oryx.

It may naturally be inferred that the scientific names applied to animals by Mr. Hornaday are not always correct. For instance, at p. 107 he records the shooting in the Wynaad forest, Southern India, of a specimen of *Semnopithecus leucoprymnus*, a kind of monkey peculiar to Ceylon. The animal shot was probably *S. priamus*, of which there is a fine South Indian specimen in the Agassiz Museum, Cambridge, Mass., very possibly derived from Mr. Hornaday's collection, but wrongly labelled *S. entellus*. The circumstance that the Wynaad *Semnopithecus* is wrongly identified makes it probable that the Ceylon monkeys called *S. leucoprymnus* (pp. 268 and 277) were also *S. priamus*.

One point in Mr. Hornaday's favour it is only just to notice. His account, so far as it is possible to judge, is truthful. He may err in citing authorities who are incorrect, but his own observations appear trustworthy, and he records his failures with as much spirit as his successes. The illustrations are numerous and as a rule fairly good, if not always very artistic, but some of the views, and especially that of Ootacamund, opposite p. 96, give a poor, and not a very correct idea of the scenery.

W. T. B.

OUR BOOK SHELF

Traité de Zoologie Médicale. Par Prof. R. Blanchard. Part I. (Paris: J. R. Baillière et fils, 1886.)

IT is difficult to comprehend what is meant by medical zoology, but it is easy to take in the object and design of this manual. These are to give a general sketch of the structure and classification of the various forms of animal life, and to call the attention in some detail of medical men or students to those species, which are either useful or injurious to man. It would thus aim at combining an introduction to zoology with a short treatise on animal parasites and some notes on economic zoology. We doubt if in the pages of a small volume such a treatment of this vast subject could be satisfactorily carried out, and it speaks a great deal for the knowledge and tact of Prof. R. Blanchard, that he has, so far as we can judge from this first part of his manual, succeeded in producing a most readable work, which cannot fail of being attractive to the class for whom it has been written, and the knowledge conveyed in which is fairly up to a modern point of view. The manual is destined to form a volume of about 800 pages, illustrated by some 400 figures, which, for the most part drawn from original sources, are fairly reproduced. We note that at least in one case this reference to original figures has not been without its advantages, for the figures given by Saville Kent, in his manual of the Infusoria, of *Asthmatos ciliaris*, Salisbury, not being exact, have been misleading to others who have again reproduced them, and there can be no doubt that this so-called parasite, thought to be the cause of hay catarrh, is nothing but an isolated epithelial cell of the naso-pharyngeal passages. The references to authorities seem very complete, and the second part is promised immediately with a title-page and "les tables." May we hope that these latter will include an index of the species referred to, or at least of those the life-histories of which are given in detail. This would immensely increase the usefulness of the volume.

Microskopische Reactionen. By Dr. Haushofer, Professor am Technischen Hochschule, Munchen. (Braunsweig: Vieweg und Sohn, 1885.)

THIS book will be hailed both by the ordinary chemist, and also by the geologist, and also by the pharmacist, as a most valuable addition to our already very numerous books on chemical reactions or analysis. The object of the author has been to arrange in such a form as can be used in the laboratory, tests and reactions of a great number of substances which may be performed on very minute quantities, and the resulting bodies recognised by their characteristic forms under the microscope. As the author says, some substances are so easily recognised in minute quantities even in the ordinary way, like iron, iodine, or by spectroscopic means, as thallium or lithium, that recourse to the microscope is seldom necessary. But in the majority of cases, where small quantities have to be looked for, the style and general habitus of crystal produced either in precipitates or by evaporation from solutions, and especially their behaviour towards polarised light, gives most valuable indications of the presence of any metal, and where, as in most cases can easily be done, several salts are in this way compared, the results are quite as conclusive as with large quantities. The substances treated of are metals, non-metals, and acids, which are arranged for greater convenience of reference in working, in alphabetical order. The principal and most general forms of crystals are illustrated by 137 well-executed woodcuts.

A Bibliography of Protozoa, Sponges, Cœlenterata, and Worms; including also the Polyzoa, Brachiopoda, and Tunicata, for the Years 1861-83. By D'Arcy W. Thompson, B.A., Professor of Biology, University College, Dundee. (Cambridge: The University Press, 1885.)

THE importance of the well-known "Bibliotheca Zoologica" of Engelmann, with its immense and accurately-compiled supplement by Victor Carus, to the biological student need not be insisted on, and in the present work we have this record carried out to 1883 for the large groups of the Protozoa, Sponges, Cœlenterata, and Worms, including also the Polyzoa, Brachiopoda, and Tunicata. This

volume of nearly 500 pages has been beautifully printed at the Cambridge University Press, and is one that will be a most handy work of reference to all students. In a short preface the author apologises in advance for possible deficiencies. It would be impossible to have a work of this sort free from omissions; but we have gone over very carefully the portion of the bibliography with which we were most familiar, and have been very much struck with its extreme accuracy. It is proposed to publish in the course of 1886 a supplement, to contain all detected omissions, and the author will gratefully receive any additional titles that may be sent to him. We would suggest that it might not add too much to the labour of preparing this, and that it would certainly add to the value of the supplement if omissions in Carus's volumes were also taken notice of, so that the bibliography of the groups now catalogued by Mr. D'Arcy Thompson should be fairly complete. This has been, we notice, already done in some instances in the volume before us. An index of authors' names would also be of use.

On the Ethics of Naturalism. (Shaw Fellowship Lectures, 1884). By W. R. Sorley, M.A. (W. Blackwood and Sons, 1885.)

THE theory of evolution has established its claim to having given the most satisfactory account of all forms of natural life, and Mr. Sorley endeavours here to show how it yields, by advancing it a step further, a complete explanation of human nature, mental as well as physical.

Whence, then, do human rules of action and aspirations for future right conduct come, and what sustains them? Mr. Sorley points out that happiness cannot *explain* the definite end of human action; it is only another name for it. Education and legislation combine to make the greatest happiness of the greatest number the desirable thing for each man's actions to tend towards, but there is little difficulty in pointing out the weakness of the theories of earlier writers who have tried, without the help of Darwin, Spencer, Galton, and others, to explain the feeling of duty; the feeling that we *ought* to do one thing rather than another when the former does not at the time seem so agreeable. We may quote Hobbes, for instance, who is unable to explain why any man feels any *duty* to his neighbour, and invents the fiction of the 'social contract"; and Prof. Bain, who has to account, by the associations of a few years, for the harmony of feeling between the individual and the whole. Evolution, of course, explains that although in the earlier days of the human race, each beneficial action sprang from egoistic motives, yet that the good result to the society has led to an inherited sympathy with such actions and such actors. There is the difficulty that since present ideas, according to the doctrine of evolution, are the latest outcome of all past experience, and what we are is the last result of all past influences, we seem to arrive at the very unprogressive conclusion that whatever is is right. And if, indeed, each man found that he had arrived at perfect harmony with all his surroundings, this would be the ideal state. This, however, is the case with none of us. Few of us but find the well-known utterances of the former and the "Video meliora, proboque, deteriora sequor" of the latter the counterpart of our own experiences, and still more easy is it to see how far from the present accepted ideals are all our neighbours. But as among all the slightly differing variations of a species there is a tendency to return to one type, so among all the contending inclinations and dispositions of the members of a race there abides an inherited code of morality, now become instinctive; one, as nearly fixed in each individual as the form of any species, but, like that, varying and developing in different individuals, families, and nations, and adapting itself to changed surroundings. These surroundings have always in human history been so different that the inborn or ideal code has not at any time become a general, still less a universal, one, and the struggles after holiness of the Hebrew, after beauty of the Greek, and after justice of the Roman, are still being continued in various proportions as modern times and conditions of existence have altered.

To some a morality never to be fixed will not appear a very steady one; a morality that is calculated to vary at different epochs and in different climates. Yet, surroundings always changing, man has to adapt himself to the change; always, therefore, will he be labouring towards a changed goal. Neither is it a cheerful prospect for the race. There will always be the "necessity for strong egoistic feelings and conduct in the struggle for existence, where the better-equipped organism asserts and maintains its supremacy only by vanquishing the organisms which are not so supplied." This struggle will continue on the highest levels of progress to which our race will reach; for "the multiplication of desires and of desiring individuals keeps so well in advance of the means of satisfying desires, that it is doubtful whether the course of evolution is fitted to bring about complete harmony between different individuals. It would almost seem that the 'moving equilibrium' in human conduct in which there is no clash of diverse interests cannot be expected to be brought about much before the time when the physical factors of the universe have reached the stage in which evolution ends."

Clark's Transit Tables for 1886. (London: E. and F. N. Spon, 1885.)

MR. LATIMER CLARK is still faithful to his self-imposed duty of enabling any one to obtain accurate time in any part of the world by means of the transit instrument, without any calculation. As in former years, Mr. Latimer Clark has now computed from the *Nautical Almanac* all the data necessary to enable this to be done for 1886. The author is doing a good work, for which every student of astronomy should thank him, for we have little doubt that most of those who procure a little transit instrument, and work it under Mr. Clark's able direction, will not end there.

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. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Late Total Eclipse

ALLOW me to call the attention of such of your readers as are not already aware of the fact that the phenomena I mentioned in my notes of the late eclipse—the "pulsation" of the sun's light just before totality and the simultaneous "wave-shadows"—are recorded by Grant ("Hist. of Phys. Astronomy," p. 404) as having been witnessed in France during the total eclipse of 1842. He mentions several probable causes or contributing causes; among them the unsteadiness of the air, which certainly existed here. I have not been able to find these phenomena (or phenomenon with a double aspect) mentioned in any other work accessible to me, and should be obliged to you for a statement of the explanation now received. To an outsider the (apparent) rarity and local character of the phenomenon seem to cause this difficulty:—If it is owing to any cosmical cause, or one common to any large part of our atmosphere, it would seem that the phenomenon should be more widely seen; if, on the other hand, it is owing to the unsteadiness of the observer's atmosphere, should it not occur oftener?

Allow me to add that in suggesting in my notes that the small prominences I saw were "Baily's Beads" I was writing ignorantly, having been long under the impression that Baily's

Beads were a phenomenon of totality, and coloured; a reference to an elementary work showed me my error. What I saw was a row of small similar-looking and about equidistant prominences of a faint pink colour. A. S. ATKINSON

Nelson, N.Z., November 13

Brilliant Meteor

I CAN confirm Mr. M'Keague's statement regarding an extremely brilliant meteor observed by him on November 27, the train of which remained visible for fifteen minutes, for about 6 o'clock the same evening I saw, when near Edinburgh, the train of one very bright meteor (brighter than Venus) last for at least ten minutes. I did not time it exactly, but it could not have been less than that, and while it remained visible it kept curving round, and diffusing itself out into a thin cloud. About half an hour later I saw the train of another very bright one remaining and behaving similarly for about five minutes.

Broxburn, December 18 JOHN STEVENSON

Models Illustrative of Phyllotaxis

PROF. PARKER'S note upon this subject induces me to mention a rough-and-ready contrivance, which I found serviceable when lecturing on this subject. This consisted merely of the framework of a collapsible opera-hat, or of two or three superposed. It is easy to attach stiff labels to these in any desired order, and easy to illustrate undeveloped or developed internodes, as the case may be. I have used the joints of an old telescope for similar purposes. Of course these are "make-shifts" only, but they are available when better things are not at hand. MAXWELL T. MASTERS

The Viper (*Vipera berus*, L.)

THE following letter, addressed to me by a most intelligent farmer, may be thought worthy of publication, as furnishing an additional item of evidence on a much-debated question.

"*Church Dale House, Egton, Grosmont, Yorkshire, November* 10, 1885

"DEAR SIR,—In the beginning of the harvest of 1878 or 1879 I was with my late father, Mr. Thomas Stanforth, of Howlsike, near Lealholm, North Yorkshire, in a corn-field on the Howlsike Farm, when we noticed a large viper in a rough part of the field. My father exclaimed, 'Hold on, there's a hagg-worm,' and just at that moment the viper moved its head and hissed, when we both saw some ten or twelve young vipers glide into the mother's mouth. My father immediately crushed the head of the animal with his heel, and we laid it on a stone wall, intending to open it at our leisure. Proceeding to our work, this was forgotten, and I did not again see the viper until the following winter, when I found it still lying on the wall, but reduced to a skeleton. I examined it closely, and found many small perfect skeletons inside the larger one.

"In the summer of 1865 I saw a large viper opened, and a full-grown skylark taken out of its stomach.

"Yours truly,

(Signed) "ROBERT STANFORTH"

Much circumstantial evidence has already been printed on this alleged habit, and it is not unreasonable to suppose that the young reptiles, when disturbed, will rush into the nearest opening that presents the appearance of a place of refuge; but I do not remember to have seen any proof of the viper returning her young to liberty when the supposed danger was past. If they merely lodge in the gullet they can doubtless be ejected at will; if they pass into the stomach, their uneasy motions may act the part of an emetic, and produce nausea and vomiting before asphyxia sets in or digestion begins; and in either of these cases the action of the mother in permitting her brood to enter her mouth may be regarded as voluntary and instinctive. It is, however, possible that the young vipers may dart, uninvited, into the parent's mouth when it is opened in the act of hissing, and that they may quickly perish and be converted into food. We can only repeat the words of the late Prof. Bell, F.R.S., written thirty-six years ago:—"In this state of doubt upon so interesting a subject, it is perhaps better to await the results of direct experiment, which might be readily made in any locality where these reptiles abound" ("British Reptiles," 2nd edition, p. 69). R. MORTON MIDDLETON, Jun.

Castle Eden, December 10

Ventilation

MR. FLETCHER, of Warrington, ought to be an authority on such a matter as ventilation, and probably he has omitted in his letter to you some material points. I should like to know something of the supply of fresh air to the rooms where the ventilation failed. If that was abundant, then, it seems, there should have been an up-draught in each flue, though, as the current in the ventilating flues would have been less than in those of the chimneys, it would have been better if possible to have their outlets a little separate. If, however, the supply of air to the rooms were insufficient for the joint draught, then the ventilating flue (so called) would have become a down-cast shaft, and (owing to its situation) would have brought down smoke, &c., as described; and this insufficient supply, when the fires were lit and the ventilation shaft heated, might have been quite enough when there was no fire, or the chimney might have been the down-cast.

It has always seemed to me that this matter of air-supply is at the bottom of ventilation failures. The amount required is so large, that it must be warmed before entering a room in winter, but there are few houses where any provision is made for this. In fact, as matters stand, it seems to me that it would be nearly impossible to make satisfactory arrangements in most cases without great expense. No doubt the best arrangement would be to warm all the air, in one place, before entering the house, and to employ the fires or stoves in the rooms only to give locally greater warmth or brightness; but such an arrangement is so un-English that I suppose it must be rejected. Because our forefathers, when they first roofed themselves in, transferred their fire from the forest or cave to the middle of the hall, and then to the side with a chimney, we must follow the same practice; meanwhile closing up the inlets, which were plentiful enough in the early arrangement. We may be Radicals, but, like our ancestors, in most things, we do not wish to change the laws of England. J. F. TENNANT

37, Hamilton Road, Ealing, W., December 18

Snails Eating Whitening

I DO not know if the observation which is recorded below is new, but it is certainly new to me, and seems to be sufficiently interesting for publication. In the autumn of 1884 I noticed that the whitening which had been painted on some greenhouse glass in a garden at Reading, had evidently been eaten off by a large Gasteropod. The whitening was almost entirely removed from one pane, and partially from many others. The outlines of the parts which had been eaten were quite unmistakable, exactly resembling on a large scale the well-known traces left by freshwater snails on the conferva-covered glass of an aquarium. I did not find the snails at work, but the gardener assured me that he had seen them upon the glass, and that they were the common garden snails (*Helix aspirsa*). Considering the entirely characteristic appearance of the marks, I think it may be taken as proved that the whitening was eaten by some large Gasteropod, and almost certainly by *Helix aspersa*. It is exceedingly probable that other forms of calcium carbonate (especially limestone rocks) are eaten in the same way, but the conditions of this particular form of the substance—spread out as it was in a thin film on a transparent layer—rendered the fact that it had been eaten especially conspicuous. As to the importance of calcium carbonate to the snail, it must be remembered that there is not only the necessity for growth of the shell in the young animal, and its repair in the adult; but there is also a regular periodical need in the latter for material to supply the place of the calcareous dart (*spicula amoris*), which is discharged before coitus, and is believed to act as an excitant in the sexual relations of these animals. The membrane (hibernaculum) which closes the mouth of the shell in winter is also to some extent calcareous.

December 14 EDWARD B. POULTON

Blackbird with White Feather

THERE is about my garden a hen blackbird with a white feather in the tail. I do not know whether this variation has been noticed before.

JOSEPH JOHN MURPHY

2, Osborne Park, Belfast, December 21

CYCLES

Variable Speed-gear

FIVE methods have been employed for making the speed of the wheels variable with respect to the pedal crank-axle whilst the tricycle is in motion, so as to vary the power to suit the nature of the road.

(1) A set of change wheels may be thrown in and out of action as desired.

(2) An epicyclic train may be used which for one speed is locked together and moves as a single piece, and is set in motion for the other speed. The well-known crypto-dynamic two-speed-gearing was figured and described. In this an internally toothed wheel is keyed to the crank-axle. Connecting this and a loose pinion on the axle are four live pinions, the axles of which are attached to the chain-wheel. The internal wheel is fitted with a clutch, by which it can either be held stationary or keyed to the chain-wheel; when keyed to the latter the gear moves as one piece, and the higher speed is employed; when held stationary the live pinions roll round the centre wheel so that the chain-wheel travels less fast than the crank-axle, and then the greater power is obtained. This change can be effected by a striking lever.

(3) A third plan is to use two sets of chain-wheels and chains, either of which can be connected or disconnected at pleasure.

(4) Expanding chain-wheels can be used. Generally one only is employed and an idle pulley is provided for taking up the slack of the chain. A specimen was exhibited in which the pitch of the teeth is never altered.

(5) Another method of obtaining increased power is to use cranks with a variable throw. A diagram was shown of such a crank which could be changed in length by preventing it from rising by pressure when at the bottom of the throw; for at that time only is it free to turn on an eccentric, being locked by pawls and a gravitating bolt at any other position.

Position of Rider.—In every machine there is a certain position for the rider's seat, in respect both to the axle of the driving-wheel and to the crank-axle, which, on the level, will enable the rider to work to the greatest advantage. In ascending a hill the rider requires to be moved more forward, but he is in reality put further back, and the reverse is true when descending a hill. The most perfect contrivance for this purpose is the swing frame, which has been applied by Mr. Warner Jones to the Devon tricycle. The saddle and crank-axle are on the same frame, which is capable of rocking about the main axle and of being locked in various positions. By such means a rider is enabled to ascend a hill without leaning forward in the usual manner. A modification of the same arrangement by Mr. Griffiths was referred to.

Another method of varying the position depends on the use of a sliding base to the saddle-spring, which may be actuated by a lever and locked in one of three positions.

Hand-power Tricycles.—A few machines driven by the arms instead of by the legs have been made, but from the greater weakness of the arms they cannot compete with ordinary cycles, but are suitable only in special cases. Two machines, the Velociman and Oarsman were described. In the Velociman a pair of hand-levers are connected to the cranks of a second axle, which drives the main axle by a chain as usual, differential gear being employed to actuate the wheels. The rear steering-wheel is actuated by a lever carrying a cushion, which can be moved by inclining the body. In the Oarsman the action is similar to rowing. The rider sits on a sliding or a rocking seat, and pulls a cross-bar which is attached to a pair of driving ends which pass over pulleys connected with the driving wheels by clutches. During the return stroke the pulleys have their motion reversed by a spring.

[1] Continued from p. 135.

Sociable Tricycles.—Of tricycles for two riders those in which the riders sit side by side are called Sociables, and those in which one is in front of the other, Tandems. The Sociable is merely an enlargement of the single form with some part in duplicate. Some can be converted into a single machine. In the Coventry rotary Sociable, since four wheels are on the ground, a joint has to be introduced to allow for the inequalities of the surface. In this machine each rider drives the wheel on his side only. An ordinary front-steering pattern of convertible tricycle was figured, in which, when one wheel is removed from the single form a second half-frame can be bolted on, while the axle of the added part is fitted where the wheel was removed, and the crank-axle of the added part is bolted to the crank-axle of the single part; thus the two riders drive through the same chain the box of the differential gear which drives each wheel equally.

Tandem Tricycles.—In these there is more scope for variety, and the different machines may be classed as follows:—

(1) The ordinary front or rear-steering tricycle in which the wheel-base is extended, so that the riders may be seated fore and aft of the differential-geared driving-axle without destroying the balance of the machine.

(2) The Humber tandem, in which the extra rider is seated in front of the driving-axle, but as nearly over it as possible, and communicates motion to it in a similar manner to the rear rider, who is seated further back than in the single machine so as to counterbalance the extra weight in front.

(3) A machine in which an auxiliary trailing frame is fixed in the rear of an ordinary front-steering tricycle. In order that the trailing frame may rise and fall with the inequalities of the road, and may follow properly when the machine is running round a curve, it is necessary for it to have both a transverse and a vertical joint between the two frames. A figure was given of a trailing frame with a chain to drive its own wheel which could be clamped to the back of any front-steering tricycle. With this arrangement there is no necessity to take off a chain when detaching. A special detachable chain for convertible tandems was shown.

Carrier Tricycles.—The most useful kind of tricycle of all is that for carrying a burden. First the "Coventry Chair" was exhibited. This consists of a Bath-chair in which the large wheels are driven by a rider at the back in the same way as the wheels of a tricycle. The driver also controls the steering and manipulates the brake. The passenger sits in a comfortable wicker chair. Though these machines cannot be driven with the freedom of an ordinary tricycle, yet when their weight and the fact that there is a passenger on board is considered, they travel with marvellous ease. Examples of journeys made were given.

Of goods carriers there are a large number of makes, but there is nothing in their construction to call for special comment; their success depends chiefly on the load being balanced as much as possible on the driving wheels. They are largely used by the Post Office for the parcels post, for the delivery of letters in rural districts. They are also largely used by newspaper offices for the distribution of papers, and by tradesmen for the delivery of goods.

Arrangement of Driving Gear.—Tricycles driven by rotary action may be subdivided according as the differential gear-box is in the centre or on one side, and according as the driving chain is in the centre or on one side.

In side-driving tricycles the loop frame is generally employed and the gear-box may be either at the centre or the side.

In central-driving tricycles the frame is usually of the T pattern. Here again the gear-box may be either at the centre or the side. Theoretically there is an advantage in the central position of the gear-box, as the friction

due to the bearings is equally distributed between the two wheels, whereas with side-gear one wheel only is retarded by this friction, but practically the difference is inappreciable. In central-driving machines the bearings must be so distributed as to prevent the main axle from bending under the pull of the driving-chain. The advantages of the T frame are its simplicity and lightness and the possibility of using adjustable cranks.

Width.—As the width of a tricycle varies between thirty-six and thirty-nine inches—excepting the Coventry Rotary, which from its special design can be made as narrow as twenty-seven inches—many arrangements have been devised for temporarily reducing the width, so as to enable a machine to pass through an ordinary doorway. Two plans only call for special notice, namely, folding frames and telescopic frames. A folding frame, when one or more pins are removed, can be folded up, but can still be wheeled along. In telescopic frames, which are always used with central-gearing, the frame and the axle on one side of the machine are made telescopic, so that by slackening a nut the parts slide over one another. A telescopic axle was shown.

Weight of Tricycle.—The proportionate weight of the several parts of a loop-frame front-steering tricycle were given.

Component Parts of Cycles

Of the component parts of modern cycles the following alone call for special notice: wheels, bearings, frame, steering-gear, brake and pedals.

Suspension wheels, the first great improvement in cycle construction, are made with either solid or hollow rims, the latter being the lightest and strongest. In an ordinary wheel the spokes are radial; they are threaded through holes in the rim, and screwed into the edge of the flanges of the hub, being butt-ended or enlarged where the thread is cut upon them. The section of the rims is crescent-shaped. Hollow rims are made either from a tube by rolling it to form, or out of a single strip of steel plate bent to the desired section, in which case the edges lap over one another and are brazed together; or out of two or more strips of metal bent to form and brazed or sweated together.

Round rubber tyres are used, but with surfaces sometimes corrugated longitudinally, which gives a better hold on the road. The outer surface of the tyres is sometimes made of harder rubber to diminish the wear, while the elasticity of the inner and softer rubber saves the jolting of hard rubber alone. Tyres are usually fixed by cement, which when properly done is sufficient, but a wire passing through the centre of the tyre is used by some.

Tangent spokes are employed to give extra torsional rigidity to the wheel. The spokes, instead of being radial leave the hub nearly at a tangent alternately in opposite directions; sometimes a single piece of wire is threaded through the flange and the two ends made fast to the rim by nuts, but in that case they invariably give way first at the point of the double bend. Headed spokes passing transversely through the edge of the flange are now used.

One of the latest innovations in the construction of wheels consists in corrugating the spokes throughout their entire length, which gives a certain amount of elasticity to the wheel. At first sight it would appear that these corrugations should seriously diminish the lateral stability of the wheel; but as far as experience shows such is not the case. As, however, wheels so constructed have not been very long in use, it remains to be seen whether they will stand the wear and tear of the road.

Bearings.—The bearings of the wheels are now almost without exception made with anti-friction balls interposed between the moving parts. The most approved kind is that known as the Æolus, which can be adjusted concentrically. The balls lie round a groove on a collar on the axle, on the two sides of which they bear. They are enclosed within a concentric casing composed of two pieces, one of which screws within the other. Each of these has a hollow conical surface, between which the balls are free to run. One piece can be screwed in until there is as little shake as may be desired, and it may then be locked in position by a small toothed bracket. A diagram was given showing the section of the usual small wheel bearing also capable of concentric adjustment. The results of the experiments made by Mr. Boys on the wear of balls in ball bearings were given. He found that in running 1000 miles each ball lost in weight only 1/250 grain, which is equal to an actual surface wear of only 1/158,000 inch.

Frame.—The frames of both bicycles and tricycles are largely constructed of weldless steel tube. In the bicycle the front fork is made of tube tapered and worked into an oval section so as to give the greatest possible strength to withstand the severe torsional stress to which it is subject. The back-bone is left round, but is tapered, while the hind-wheel forks are usually made from a stamping in sheet steel.

The hollow framing of tricycles is usually circular, having a diameter of from 1 to 1¼ in. and a thickness of from 0·065 to 0·095 inch. The large number of solid parts necessary are usually made from wrought-iron or steel stampings. Malleable-iron castings are also largely used and are the cause of many of the breakdowns of machines. Owing to the great expense of dies the temptation to use these is strong. This expense, combined with the fact that the patterns of tricycles at present are frequently being changed, is the cause of the present high price of first-class machines.

Steering-gear.—The steering-gear may be dealt with under two heads: (1) the method of mounting the steering-wheel so that it may be turned for the purpose of steering; (2) the method of controlling the wheel.

(1) The steering-wheel of all bicycles and of most tricycles is mounted in a fork, at the top of which is a "head" by which the fork is attached to the frame. In the head is the joint to allow the steering-wheel to be turned. The "Socket" and the "Stanley" head were described and a figure given of an improved "Stanley" head in which, instead of cones, balls are used to allow of free motion between the head and the central pin. A figure was given of another form of Stanley head in which a central pin is employed.

The steering-wheels of tricycles are not always mounted in forks. Among other methods that employed in the "Quadrant" tricycle was described, and another in which a large skeleton hub carries within it a small head actuated by a lever from the outside.

(2) On an ordinary bicycle the steering is controlled simply by a handle bar rigidly fixed to the fork.

Tricycles have their steering actuated usually by the rack and pinion; a handle-bar as used on a bicycle is also employed either connected directly with the fork or through levers.

Owing to the sensitiveness of this mode of steering, mechanism has been contrived which tends to keep the steering-wheel to a straight course. The most effectual is that employed on the Humber make of front-steering tricycle. A V-shaped cam on the steering-rod lies in a corresponding recess on the top of the socket of the steering-spindle and is held down by a spring. When the machine is steered the spring is compressed by the action of the cam, and so it tends to bring the wheel back to the straight line.

Brake.—There are but two varieties of brake; the spoon- and the band-brake. The spoon-brake consists of a spoon-shaped lever so pivoted that it can be pressed against the tyre of the large wheel in the bicycle or the two wheels of a tricycle.

The band-brake, almost exclusively used on tricycles,

consists of a band of steel lined with leather encircling a drum in the driving-axle. By a hand-lever this can be tightened with great force. In some central-geared tricycles a band-brake can be applied with the foot to the crank-axle.

Pedals.—When bicycle cranks are used the pedals are mounted on pedal pins bolted to the cranks. With cranked axles they are made in two halves. Ball bearings are frequently employed. Both rat-trap and rubber pedals are made: the latter are more slippery than the former, but absorb more vibration and so are more comfortable. The combination pedal with rat-trap plates on one side and rubber on the other is due to the author. A common cause of danger in bicycle riding is the slipping of the feet from the pedals when driving with much power, which puts the weight so far forward as to throw off the rider in front. Pedals to grip the feet have been devised, but some forms are apt to hold the feet so firmly as to make a sudden dismount occasionally impossible. The author has invented a pedal in which by bell-crank levers the foot is only held when pressure is exerted.

Fittings, &c.—Of the fittings and accessories the varieties are far too extensive for enumeration; but many display an amount of ingenuity that will well repay an inspection of them. The manufacture of these fittings forms separate trades, which employ a large amount of capital and labour.

The Chairman having complimented the author on the excellence of his paper, invited discussion.

Mr. C. Vernon Boys, referring to the undoubted going powers of the small Safeties, thought that in addition to the reason given in the paper the facts that the wind resistance was enormously reduced and that the rider could work in a position of comfort, without straining himself to ride as high a wheel as possible, had a great deal to do with the observed result. He thought that on a racing path the wind resistance of the spokes was the chief opposition to the motion of the machine.

He pointed out that the method of turning the Otto as described by the author, though employed by some, was essentially bad, tending to rub the tyres off one of the wheels, and explained the perfect method by which the wheels are made to turn simultaneously in opposite directions, by which no strain is put upon the tyres and only half the space is required for turning.

He thought too much preference had been given the clutch as compared with the differential gears for driving tricycles, and pointed out that in starting round a curve owing to the fact that the wrong wheel—the inner one—alone drives, more strain is thrown upon the steering-wheel, causing it to slip, than it ever experiences in ordinary riding when one wheel of a differentially-geared machine meets with greater resistance from mud or other causes than the other.

He mentioned the fact that Mr. Burstow, the inventor of the centre-cycle, had shown him nearly two years ago a double-acting clutch such as the author considered to be even more perfect than the differential gear, but he did not know how it was constructed.

Passing on to the Oarsman tricycle, Mr. Boys said that though apparently a hand-worked machine it was in reality driven chiefly by the muscles of the legs and body, and the stroke was only completed by the arms; and also that though a clutch-driven machine it had the advantages of a differentially-geared machine, in that when turning a corner the two cords could be pulled to different extents, and each wheel could at all times be driven.

He gave his experience of the elastic spokes. Since Christmas he had ridden a pair of wheels 3,800 miles, and had tested them most severely, but as yet they showed no signs of becoming untrue or losing their elasticity.

He had made further tests of the wear of balls, letting them run 1000 miles without being opened, after which he found that the wear was about one-fifth the rate of that previously observed. This, he considered, went to show that the wear, such as it was, was almost entirely due to a very small amount of grit which it is impossible to prevent from entering the bearing from the screw however carefully it may be cleaned. However, the result last obtained showed that the loss of weight of each ball in travelling 1,000 miles, during which it turned on its own axis about 1,400,000 times was less than 1/1000 grain. This, he thought, showed that those who found fault with ball bearings did so very rashly.

Mr. Sampson referred to a machine shown at the Inventions Exhibition on the lines of the Otto, but driven with a chain and with definite worm-gear for steering, which was worthy of attention.

Mr. Dalby, speaking as a rider, said he was sure that the author of the paper had not set the invention of the balance gear at its true value, that he had done special pleading on behalf of the clutch system. After severely criticising the arguments of the author, he attributed the poisibility of the modern tricycle mainly to the balance gear.

Mr. F. Warner Jones thought that more might have been said on the principles of cycle construction. The paper had been mainly descriptive of machines, and very little of first principles was to be found in it.

He agreed that the wind resistance was so much less felt on the small safeties than on a full-sized machine, that this should be considered an important factor in the cause of their good qualities. But he did not quite agree with Mr. Boys as to the way in which this acted. In any case the seat must be about seven inches behind the pedal axle to enable the rider to work in a proper position. With a saddle so placed on an ordinary bicycle the position became dangerous when descending a hill, but owing to the construction of the safety bicycles this position could be attained with perfect safety, the rider being more between the wheels. On a high machine the wind acted with a greater leverage, throwing more pressure on the hind-wheel in proportion than in a Safety.

The Safety bicycles with the steering-wheel in front were safer than the others owing to their greater length, and the fact that the rider was so far back, but they were not so fast, as less weight was on the driving-wheel. The rider could not be placed far enough back to put as much weight on the driving-wheel unless the pedal axle were divided. By adapting the swing frame with the divided pedal axle to such a class of machine, as much weight as desired could be placed upon the driver, and the advantages of the dwarf bicycles and of the Otto secured in one machine.

Concerning the Otto there seemed an anomaly—that they were better hill climbers when the wheels were as high as 56 in. than when smaller. As it was necessary for the centre of gravity to be over the points where the wheels touched the ground, there was a limit to the steepness of hill which could be surmounted.

He quite agreed with Mr. Boys as to the good qualities of the elastic spokes. He considered they were correct in principle.

Mr. Boys showed that even in the case of the steepest hills the amount by which the points of contact of the wheels with the ground were advanced was so small as to produce none of the effects supposed by Mr. Jones. In fact the hill-climbing power of the machine was perfectly well known.

Mr. Phillips felt sure that the slow pedalling was a far more important factor than the diminished wind resistance in the cause of the excellence of the Safeties. He had not intended to represent that the clutch gear was as good as the differential, but that at present the differential was greatly superior; he however believed that some device of the kind that he had spoken of—a perfect and instantaneous double-acting clutch—would be better than either.

He had not seen Mr. Burstow's clutch mentioned by Mr. Boys.

In speaking of the loss of power due to perpetually bending steel driving bands he did not refer to the very thin bands of the Otto, but to driving bands with holes to fit over pins some four or five times as thick.

The Chairman considered it an open question whether the path of a bicyclist were really wavy as theory seemed to show. He had often watched a bicyclist and it was almost impossible to believe that he did not travel in a straight path. He thought this question worthy of more attention. He had heard it asserted that no advantage could be gained by the use of artificial cycles over natural legs, but it must be remembered that legs were implements fitted for other purposes besides running, such as jumping and climbing. Again, no one supposed that a horse could carry on his back such a load as he could easily draw in a carriage on a road; here the extra weight of the carriage corresponded to the addition of the bicycle.

As in many other industries, bicycle and tricycle construction depended to a large extent for its success upon the perfection of many details of construction; as instances of important details he referred to rubber, steel wire, steel stampings, and driving-gear. Having made some remarks on the necessity of good roads he expressed the opinion that in time cycle ways might be laid down with advantage.

It was a mistake to suppose that cycling was only suitable for the young and active; people of all ages and conditions might enjoy the benefits of the wheel. The advantage of a sound machine to a labouring man, or of a hand-driven machine to a lame man, was inestimable, while invalids could even enjoy a run to the seaside in a Coventry-chair without the annoyance of cabs, railway stations, and trains. Having proposed a hearty vote of thanks to Mr. Phillips for his paper, he brought the proceedings to a close.

ALFRED TRIBE

ON November 26 died, after a very short illness, Mr. Alfred Tribe. He was born in London forty-six years ago in humble circumstances, and his first acquaintance with science seems to have been obtained as a boy at the Royal College of Chemistry. While waiting upon the students there he acquired whatever knowledge he could, and repeated in a back kitchen at home many of the experiments he had seen them perform. Prof. Hofmann, pleased with his desire for knowledge, gave him every encouragement and assistance in his power. At the age of sixteen he entered into the service of Dr. Medlock, then of Dr. Forbes Watson, and afterwards he assisted Prof. Williamson, of University College. He then went to Dr. Bernays, who after some time induced him to spend a year at Heidelberg under Prof. Bunsen, and kept his place at St. Thomas's Hospital open for him while he was away. On his return he continued to act as laboratory assistant and Demonstrator of Chemistry.

Twenty years ago he became my private assistant, and remained head of my laboratory till his death. During the same time he held the Lectureship on Metallurgy to the Medical School of the National Dental Hospital, and since 1874 he has been Lecturer on Chemistry and Director of Practical Chemistry in Dulwich College.

He became successively a Fellow of the Chemical Society, of the Institute of Chemistry, and of the Society of Chemical Industry.

Mr. Tribe was pre-eminently a scientific investigator. He loved patient and original research, and all his work was most carefully and honestly done. He published a large number of papers, some in his own name, and others in conjunction with myself. His first paper was on Sulphide of Ammonium, his second on the Expansion of Bismuth at the Freezing-point. His more important inquiries were connected with the occlusion of hydrogen by copper and the rarer metals, and especially a series of experiments on the distribution of the electricity in an electrolyte traversed by a current. The curious and suggestive results of this investigation appear in abstract in the *Proceedings* of the Royal Society for January and June, 1881, but they are most fully expounded, with coloured illustrations, in the second edition of Mr. J. E. H. Gordon's Treatise on Electricity and Magnetism."

His most important research in conjunction with myself is contained in a series of papers on the Copper-Zinc Couple, published principally in the *Journal* of the Chemical Society. He was the first to observe the greatly enhanced chemical power of zinc when covered with spongy copper. Whatever value there was in this extended research was due to his original suggestions, as much as to his careful manipulation. The same credit is due to him with regard to the series of papers on the aluminium-iodine reaction, the last of which was read only the night before he was taken ill. His discovery of these two new methods of acting upon chemical compounds was productive of many new substances, including the aluminium alcohols.

In addition to these chemical inquiries, we worked together on some electrical matters—describing an air-battery, that is, one in which the oxygen of the air took part; some experiments on thermal electrolysis; and, more particularly, the chemistry of the secondary batteries of Planté and Faure. The results of this investigation were first made known through the pages of NATURE, and were afterwards collected together in a separate treatise.

As a teacher of science, Mr. Tribe was very successful. He had the art of communicating his own enthusiasm to his laboratory students, and many of them have distinguished themselves since at the Universities or elsewhere. Only the week before his death he had the satisfaction of knowing that his favourite science was to receive a more worthy share of attention in the Dulwich College.

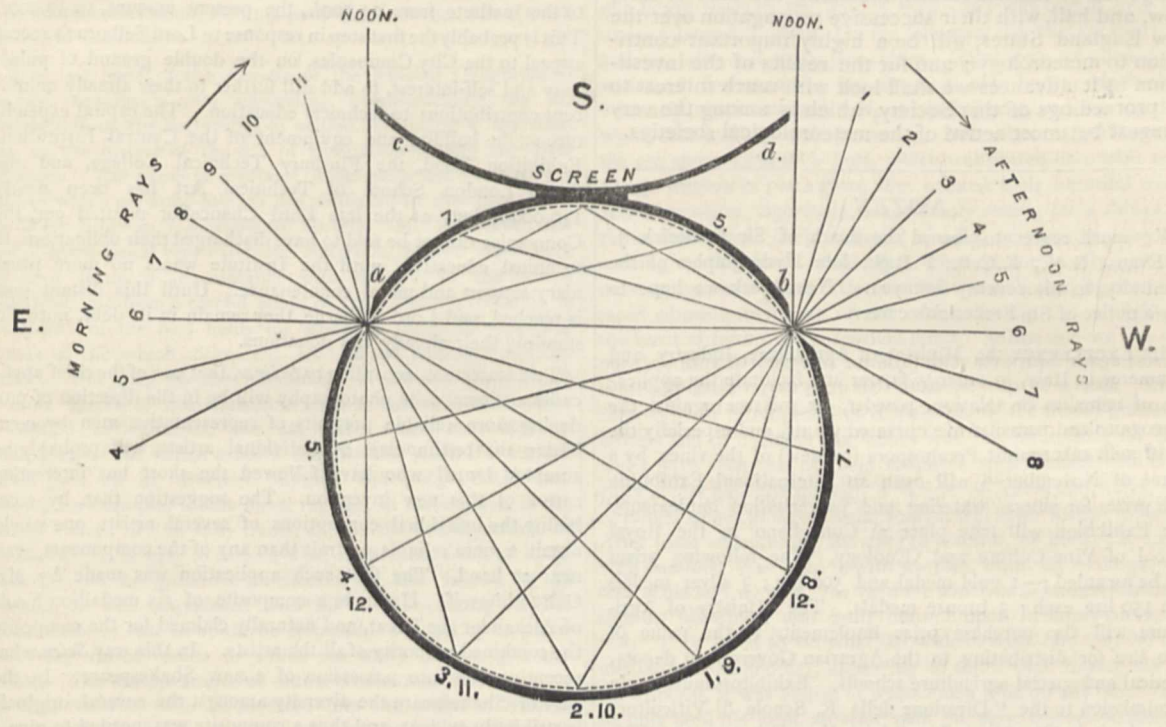
At these pursuits Mr. Tribe worked earnestly and continuously, being little known beyond his laboratories and his home. His widow, and four surviving children, together with a small circle of intimate friends, will however long remember the thorough uprightness of his character, and the self-denying purpose of his life.

J. H. GLADSTONE

JORDAN'S PHOTOGRAPHIC SUNSHINE RECORDER

UP to the present time the only instruments in general use for registering the duration of sunshine are modifications of the original apparatus invented by the late Mr. J. F. Campbell, of Islay, in 1853, the essential part of which consists of a clear glass globe capable of condensing the solar rays sufficiently to burn a trace on a card placed within its focal range. New forms of instruments have, however, been lately devised, and in the International Inventions Exhibition there were exhibited two Sunshine-recorders differing entirely from those hitherto used, the results being obtained by means of photography. Prof. McLeod's instrument was described in NATURE (vol. xxxi. p. 319), and we now give particulars of Mr. Jordan's photographic Sunshine-recorder. This instrument is of very simple construction. The working part consists of a cylindrical box or dark chamber 2½ inches diameter and 3½ inches long, mounted on a suitable stand having the means of adjustment to suit the latitude of the station where used. This cylinder is pierced with two small rectangular apertures or knife-edged slits, and, being placed in a position facing south,

the rays of sunlight pass directly through these apertures and are received on the sensitised surface of a photographic paper or chart placed inside. By reason of the earth's rotation, the spot of sunlight thus obtained travels over the chart in a more or less curved line (according to the season), marking its path by a clearly-defined blue trace, which can be rendered permanent by simply immersing the paper for a few minutes in cold water. The position of the sun in relation to the instrument at the different hours of the day will be understood by reference to the figure, which is a cross-section through the cylinder; the dotted circle shows the position of the prepared chart, The screen, *c d*, is for the purpose of cutting off the rays from the eastern aperture at noon, and at the same time



allowing them to pass through the western aperture; it also forms a protection from rain and diffused light.

Observations made with this instrument prove that photography is well adapted for recording the duration of sunshine, and under some conditions it has advantages over the burning method. At those times when the atmosphere is perfectly clear the two methods give similar results, but when the sun is partially obscured by haze or thin cirrus cloud there is a difference in the records obtained. The result of a month's comparative observations, taken in June last, gave an excess of 11 per cent. of sunshine recorded by the photographic process, this variation being mainly due to a hazy atmosphere near the horizon about the times of sunrise and sunset.

METEOROLOGY IN THE NEW ENGLAND STATES[1]

THE New England Meteorological Society was founded in June, 1884, with a membership of 9, which at the close of its first year had risen to 95. Notwithstanding this very modest commencement, it has succeeded, largely through the generous co-operation of friends who have from time to time contributed liberally to its resources, in keeping its expenses within its income, while at the same time it has regularly published its *Monthly Bulletin* of eight pages, including a weather-map for the month; largely added to its observing stations; and largely extended the sphere of its operations. The annual fee for membership, which constitutes the whole income of the Society, is three dollars.

During its first year, ending last October, the Society has addressed itself more particularly to the securing of a corps of reliable observers of meteorological phenomena, with special attention to rainfall and temperature; the publication of the *Monthly Bulletin*; the dissemination of the daily indications of the U.S. Signal Service; the local display of weather-flags; and the special investigation of thunderstorms. The first number of the *Bulletin* contained reports from forty-five observers; but, so vigorously was this important branch of the Society worked out, that in September the number had risen to 123 observers. The greatest attention has been given to secure uniformity in the instruments and methods of observation. In the last-published *Bulletin* the amount of precipitation and the mean temperature are given in Table I. for thirty-five places, these being at the same time compared with the averages of previous years, which range from eleven to seventy-four years. Table II. gives a succinct summary of the results of the observations of temperature, pressure, humidity, and precipitation at the 123 stations, and the weather-map shows graphically the precipitation and range of temperature for the month.

A striking feature of the Society's work is its hearty co-operation with the U.S. Signal Service in the dissemination of daily forecasts of the weather, and the local display of weather-flags. A member of the Signal Corps has been assigned to this duty under the Society's control, with the gratifying result that local weather flags are daily displayed in upwards of 100 cities and towns of New England.

The special investigation of thunderstorms has been conducted under the supervision of the Secretary, Mr. Well

[1] *Bulletin* of the New England Meteorological Society, Nos. i. to xii. Nov. 1884, to Oct. 1885).

Davis, of Harvard College. The National Academy, which constitutes the trustees of the Bache fund, has granted 200 dollars for this work. Upwards of 400 observers are co-operating in the inquiry, and as regards one thunderstorm reports from 203 observers were received. The discussion of the important results already obtained will by and by appear in the *Bulletin*. A thorough investigation of thunderstorms, including the falls of rain, snow, and hail, with their successive propagation over the New England States, will be a highly important contribution to meteorology; and for the results of the investigation as it advances we shall look with much interest to the proceedings of this Society, which is among the very youngest but most active of the meteorological societies.

NOTES

We much regret to record the death of Sir Frederick J. O. Evans, R.N., K.C.B., F.R.S., late Hydrographer of the Admiralty, in his seventy-first year. Next week we hope to give a notice of Sir Frederick's career.

His Excellency the Minister of Agriculture, Industry, and Commerce in Italy, in order to favour and facilitate the application of remedies in solution, powder, or mixture against the cryptogams and parasites of cultivated plants, and especially the use of milk calx against Peronospora (mildew) of the vines, by a decree of November 9 will open an International Exhibition with prizes for pumps, watering and pulverisation implements. The Exhibition will take place at Conegliano in the Royal School of Vine-Culture and Œnology. The following prizes will be awarded:—1 gold medal and 500 lire; 3 silver medals with 150 lire each; 5 bronze medals. The Ministry of Agriculture will also purchase prize implements to the value of 1000 lire for distributing to the Agrarian Government depots, practical and special agriculture schools. Exhibitors must apply for admission to the "Direzione della R. Scuola di Viticoltura ed Enologia in Conegliano" not later than February 22, 1886. The demand must contain a short description of the instruments and the price of each object to be exhibited.

It is stated that the Mexican Government are about to establish a meteorological station among the highest mountains in Mexico, at an elevation of nearly 20,000 feet above the sea-level. Access to such a place must be always precarious, and frequently impossible for a long time together, hence it is necessary to make exceptional provision for rendering the instruments almost independent of human attention and supervision. The necessary apparatus is being constructed by Hottinger, of Zurich, and, as far as possible, all the instruments are being made to go for a year without stopping.

At the monthly meeting of the Council of the Sanitary Assurance Association arrangements were completed for the series of free lectures to be given by the Association at the Parkes Museum during January and February next. The first lecture is to be by Prof. Roger Smith, on "A Damp House," on Wednesday evening, January 20, and on the following Wednesday Mr. F. B. Jessett, F.R.C.S.Eng., will lecture on "Preventible Diseases."

The science certificates and prizes obtained by the students attending evening classes established by the Birmingham School-Board were distributed by Prof. Lapworth, LL.D., F.G.S., in the large hall of the Icknield Street School, on December 14. The report of the year's work, by the Board's demonstrator, Mr. W. J. Harrison, F.G.S., showed that some 5000 children are now receiving elementary instruction in science in the day-schools, while 500 teachers attend the evening classes. Prof. Lapworth afterwards delivered a very able and scholarly address. In consequence of the rapid growth of the system of science teaching, the Board has just resolved to enlarge the chemical laboratory at a cost of about 700*l*.

The Clothworkers' Company have promised to raise their annual subscription to the City and Guilds of London Institute from 3000*l*. to 4000*l*., provided the Corporation and Associated Livery Companies raise the total of their annual subscriptions to the Institute from 24,500*l*., the present amount, to 30,000*l*. This is probably the first step in response to Lord Selborne's recent appeal to the City Companies, on the double ground of public duty and self-interest, to add still further to their already munificent contributions to technical education. The capital expenditure on the building and equipment of the Central Institution, Exhibition Road, the Finsbury Technical College, and the South London School of Technical Art has been nearly 140,000*l*., but, as the late Lord Chancellor pointed out, the Companies cannot be said to have discharged their obligations to technical education, until the Institute wants no more pecuniary support and moral countenance. Until this distant goal is reached, said Lord Selborne, they remain in its debt, notwithstanding their already vast donations.

The statement, according to *Science*, that one of the chief applications of composite photography will be in the direction of producing more reliable portraits of representative men by combining the testimonials of individual artists, will probably be accepted by all who have followed the short but interesting career of this new invention. The suggestion that, by combining the individual conceptions of several artists, one would obtain a more reliable portrait than any of the components, was near at hand. The first such application was made by Mr. Galton himself. He made a composite of six medallion heads of Alexander the Great, and naturally claimed for the composite the combined authority of all the artists. In this way *Science* has recently come into possession of a new Shakespeare. In the case of Shakespeare the diversity amongst the several originals is strikingly evident, and thus a composite was needed to give a characteristic, individual, natural face. This suggested to Mr. W. C. Taylor the application of the same process to Washington's portraits. He has grouped the several portraits into three groups, owing to the differences of position of the portraits, and the accuracy of the work is well shown by the fact that the agreement amongst the resulting three composites is very close, while the originals show every shade of individual differences. These portraits were first published in the *Journal of the Franklin Institute*, and are given on a new and enlarged plate in the number of *Science* for December 11.

In pursuance of a resolution passed at the Medical Congress on Brain Diseases, held during the past summer at Antwerp, by which it was suggested that local conferences should be held to draw up trustworthy international tables of statistics on insanity, a Conference of Austro-Hungarian specialists will be held at Vienna on the 26th and 27th inst., with the object of revising and extending the nomenclature of mental disorders. Invitations to the Conference have been issued by four leading doctors of Vienna.

The work of spawning Salmonidæ at the establishment of the National Fish-Culture Association at Delaford Park has commenced, and it is expected that a large number of ova will be obtained. The establishment, which was opened in the early part of the present year, is now in excellent order, and all the fish that have been reared are doing well. It has been found necessary to increase the number of breeding-ponds in view of the extensive nature of the operations to be carried on next year.

The new aquarium for the Indian and Colonial fish at South Kensington is now in course of construction and will be on view

at the next Exhibition. The tanks are to be erected at the back of the present aquarium, which will be maintained as heretofore, but as the fish to be exhibited require careful and special treatment no connection can exist between the two aquaria, which will be quite separate. It is to be hoped that the collection, when formed, will not be allowed to collapse at the termination of the forthcoming Exhibition, but that it will be maintained as a permanent institution, for an aquarium of foreign fish is much needed in London.

THE last issue of the *Izvestia* of the Russian Geographical Society contains a very interesting communication, by M. Yadrintseff, on the beginnings of settled life, being a contribution to the history of the rise of civilisation among the Ural Altayans. The paper is a *résumé* of an elaborate work on the subject which we hope soon to see published in the *Memoirs* of the West Siberian Geographical Society. M. Yadrintseff has had at his disposal very extensive materials, derived both from his own intimate acquaintance with the life of the native Siberians, and from a careful study of their history. Siberia is really one of the best fields for studying those intermediate phases of life which ultimately lead to the nomads becoming settled. Not only do the inhabitants of Siberia show us all possible stages in the transition from a nomadic life to that of settled agriculturists, but all these stages may also be studied under the varied aspects they assume when the modification goes on in different physical and geographical conditions, for example, in the forest regions, in the steppes, in the narrow valleys of the hilly tracts, and on the broad surfaces of the plains. It is easy to foresee what a valuable mass of information could be gathered in Siberia on this subject by an observer so well acquainted with his mother-country as M. Yadrintseff is; but it would be impossible to sum up in a few words the varied results to which the study has brought the author. The disappearance of entire civilisations like those of the Ural Altayans who immigrated into the plains of Siberia from the hilly tracts of the Altay, only add to the already great interest of the subject. We notice, moreover, the importance justly attached by the author to those intermediate phases which the nomad goes through when he abandons his former mode of life, and, by narrowing the region of his migrations, by staying at a permanent wintering place, and by merely migrating from a permanent summer dwelling to a winter dwelling, finally becomes a settled agriculturist; the relative facility with which this modification is undergone by the inhabitant of a forest region as compared with the difficulties met with by an inhabitant of the steppes; the similarity between many Siberian indigenes now passing through these intermediate phases of civilisation and the Germans at the time of Tacitus; and very many minor conclusions, all possessing great interest.

AMERICAN papers state that an aërolite or meteoric stone, which caused a loud detonation, heard throughout the greater part of Washington and Alleghany counties, Pa., on Saturday, the 3rd inst., fell upon the farm of Mr. Buckland, in Jefferson township, Washington county, near the West Virginia line. A mail carrier states that looking up he saw, moving high above him, a huge mass, which he described as resembling a great coal of fire as large as the largest barn he ever saw. There appeared to be attached to it an immense flame of a deep red colour, which tapered off into a darker tail. Instantly the noise which accompanied it ceased; the fire-like appearance, the flame, and the tail disappeared, and in their stead the stone assumed a whitish hue, which it retained until it passed out of sight. When the stone fell it broke into three pieces, but did not penetrate the earth to any great depth, as two-thirds of it remained above ground. It is grayish in colour, with a succession of red streaks, is irregular in form, and at least fifty feet in diameter.

A CORRESPONDENT of the *Times*, referring to Sir John Lubbock's discovery of much greater longevity of ants than has hitherto been believed, thinks that the same may be true with regard to the butterfly, although the common notion is that the butterfly's life is a short and merry one. The correspondent, who writes from Bournemouth, then relates the following incident:—"On August 15 last a fine peacock butterfly flew into our house through the garden door, and was caught and put under a large bell glass. On the following day another came in, and was also put under the glass. They were supplied daily with fresh flowers and a few drops of new honey, which they evidently much enjoyed. No. 1 died during a suddenly cold night, No. 2 lived until yesterday, December 14. Whenever the sun shone upon their cage, which was placed on a table near a large window of plate glass, they opened their beautiful wings and flew about vigorously, occasionally resting on a flower to thrust their trunks deeply into its corolla, or standing over and sucking up the drops of honey. The extraordinarily sensitive nervous system of these little beauties was indicated by the most rapid vibratile trembling of the wings directly the sunlight or the scent of fresh flowers reached them. When the sun was not out they usually remained perfectly still, with their wings closed, especially selecting to hang on the under side of a leaf. They showed great intelligence in distinguishing the freshly-gathered flowers and in deciding that honey was the right thing to eat, and I have seen one of them scramble with considerable difficulty across his cage through a tangle of leaves and stalks, determined to get to a particular leaf on which he wished to hang. After some unsuccessful attempts to reach it, he hooked it down with one foot, then held it with another, until he could get the rest of his legs upon it, having done which he appeared satisfied, shut up his wings, and hung himself upon it, topsy-turvy, to rest. If he failed to do what he wished with one leg, he immediately tried another, appearing to think that, having six at his disposal, it was foolish to waste much time on any one. But he only used his most anterior pair on very special occasions. How long each butterfly had lived before it was caught I do not know, but No. 2 lived in its glass cage 121 days."

THE amount of carbonic acid in the air has recently been measured by MM. Spring and Roland in a series of 266 determinations in the course of one year, the place being at Liége, in Belgium, having on one side a busy centre of the iron industry and on the other an agricultural district. The average obtained was 5·1258 parts by weight and 3·3526 parts by volume in 10,000 parts of air. This is considerably more than the air of Paris contains (4·83 and 3·168 respectively). Besides the plentiful carbonic acid from those iron-works, there is a large emission of the gas from the ground, which is rich in coal; indeed, cases of local heating often occur, with withering of the plants. To the relative abundance of carbonic acid the authors attribute the greater heat of Liége as compared with the surrounding regions, as the gas strongly absorbs heat-rays and limits radiation by night. A return of cold in May is thought to be due to the unfolding leaves diminishing the amount of CO_2, so that the nightly radiation is increased. The amount of CO_2 is considerably increased by a fall of snow (to 3·761 ten-thousandth parts by volume), except when the earth is already covered with snow. Cloud also gave an increase (3·571). The winter months gave a greater amount than the summer. The difference between day and night was but slight, nor had temperature nor rainfall a decided effect; but the rain in thunderstorms increased the amount. As to wind there were three maxima—viz. with north, north-west, and south-south-west winds, corresponding, apparently, to the directions of industrial centres. The CO_2 diminished in high winds and increased with a high barometer. These researches are the subject of a recent memoir to the Belgian Academy.

THE average heat-value of well-purified coal-gas at constant volume has been recently determined by M. Witz (*Ann. de Chim. et de Phys.*) as about 5200 calories per cubic metre at 0° and 760 mm. when the water formed is fully condensed. This value, got from a great variety of experiments with gas from different works, appears to make the generally-accepted figure of 6000 calories about 15 per cent. too high, and the calculation of gas motors is here concerned. The heat-value of the gas from one and the same works varied in the course of a year from 4719 to 5425 calories, which was more than the variation between different works. The influence of temperature and external pressure was not perceptible. The operations for purifying gas diminish the heat-effect, sometimes as much as 5 per cent. The gas of the last hour of distillation is (contrary to the usual view) less rich than that of the first hour. Dilution with oxygen lessens the heat-value; but in dilution with air, curiously, no such effect was observed; the heat of combustion was the same with six or with ten volumes of air.

IN his investigations of the changes of level of inland lakes (known as *seiches*), Prof. Forel has arrived at the simple formula $t = l/\sqrt{gh}$ for those movements, in which t expresses the time, in seconds, of a half oscillation of a uninodal *seiche*, l, the length, and h, the mean depth of the cross-section of the lake in which the variation is observed. This formula holds good for the lakes of Neuchatel, Brienz, Thun, Wallenstadt, and Geneva. An interesting confirmation of it is found by M. Forel in observations made by Mr. Russel with a limnograph on Lake George in New South Wales. This instrument had recorded 33 very regular *seiches* on the lake this year, and the duration of a whole oscillation proved to be 131 minutes. Now the length of the lake being 28,962 metres, the above formula gives, for the mean depth, 5·536 metres, or 18·1 feet. Mr. Russel states that the mean depth is between 15 and 20 feet.

THE prevailing direction of the winds on the shores of the Black Sea and the Sea of Azov has been recently studied in great detail, and in connection with the recent progress of meteorology with regard to wind generally, by M. Spindler, who has published his work, with maps, in the Russian *Maritime Review* (*Marskay Sbornik*). Four maps show the prevailing direction of the wind at 7 a.m. and at 1 p.m. during the four seasons of the year. During the winter a notable difference between the prevailing direction at these two hours of the day is seen only on the eastern shore; while in the spring and summer nearly everywhere on the Russian coast of the Black Sea these two directions differ by 90°, and at some places they are quite opposite to one another, thus showing that the predominating influence of the currents of air depend upon the different heating of land and sea.

IT is reported from Kara-hissar, in Asia Minor, that an earthquake shook that neighbourhood on Tuesday, December 2. In the hamlet of Kemin the earth opened for a length of about 40 feet, and from 3 to 5 feet wide.

THE last earthquake shock in Algeria was felt at Blidah on December 13, at 5 a.m. Subterranean noises were heard. The first shock, in Hussein Dey, near Algiers, was felt on December 3, at 8h. 23m. a.m. This has been proved by the stopping of a clock in a distillery.

HOW great are still the numbers of Carnivora in Finland may be seen from the following figures, given in the last issue of the "Statistical Yearbook" for Finland. In 1882 not less than 85 bears, 128 wolves, 407 lynxes, 4005 foxes, 76 gluttons, 240 river otters, 148 martens, 1583 ermines, and 3947 carnivorous birds were killed, for which an aggregate of 1646*l.* was paid in premiums by the Government. The ravages occasioned by Carnivora the same year were immense: they are estimated at 274 horses, 846 horned cattle, 5246 sheep, 168 pigs, 119 goats, 1681 reindeer, and 2366 domestic fowls. The greatest number of bears were killed in Viborg and Uleåborg (respectively 33 and 30), while most wolves were killed in the more densely-peopled Government of Tavastehuus.

AT the meeting of the Royal Physical Society of Edinburgh, held December 16, the following office-bearers were elected, viz.—President: Prof. William Turner, F.R.SS.L. and E., Edinburgh University; Vice-Presidents: John A. Harvie-Brown, F.R.S.E., Rev. John Duns, D.D., Prof. J. Cossar Ewart, F.R.S.E.; Secretary: Robert Gray, V.P.R.S.E.; Assistant-Secretary: John Gibson; Treasurer: Charles Prentice, F.R.S.E.; Librarian: William Evans Hoyle, F.R.S.E.; Council: John Hunter, F.C.S., Robert Kidston, F.G.S., A. B. Herbert, Prof. James Geikie, F.R.S., G. Sims Woodhead, F.R.C.P.Ed., Hugh Miller, F.G.S., Arthur W. Hare, M.B., R. Milne-Murray, M.R.C.P.E., H. Moubray Cadell, B.Sc., R. H. Traquair, F.R.S., R. Sydney Marsden, D.Sc., F.R.S.E., Benjamin N. Peach, F.G.S., F.R.S.E.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by the Rev. Spencer Fellows; a Black-backed Jackal (*Canis mesomelas*) from South Africa, presented by Mr. J. Robson; a Slender-billed Cockatoo (*Licmetis tenuirostris*) from Australia, presented by Mrs. Sturt Cavell; a Kestrel (*Tinnunculus alaudarius*), British, presented by Mr. T. E. Gunn; three Wild Ducks (*Anas boschas*), British, presented by Mr. C. T. McNiven; a Lapwing (*Vanellus vulgaris*), British, purchased.

OUR ASTRONOMICAL COLUMN

TOTAL SOLAR ECLIPSE, 1886 AUGUST 28–29.—The eclipse will be total throughout the Island of Grenada. The *Greenwich* mean times of beginning and ending of totality for any point in the island may be found from the formulæ:—

$$\text{Cos } w = -4\cdot99267 - [1\cdot77822]\ \sin l + [1\cdot26284]\ \cos l\ \cos(\lambda + 48^\circ\ 13'\cdot5$$
$$t = 1\text{h. } 12\text{m. } 41\cdot7\text{s.} \mp [2\cdot04698]\ \sin w - [3\cdot24330]\ \sin l$$
$$- [3\cdot84970]\ \cos l \cos(\lambda + 82^\circ\ 53'\cdot0),$$

where l is the *geocentric* latitude of the place, λ its longitude from Greenwich, taken *negatively*, and the quantities in square brackets are logarithms; upper sign for beginning, lower for ending.

For long. 4h. 6m. 20s. W., lat. 11° 59′·5 N. near the *southern* extremity of the island, totality begins at 19h. 11m. 0s. local mean time, and continues 3m. 42s. ⊙'s altitude 20°.

In long. 4h. 6m. 40s. W., lat. 12° 15′·0 N. near the *northern* extremity of the island, totality begins at 19h. 10m. 37s. local mean time, and continues 3m. 37s.

At Carriacou I. (Grenadines)—

Totality commences at	19h. 11m. 45s. local M.T.
Duration	3m. 21s.
Sun's altitude	20°

FABRY'S COMET.—Dr. H. Oppenheim continues his ephemeris of this comet in the *Dun Echt Circular*, No. 102, as follows:—

Ephemeris for Berlin Midnight

1885	App. R.A. h. m. s.	App. Decl. ° ′	Log. Δ	Brightness
Dec. 28 ...	23 48 29 ...	+20 52·6 ...	0·0849 ...	1·6
29 ...	47 14 ...	54·8		
30 ...	46 2 ...	57·3		
31 ...	44 52 ...	21 0·0		
32 ...	43 45 ...	3·0 ...	0·0850 ...	1·8

β CYGNI OR 6 CYGNI?—M. Flammarion in the December number of *L'Astronomie* falls into a curious confusion with regard to these stars. Dr. Ball had found the parallax of B.A.C. 6579 (B) to be $+0''\cdot482 \pm 0''\cdot054$, and following Bode's numbers called the star 6(B) Cygni. Unfortunately, however, M. Flammarion supposed Dr. Ball referred to Flamsteed's 6 Cygni, which is β Cygni, and based an article on the supposed determination

of its parallax. The mistake was a very easy one to make, but at least the Dunsink observations are not to blame, for Dr. Ball gives not only the place of the star he observed but its number in three catalogues—Groombridge, Struve's *Mensuræ*, and the *Durchmusterung*.

BARNARD'S COMET.—Dr. H. Oppenheim (*Astr. Nachr.*, No. 2697) has computed the following elements and ephemeris for this comet:—

Perihelion Passage = 1886 May 14·1430 Berlin M.T.

$$\left.\begin{array}{rl} \omega = & 116^\circ\ 31'\ 57'' \\ \Omega = & 66\ 22\ 12 \\ i = & 94\ 8\ 7 \end{array}\right\} \text{Mean Eq. } 1885{\cdot}0$$

$$\log. q = 9{\cdot}74184$$

Error of the middle observation:—

$$\delta\lambda = +4'' \qquad \delta\beta = -3''.$$

The elements resemble those of Comet 1785 II.

Ephemeris for Berlin Midnight

1885	App. R.A. h. m. s.	App. Decl.	Log. Δ	Brightness
Dec. 24 ...	3 30 5 ...	+7° 2′6 ...	0·2372 ...	1·3
26 ...	25 12 ...	19·8		
28 ...	20 23 ...	37·5 ...	0·2358 ...	1·4
30 ...	15 39 ...	55·8		
32 ...	11 1 ...	+8 14·6 ...	0·2359 ...	1·5

The brightness on December 5 is taken as unity.

THE PULKOWA OBSERVATORY.—From his Report, presented May 25, 1885, it appears that M. O. Struve was chiefly occupied, during the year to which the Report refers, with work connected with the erection of the great 30-inch refractor. Various unexpected delays had occurred, in connection chiefly with the construction of the dome, but, at the time of writing his Report, M. Struve states that regular observations could be commenced immediately. He expresses himself as greatly pleased with the mounting of the instrument, which has been designed and constructed by the Repsolds. At present the dome is moved by hand, but it is hoped that this may eventually be done by electricity, and that motive power will thus be obtained sufficient to overcome the hindrance to the rotation of the dome caused by snow and frost. It is proposed to use the great refractor for observing such double-stars as are beyond the reach of the 15-inch equatorial, and to undertake observations of interesting nebulæ, as well as spectroscopic researches in cases where the great optical power of the instrument will be of special importance. We learn from *Science* that M. Struve has written to Messrs. Alvan Clark and Sons, acknowledging the excellent performance of the object-glass furnished by them, and announcing that the Emperor of Russia had conferred on them the Honorary Gold Medal of the Empire.

Notwithstanding the additional cares and labours thus imposed on the staff of the Pulkowa Observatory, further increased by M. O. Struve's regrettable illness, the usual work in the various departments has been kept up with vigour, and it is evident that the famous Russian institution, under its present superintendent, will continue to maintain its great reputation.

SUSPECTED "NEW" STAR.—It is announced in the *Dun Echt Circular*, No. 104, that Mr. Gore, observing with a binocular on the evening of December 13, found a reddish star of 6th mag., and about 20′ following χ' Orionis. This object is not given by Harding, Lalande, Heis, Birmingham, or the Bonn maps. On December 16 Copeland and Becker, observing at Dun Echt, found it of the 6½ mag., and of an orange-red colour. It has a very beautiful banded spectrum of the third type, seven dark bands being readily distinguished with the prism. The bright intervals seem full of bright lines, especially in the green and blue. The mean place for 1885 is R.A. 5h. 48m. 59s.; Decl. + 20° 9′·4.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1885 DECEMBER 27—1886 JANUARY 2

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on December 27

Sun rises, 8h. 8m.; souths, 12h. 1m. 27·7s.; sets, 15h. 55m.; decl. on meridian, 23° 19′ S.: Sidereal Time at Sunset, 22h. 20m.

Moon (at Last Quarter on Dec. 28) rises, 22h. 18m.*; souths, 4h. 56m.; sets, 11h. 23m.; decl. on meridian, 4° 19′ N.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridia ° ′
Mercury ...	6 36 ...	10 51 ..	15 6 ...	19 57 S.
Venus ...	10 28 ...	15 13 ...	19 58 ...	15 5 S.
Mars ...	22 30* ...	5 6 ...	11 42 ...	6 19 N.
Jupiter ...	23 57* ...	5 57 ...	11 57 ...	0 50 S.
Saturn ...	15 44 ...	23 54 ...	8 4* ...	22 31 N.

* Indicates that the rising is that of the preceding and the setting that of the following day.

Occultations of Stars by the Moon

Dec.	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
27 ...	τ Leonis ...	... 5 ...	5 48 ...	6 47 ...	110 232
29 ...	θ Virginis...	... 4½ ...	4 5 ...	5 15 ...	60 211
Jan. 1 ...	η Libræ ...	... 6 ...	5 8 ...	6 15 ...	58 210

Dec.	h.	
27 ...	9 ...	Mars in conjunction with and 2° 48′ north of the Moon.
28 ...	9 ...	Jupiter in conjunction with and 0° 5′ south of the Moon.
31 ...	5 ...	Sun at least distance from the Earth.

Variable-Stars

Star	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·2 ...	81 16 N. ...	Dec. 29,	1 24	*m*
Algol	3 0·8 ...	40 31 N. ...	,, 27,	21 29	*m*
			,, 30,	18 18	*m*
ζ Geminorum ...	6 57·4 ...	20 44 N. ...	Jan. 2,	22	*M*
S Canis Minoris ...	7 26·5 ...	8 34 N. ...	Dec. 27,		*M*
S Cancri	8 37·4 ...	19 27 N. ...	,, 31,	4 8	*m*
δ Libræ	14 54·9 ...	8 4 S. ...	,, 29,	18 39	*m*
			Jan. 1,	2 30	*m*
U Coronæ	15 13·6 ...	32 4 N. ...	Dec. 30,	5 59	*m*
R Coronæ	15 43·9 ...	28 30 N. ...	,, 31,		*M*
δ Cephei	22 24·9 ...	57 50 N. ...	Jan. 1,	6	*m*
			,, 2,	22	*M*

M signifies maximum; *m* minimum.

Meteor Showers

The principal periodic shower at this time is that of the *Quadrantids*, R.A. 225°–232°, Decl. 55°–60° N., seen on January 2 and 3. As the radiant-point rises after midnight, the shower must be looked for during the morning hours. A shower with radiant near Aldebaran may be looked for during this week and throughout January.

Stars with Remarkable Spectra

Mira Ceti, R.A. 2h. 13m. 36s., Decl. 3° 29′·6 S., should be examined with the spectroscope on every favourable opportunity now that it is approaching its maximum. It is a fine example of Secchi's third type.

Star	R.A. 1886·0 h. m. s.	Decl. 1886·0 ° ′	Mag.	Type of spectrum
γ Cassiopeiæ ...	0 50 6 ...	60 7′0 N. ...	2·2 ...	Bright lines
Mira Ceti	2 13 36 ...	3 29·6 S. ...	Var. ...	III.
ρ Arietis	2 49 24 ...	17 52·1 N. ...	6·0 ...	III.
α Ceti...	2 51 19 ...	3 38·5 N. ...	2·5 ...	III.
ρ Persei	2 57 52 ...	38 24·0 N. ...	Var. ...	III.
D.M. + 57°·702 ...	3 2 38 ...	57 28·2 N. ...	7·9 ...	IV.
51 Schj.	4 59 30 ...	1 1·2 N. ...	6·0 ...	IV.
20 Leporis... ...	5 6 3 ...	11 59·4 S. ...	6·0 ...	III.
α Orionis	5 49 0 ...	7 23·1 N. ...	Var. ...	III.
μ Geminorum ...	6 16 3 ...	22 33·6 N. ...	3·0 ...	III.
78 Schj.	6 28 42 ...	38 31·0 N. ...	6·3 ...	IV.
51 Geminorum ...	7 6 49 ...	16 18·4 N. ...	5·5 ...	III.

GEOGRAPHICAL NOTES

TWO papers in the December number of the *Proceedings* of the Royal Geographical Society are of unusual interest. The first is Mr. F. Simons's account of his exploration of the Goajira peninsula of the United States of Colombia; the second, a series of letters, hitherto unpublished in English, from Colonel Prjevalsky, translated by Mr. Delmar Morgan. Mr.

Simons first describes the topography of the little-visited peninsula in some detail, and then gives an account of the tribe of Indians inhabiting it, which is of exceeding interest, so remarkable are many of their customs. Their system of compensation —consisting of tear and blood-money, or fines for tears or blood supposed to be shed—is one of the most extraordinary ever found amongst a primitive people, extending not only to injuries, wilful or accidental, done to one man by another, but to accidents happening to a man himself. Every man is a hostage for every one of his clan, and is liable to be called upon to pay various fines for the acts of another; if a man borrows an animal of another and is thrown off, the lender has to pay, first, the relatives of the mother, then the relatives of the father, and, lastly, the friends of the borrower. If a man injures himself he is forced to pay his mother's relations for his own blood which has been spilt, his father's for the tears which they are presumed to have shed, and his friends for the sorrow the accident has caused them,—and all this if he has only cut his finger with his knife. Many other curious customs are also recorded. Colonel Prjevalsky's letters describe certain districts around Lob-Nor, and the route to Cherchen and Kiria. The work of the Admiralty Surveys for 1884 is detailed from the Hydrographer's report. Sir Frederic Goldsmid writes on the geographical nomenclature of places between Merv and Herat, and Admiral Irminger, of the Danish Navy, explains, in a letter to the secretary, the so-called subsidence of one of the Faroe Islands, which turns out not to have been a "subsidence" at all.

M. Potanin has again written to the Geographical Society, from Si-nin, under date of April 29. The expedition was continuing its work without the least hindrance, MM. Potanin, Stassy, and Berezovsky exploring the region in all directions, after having wintered in three different towns; the astronomical determinations were also made, and the population, far from hindering the surveys, assisted them. A Tangut, in the service of M. Potanin, is a valuable aid in making collections of insects. MM. Potanin and Skassi left San-chuan on April 15, taking a northerly direction to reach the Si-nin River (called Nimbimuren in its lower course). Its valley is inclosed between high walls of loess, and at three different points it is narrowed by crags of gneiss, where some gold is dug. In the Lau-va-sya gorge the limestone crags are covered with numerous and beautiful *marmites de géant*, one of which has a diameter of 160 centimetres. Above this gorge the valley reaches a width of more than two miles, and two towns, Lau-va-sya and Nimbi, are situated there. They are peopled with Mongols, many of whom are Mussulmans; the villages are peopled with Chinese. Si-nin was reached on April 24, and M. Potanin proposed to leave it soon for Min-cheu, *via* Gui-Dui, so as to connect his surveys with those of M. Prjevalsky.

The German Emperor has ordained that the harbour discovered on the north-east coast of Kaiser Wilhelm's Land, north-west of Port Constantine, shall henceforth be known a "Friedrich Wilhelm's Hafen," and the bay near it "Prince Heinrich's Hafen"; the large navigable river discovered east of Cape de la Torre as the "Kaiserin Augusta Fluss," while Beaupré, situated in the middle of the peninsula will now be called "Varzin." "Neu Mecklenburg" will be substituted for New Ireland, "Neu Lauenburg" for the Duke of York group, and "Neu Pommern" for New Britain, the largest island of the Bismarck Archipelago.

The voyage of the *Vega* along the north coast of Europe and Asia seems likely to bring about another result, namely, the connection of the Petchora with the Obi by a route presenting fewer dangers than the navigation of the Kara Sea. Thanks to the continuous efforts of MM. Sidoroff and Sibiryakoff, the exploration of the Northern Urals, with a view to discover the best routes for connecting the great river of North-East Russia with the chief artery of Siberia, is being busily prosecuted. It appears now, from a communication by M. Nosiloff to the Russian Geographical Society (*Izvestia*, iv. 1885), that there are in the Northern Urals passes which would permit of establishing an easy link between the two basins. The best of them seems to be the Schokuriinsk Pass, the same that Prince Kurbsky availed himself of in 1449 to reach the Obi. A portage, only 98 miles long, leads from Kuya—a village on the Petchora, within easy reach of steamboats—to the Sygva River, a tributary of the Sosva, which appears to be navigable for boats up to a point distant only 35 miles from the pass over the Ural Mountains. The Sygva has a depth of from 4 to 7 feet, and a width of 150 to 350 yards; while the Sosva, 6 to 18 feet deep, forms an excellent channel for even larger vessels. As to the portage itself, its highest point reaches only 1450 feet above the sea, and 1150 feet above the Sygva; and a railway less than 100 miles long would avoid all those difficulties which are now presented by the navigation of the Kara Sea and the ice-bound Gulf of Obi. Another pass, Voikarsky, is at almost the same distance, and its highest point rises about 1650 feet above the sea. The existence of these deeply-indented valleys, and the general configuration of the region, together with the direction of the rivers, once more raises the question, whether the Northern Urals, instead of being *one* winding mountain-chain, are not rather a complex of several smaller chains having a north-easterly direction, and arranged in *échelons* from south to north. It would be most desirable to have a thorough orographical and geological exploration undertaken in connection with the above work, in order to settle one of the most important questions as to the orography of the northern part of the great Russian plain.

We notice in the last issue of the *Izvestia* of the Russian Geographical Society (1885, iv.) the following information communicated by Gen. Meyer with regard to the Transcaspian region. The great ranges of mountains which bear the names of Great and Little Balkhans, Kuren-dagh, and Kopet-dagh, and are continued on the Persian frontier under the names of Aselma, Deireghez, Kelat, and so on, diminish in height towards the east, until they almost entirely disappear about Sarakhs. The chief range reaches, however, 6000 to 7000 feet, with separate peaks 8000 feet high, and the upper parts of its northern slope are covered with snow nearly all the year round. Notwithstanding this, the streams which flow from these mountains into the steppes are remarkably poor; the slates, of which the slopes of the mountains consist, giving the water a free passage into the soil. The ancient inhabitants knew how to utilise this structure of the soil by making their *kerizes*, or wells, connected together by underground galleries, which, after being dug thus for a mile or two, yielded water for irrigation. These wells are now unfortunately mostly in a bad state, and few of them are of any use. The much-talked-of dams on the Murghab and Heri-rud would not be of great use, as the high water in both rivers comes in the spring, and not in the summer when the fields are most in need of irrigation. The characteristics of the ground are strikingly uniform, a terrace with a soil of dry clay, intersected by small ravines, in all cases spreading at the foot of the mountains. The climate is very dry, but fevers are common, probably in consequence of the very rapid variations of temperature from a hot day to a cold night. At Askabad the yearly average temperature is 24°·8 C., the extremes being 31°·5 and − 8°·1. Up to a height of 4000 feet the mountains are covered with a steppe flora. Higher up they are mostly quite devoid of vegetation. The *artcha*, reaching sometimes twenty-five feet, but never growing in forests, is excellent as fuel, but cannot be employed for building. A few willows, poplars, and rushes are sometimes met with along the streams. In the spring the plains are all covered with herbaceous vegetation, which is, however, unfit for pasture. Grazing-grounds are met with only on sandy ground about Akhal. Further east, towards Merv, there are no pasture-grounds, but trees are more numerous. When watered the soil gives good crops: wheat, barley, the Khiva millet, lucerne; cotton and silkworm trees grow well on watered fields, as also poplars, willows, plane-trees, and various kinds of brushwood.

The following information as to the population of the Transcaspian region, communicated to the last issue of the *Russische Revue* (1885, iv.), by M. Seidlitz, may complete the above. The aggregate population of the region is estimated at from 214,000 to 260,000 inhabitants, including Merv—that is, much below previous estimates. The whole region being divided into the districts of Akhal-tekke, Krasnovodsk, Manghishlak, Merv, and Tejen, it appears that the population of the three former districts numbers about 93,000, who live on agriculture in Akhal-tekke and on cattle-breeding in Krasnovodsk and Manghishlak. The agriculture of Akhal-tekke is considerable, the crops of 1883 having yielded no less than 190,000 quarters of wheat, barley, and *Sorghum cernuum*. The cattle in the three districts are estimated at no less than 44,000 horses, 76,000 camels, and more than 600,000 sheep, to which nearly 130,000 horses, 193,000 camels, and one million and a half of sheep must be added for Merv and Tejen. The culture of cotton and of the silkworm in Akhal-tekke is also worthy of notice. The

population of Akhal-tekke consists of Tekke-Turcomans (8400 *kibitkas*, about 42,000 souls), with some 1160 Persians and Tartars, 930 Armenians, and 340 Russians, without families. Askabad, the chief town of this district, has already an important trade. The inhabitants of the Krasnovodsk and Manghishlak districts, on the contrary, are nearly all nomads, and their chief towns, Krasnovodsk and Alexandrovsk, are miserable hamlets with less than 400 inhabitants each. The oasis of Merv, with its 32,000 *kibitkas*, is well peopled. The *bazaars* of the chief town are very animated, 8000 to 10,000 people gathering there twice a week. Since 1785, when the Sultan-bend dam on the Murghab was destroyed by the Ameer Murad Khan, the area of the oasis has much diminished, and it occupies now only a length of 160 miles, and a width of some 13 miles. The town Bairam-kalæ was abandoned for want of water. The Tekke Turcomans, who have inhabited the oasis since 1857, when they drove away the Saryks, are divided into two stems, the Okhtamyshs and the Tokhtamyshs. The richer of them live in felt tents, while the poorer ones make huts of clay of the same shape as the felt tents. These settlements and villages are not permanent, and may be changed at the first signal of alarm. In fact the population is too numerous for the watered area. As to the fertile oasis of Tejen, on the Heri-rud, it was formerly visited only in the summer. It has now some 7500 Tekke inhabitants, who have immigrated from Merv, Akhal, and Atek.

MR. SHIPLEY, the American Consul at Auckland, New Zealand, reports to the State Department at Washington, the following facts about a new volcano in the Pacific Ocean :—"At daylight on October 13 we observed dense volumes of steam and smoke clouds ascending. We sailed sufficiently near to see that it was a submarine volcanic eruption. Considering that it was not prudent to approach any nearer that night, we lay to until morning. We then approached to about a distance of two miles. I have not words to express my wonder and surprise at its changing splendour. Eruptions take place every one or two minutes, changing in appearance every second, like a dissolving view. I can only say that it was one of the most awfully grand sights I ever witnessed on the high seas. As near as I was able to calculate the position of the volcano, it is about fourteen miles from the island of Honga Tonga. As to the size of the island thrown up, I am unable to state it correctly, there being so much steam and cloud hanging over it; but I judge it to be at least two or three miles long, and 60 feet high, in lat. 20° 21′ S., long. 175° 28′ W."

THE PARIS ACADEMY OF SCIENCES

THE yearly meeting of the Paris Academy of Sciences took place in the large hall of the Institut on December 2. Rear-Admiral Julien de la Gravière was in the chair. He read a short paper summarising the *éloges* of eight members who died during the past twelve months. This number is unusually large in a body of sixty-six.

M. Bertrand delivered two addresses on M. Lagourneria, a geometer, and M. Combes, an engineer, who died some years ago, after having enjoyed the academical honours during many years.

The number of prizes delivered by the Academy is increasing yearly, not less than thirty-three being offered for competition in 1886. The total of the sums to be awarded is more than 3000*l*., exclusive of some of which the value is to be determined according to the merits of competitors, and the Bréant Prize for a cure for cholera. Dr. Ferran was not even mentioned in the verdict, and the interest of the 4000*l*. was given to several writers on the etiology of cholera.

Some of the prizes for 1885 were not awarded, for want of competition, although, except a very few, they are open to every nation, and memoirs can be written in any language as well as in French. A large number of prizes were not delivered for want of merit in the contributions sent. Some of them were awarded to scientific writers who have published volumes on topics connected with the subject-matters. Of this last class we may mention, *inter alia*, "Memoire sur la Marche et l'Extension du Choléra Asiatique des Indes Orientales," &c., by Dr. Mahé, representing France at Constantinople; "Contributions à l'Etude de la Fièvre Typhoïde," by Dr. Pietro Santo; "Statistique de l'Industrie minérale et des Appareils à Vapeur en France et en Algérie," by M. Keller; "Contributions à l'Etude statistique du Suicide en France," by Dr. Jules Socquet; "Histoire de l'ancienne Académie de Marine de Brest," by M. Donneaud du Plan, Librarian of the Navy at Dieppe.

Amongst the most important prizes awarded we notice the following :—

M. Amsler Laffon, of Shaffhouse, for his instrument for polar planimetry, as presented by Mr. Scott Russell to the Institution of Naval Architects in 1880 (Monthyon Medallist for Mechanical Arts).

M. Colladon, of Geneva, for the application of compressed air as a motive power in tunnelling Mont Cenis (Fourneyron Medallist).

M. Thollon, for mapping the solar spectrum in the Bischoffsheim Observatory, Nice (Lalande).

Dr. Spörer, of the Potsdam Astro-Physical Observatory, for his studies on solar spots (Voltz).

Dr. Edlund, member of the Academy of Sciences of Stockholm, for his memoir on the origin of electrical tension of the atmosphere. He considers this tension to be produced by the rotation of the earth, which is a magnet. The soil being made negative, the atmosphere becomes positive by induction. The difference of tension resulting from his calculations is 223 volts per kilometre altitude. No less than twelve memoirs were sent —five in French, four in German, and three in English (Boydron Prize). The memoir of Dr. Edlund had been already printed and published.

M. Gernez, for his discoveries in rapid solidification of supersaturated liquids.

M. Halphen, a major in the French Artillery, took the Petit d'Ormay Prize for the *ensemble* of his mathematical work and principally the solution of the following problem :—Trouver les équations différentielles qui se reproduisent par une substitution linéaire.

The Monthyon Prize for discoveries in connection with unhealthy arts has been given to M. Chamberland, chief assistant of M. Pasteur, who invented a filter in chinaware which stops even microbes.

The Government Prize was given to M. Joannes Chatin for his study of the sensation organs of invertebrate animals.

The Cuvier Medallist for this year is Prof. Van Beneden, of the Louvain University, for half a century of work in physiology.

THE NEW ZEALAND INSTITUTE

THE volume of *Transactions* of the New Zealand Institute for 1884 was issued to the members in May of the present year. It is edited by Dr. Hector, and contains fifty-five memoirs, which, read before the various affiliated societies, have been deemed worthy, by the Governors of the Institute, of publication. While the papers on biological subjects occupy three-fourths of the space devoted to the transactions, those on geology are but few in number. Among the more important of the zoological memoirs may be mentioned the following :—"Descriptions of New Zealand Micro-Lepidoptera," by E. Meyrick (pp. 68–149). In continuation of his previous memoirs we have here full details and an analysis of the following families :—Scopariadæ; while no species of this family is common to New Zealand and Australia, the author has included in his memoir descriptions of the known Australian species of the genera Scoparia, Tetraprosopus and Xeroscopa. Fifty-eight species of the first and sixteen species of the last genus are described. Pyralidæ : Hydrocampidæ; these families are each represented by a single species, neither of which is, in a strict sense, indigenous, *Asopia farinalis* being introduced from Europe. The representative of the latter family, *Hygraula nitens* (Butl.), being regarded as a recent migrant from south-east Australia. Pterophoridæ; eleven species are described: one is closely allied to a European form, one is Australian; the other nine are all endemic. In a supplement a number of additions to the previously-published list of species of Crambidæ and Tortricidæ are described. "Further Notes on Coccidæ," by W. M. Maskell. The author comments on our notice this time last year of the roughness of the plates in Vol. XVI. While we agree with him that all biologists are not artists, yet we venture to think that it is not too much to expect that there should be one artist at Wellington who could execute plates in a style worthy not only of the New Zealand Institute, but in keeping with the excellent typography of the volume. Thus, the very "lettering" of the plates in the present volume is not only bad, but misleading, Vol. XIV. being misprinted for Vol. XVII., and Plate

8 for Plate 7. We notice, however, an improvement in the lithography. In his notes Mr. Maskell describes several new species, and advances our knowledge of the New Zealand fauna very considerably. In a paper on the spiders of New Zealand, Mr. A. T. Urquhart describes and figures a great many new species, chiefly from the neighbourhood of Auckland. Prof. Jeffrey Parker gives notes on the skeleton and baleen of a Fin Whale (*Balænoptera musculus*), and Mr. S. Mieson gives some interesting details about a plague of rats in Nelson.

Among the botanical memoirs may be noted those of Mr. T. Kirk, on the flora of Stewart Island. Prefaced by a short sketch of the island, and the facts previously known as to its natural history, Mr. Kirk gives the results of his investigations of its flora made during two visits in January, 1882, and in January, 1884. So far as at present known the flora of the island comprises about 380 species of Phænogams, and nearly 70 species of Pteridophytes. The area of the island is estimated at 640 square miles. Attention was at once attracted by the blaze of crimson presented by the flowers of *Metrosideros lucida*, often flecked by the beautiful pale racemes of *Weinmannia racemosa*. *Veronica salicifolia* occurred by the side of watercourses, but was far from common. The soil was often carpeted with a compact growth of the charming liliaceous plant *Callixene parviflora*, with its elegant drooping flowers. The terrestrial orchids formed a marked feature in some parts of the forest. *Coryanthes oblonga* and *C. rivularis* produced their attractive flowers literally by thousands. Arborescent ferns were abundant, the most abundant being *Dicksonia squarrosa* and *Hemitelea smithii*. The crest of Mount Anglem, the highest peak of the island, was ascended. The weather, unfortunately, was unfavourable, the driving snow obscuring the prospect. A splendid Alpine flora was discovered. *Dracophyllum muscoides* formed a compact dark green sward gemmed with white flowers; several species of Coprosma, *Ranunculus lyalii*, the beautiful *Ourisia sessiliflora*, also *O. cæspitosa*.

On exposed portions of the coast on both sides of the island *Olearia angustifolia* was found; it is one of the grandest of flowering plants. Varying in size from shrubs of about 6 feet high, to a tree of 20 feet, the snowy ray florets, with the dark purple of those of the disk of the innumerable flower heads, set off by the dark, deep, glossy green foliage, form a never-tiring source of attraction, while the aromatic odour exhaled is of a grateful type. *O. trailii*, also another splendid species, but sparingly occurred. A list of the ferns and fern allies is given. *Todea superba* grows luxuriantly; one specimen was examined which had a stout stem some 18 feet high, from which arose a dense crown of nearly erect fronds, with drooping tips; some of these were several years old and were between four and five feet in length, of a deep blackish green. Mosses and large frondose Hepaticæ also abounded.

Mr. Cheeseman, Mr. Colenso, and Mr. Petrie, continue their descriptions of species new to science and to New Zealand.

In the section devoted to geology Capt. F. W. Hutton describes a large number of new Tertiary shells; Dr. J. von Haast has notes on the geological structure of the Southern Alps of New Zealand, in which he criticises Dr. Hector's recently-published map of this district; and Dr. Hector has a note on the geological structure of the Canterbury Mountains, in which he very temperately justifies changes in his views of geological periods as based on the progress of his knowledge of facts. Mr. James Parks's account of the ascent of Mount Franklin will be read with interest; though occupying a central position in the province of Nelson, it does not seem to have been before ascended. The Waiau Gorge is described as one of the most wonderful in New Zealand. On both sides the mountains frequently rise by a succession of steep, rugged precipices to a height of 3500 feet over the river. About 6050 feet high a small area of glacier ice was found, probably all that now remains of the great Waiau Glacier. Small patches of red snow were found; at 6500 feet in height permanent snow-fields were met with, and the top of the range, described as a mere razor-back, only a few feet wide, and composed of loose, angular, and slab-like rocks was found to be 7500 feet high. The highest peak, by aneroid measurement, was 350 feet higher. A list of the Alpine plants collected on the occasion, and determined by Mr. J. Buchanan, is appended.

It will be judged from this short notice that this volume, edited by Dr. Hector, is one coming in no way short of its predecessors and that it reflects credit on the scientific workers of New Zealand.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—A Fellowship will be filled up in Lincoln College in January next.

The Examination will be in the subjects of Animal Physiology and Animal Morphology; and candidates are invited to send in any treatises or theses that they may have written or published in special branches of one or both of these subjects.

Candidates should communicate at once with the Rector, who will furnish them with full information as to the conditions and tenure of the Followship.

CAMBRIDGE.—Another development from Prof. Stuart's School of Engineering is probable. The Special Board for Physics and Chemistry, considering the number of students of engineering warrants such a step, propose for their benefit an Honours Examination, to be connected with the Natural Sciences Tripos. Certain branches of Mathematics, useful alike for students of Engineering, Physics, and Chemistry, are to be introduced into an examination alternative with the first part of the Natural Sciences Tripos. Papers should be included on Principles of Measurement, Theory of Structures, Properties of Matter, Principles of Mechanism, and other branches of Physics and Chemistry, and there should be practical work in Engineering, as well as in Physics and Chemistry, each candidate being required to pass the practical examination in at least one of these three subjects. A student passing this examination with credit in his third year should be entitled to a degree in honours.

A second higher Examination is proposed, to be concurrent with the second part of the Natural Sciences Tripos, in the same subjects as above-mentioned, and the examiners should be at liberty to set questions involving the Mathematics of the first Examination, and in those parts of Mineralogy which belong to Physics and Chemistry. Other conditions are similar to those of the Natural Sciences Tripos. The Special Board for Mathematics has expressed its general approval of the scheme.

At St. John's College E. H. Hankin and F. S. Locke, both of St. Bartholomew's Hospital Medical School, have been elected to Exhibitions of 50*l.* a year in Natural Science. In Mathematics, F. M. Monro, King William's College, has been elected to a Foundation Scholarship of 80*l.* a year; A. G. Cooke, City of London School, to a Minor Scholarship of 75*l.* a year; A. Kahn, Middle Class School, Cowper Street, E.C., and J. A. Lawrenson, Liverpool Institute, to Minor Scholarships of 50*l.* a year; W. H. Box, University College, Aberystwith, and S. Humphries, Middle Class School, Cowper Street, E.C., to Exhibitions of 40*l.* a year for three years.

SCIENTIFIC SERIALS

The Journal of Anatomy and Physiology for October (vol. xx. part 1) contains:—On the anatomy of the muscles, ligaments, and fascia of the orbit, by C. B. Lockwood (plate 1).—Two cases of an abnormal coronary artery of the heart arising from the pulmonary artery, by Dr. H. St. John Brooks (plate 2).—On a second bursa connected with the insertion of the biceps, &c., by A. Ward Collins.—Abnormalities of the lobes of the human lung, by A. E. Maylard.—On the nature of ligaments, part 4, by J. Bland Sutton (plate 3).—Vital relations of microorganisms to tissue elements, by Drs. G. S. Woodhead and A. W. Hare.—The blood-forming organs and blood-formation: an experimental research, part ii., by Dr. J. Lockhart Gibson.—The relationship of urea-formation to bile-secretion: an experimental research, by Dr. Noel-Paton.—The index of the pelvic brim as a basis of classification; and on the anatomy of Sowerby's whale, by Prof. W. Turner (plate 4).

The Quarterly Journal of Microscopical Science for October contains:—On the chromatology of the blood of some invertebrates, by Dr. C. A. MacMunn (plates 33 and 34). Among other pigments referred to, the colouring-matter of the perivisceral fluid of *Strongylocentrotus lividus*, named echinochrome, is described in detail.—On the cephalic appendages of the gymnosomatous Pteropoda, and especially of Clione, by Dr. Paul Pelseneer (plate 35). The cephalic appendages in Clione, Clionopsis, and Pneumodermon are described. In Clione there are tentacles, properly so called, and buccal cones. In Pneumodermon there are tentacles and two acetabuliferous buccal appendages, and in Clionopsis only tentacles are found. While the author leaves the function of the buccal cones in Clione

doubtful, there can be no doubt as to the sucker-like functions of the appendages in Pneumodermon.—Evidence in favour of the view that the coxal gland of Limulus and of other Arachnida is a modified nephridium, by G. L. Gulland, M.A. (plate 36), with a note thereon by Prof. E. Ray Lankester, in which the following important statement is made :—"The space in the connective tissue into which the young nephridium opens internally is *not* a blood space. The blood system in the larger Arthropoda is altogether distinct from the general system of lacunæ of the connective tissue. The *lacunæ* form a *lymphatic system* which contains a liquid distinct from the blood: they represent the body cavity, and as such receive the internal openings of the nephridia."—Notes on the embryology of Limulus, by Dr. J. S. Kingsley (plates 37–39).—On the anatomy of the Madreporaria, part i., by G. Herbert Fowler, B.A. (plates 40–42).—The issue of the "Supplement" numbers of this journal being found inconvenient, it has been decided to publish its numbers for the future at such intervals as the accumulation of material renders desirable. Though more than four numbers will thus in all probability be published in the course of a year, the title will remain unaltered. Four numbers will make a volume.

Two papers are especially noteworthy in the *Journal of Botany* for November:—Rev. H. E. Fox and Mr. F. J. Hanbury's "Botanical Notes of a Tour in Caithness and Sutherland," where they had the opportunity of visiting large tracts of country from which botanists are, as a rule, now practically shut out, that they may not interfere with the sports of the owners; and Mr. F. N. Williams's careful "Enumeration of the Species and Varieties of *Dianthus*."

The number for December is signalised by a continuation of the record of Mr. Thos. Hick's important observations on protoplasmic continuity in the Fucaceæ. He has now detected this continuity in two other species, *Hemanthalea lorea* and *Laminaria digitata* (the latter not strictly belonging to the Fucaceæ), in the cortical and central, less certainly in the epidermal tissue. In the latter species the continuity is effected through the intervention of sieve-plates. Mr. James Britten gives a complete history of the important botanical collections made by Messrs. J. R. and G. Forster.

The Proceedings of the Linnean Society of New South Wales, vol. x. part 2, July 31, contains the following papers:—W. Macleay, revision of the genus Lamprina, and descriptions of new species; on two new Australian Lucanidæ; on new fishes from the Upper Murrumbidgee.—N. de Miklouho-Maclay, on the zoology of the Maclay coast, New Guinea, ii.; on two new species of Dorcopsis (plates 19 and 20); on the brain of *Halicore australis* (plate 24).—Dr. R. von Lendenfeld, on Australian sponges lately described by Carter; on a Medusa from the tropical Pacific.—A. G. Hamilton, on the fertilisation of *Goodenia hederacea* (plate 21).—K. H. Bennett, on the habits of *Falco subniger* and *Glareola grallaria*.—Rev. J. M. Curran, on the geology of Dubbo (plates 22 and 23).—Baron von Mueller, on a remarkable Haloragis from New South Wales.—A. S. Olliff, the Cucujidæ of Australia.—D. Ogilvy, description of new fishes.—E. P. Ramsay, notes on birds from New Guinea; on a new species of Collyriocincla.—G. F. Mathew, R.N., on the natural history of Claremont Islands; on the butterflies of Thursday Island.—W. A. Haswell, M.A., jottings from the biological laboratory of Sydney University.

Zeitschrift für wissenschaftliche Zoologie, Band 42, Heft 3, October 27.—On the movements of the foot in the Lamellibranchs, by Dr. A. Fleischmann (with five woodcuts).—On the oceanic fauna off the coast of New Guinea, by Dr. R. Greeff (plates 12–14). Rolas or Pigeon Island is separated from St. Thomas by a channel of from 3 to 4 km. wide. Under favourable winds, shoals of larval and mature Crustacea, Mollusca, Echinoderm larva, Medusa, Radiolaria, &c., float through. The general description of the place is most alluring; surely the proprietor, Mr. F. José de Araujo is in the possession of an earthly paradise for a marine zoologist. In this memoir Dr. Greeff describes and figures several new species of Tomopteris and Alciope, giving, at the same time, anatomical details.—Contributions to the anatomy and histology of *Priapulus caudatus*, Lam., and *Halicryptus spinulosus*, V. Sieb., by Dr. W. Apel (plates 15–17).—Contributions to our knowledge of the Mallophaga, by Dr. F. Grosse (plate 18). These researches are chiefly based on a remarkable new parasite from a pelican found by Dr. Reiss in Chili, which is described as belonging to a new genus and species (*Tetrophthalmus chilensis*).—On the reproductive organs in *Nematois metallicus*, Pod., by N. Cholodkovsky (plate 19), a memoir of importance to the Lepidopterist.

Archives Italiennes de Biologie, tome vi. fasc. 2, March 31, contains:—Clinical and physiological researches on paraldehyde, by Dr. V. Cervello.—On the physiological action of antipyrene, by Dr. F. Coppola.—On perimetry, and on self-registering perimeters, by Dr. Ferri.—On the effects of salt on Cercaria, by Prof. E. Perroncito.—On cicatrisation after wounds in the kidney; and on the partial regeneration of that organ, by G. Pisenti (plate).—On albumen in the saliva, and the bile in albuminuria, by Matilda Dessalles.—On the minute structure of the air-sacs in birds, by Dr. E. Ficalbi (abstract).—On anomalies in the number of the semi-lunar, aortic, and pulmonary valves, by G. Martinotti, and G. Sperino.—On microphytes in the normal human epidermis, by Prof. G. Bizzozero (from *Virchow's Archiv*), December, 1884 (plate).—On the organ of Corti in the Cercopitheci, by Prof. A. Tafani (illustrated).—Notes on the anatomy of a negro (iii.), by Prof. Giacomini (plates).

THE October number of the *Nuovo Giornale Botanico Italiano* contains only two original papers:—On the Bryology of the neighbourhood of Cuneo, by Sig. Macchiati; and On the nature and development of the integuments of the seed in *Tilia*, by Sig. Mattirolo. These integuments may be classified into two layers, the inner of which displays the light line characteristic of the genus *Tilia*, and which is due to the formation of lignin.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 17.—"A New Form of Spectroscope." By J. Norman Lockyer, F.R.S.

Some two or three years ago, when the sun-spot work carried on at Kensington revealed the different behaviour, in different spots, of lines visible in the spectra of the same element, it seemed desirable to extend similar observations to metallic prominences, and, if possible, in such a way that comparisons over a considerable reach of spectrum should be secured.

It then struck me that a grating cut in half, with one part movable, would afford a ready means of doing this.

Circumstances prevented the realisation of this scheme till quite recently, when I put into Mr. Hilger's hands a grating presented to me by Mr. Rutherfurd.

The result is excellent. It is possible to observe C and F, for instance, together, quite conveniently, with either a normal or a tangential slit. The only precautions necessary are to see that one-half of the light passing through the object-glass falls on one-half of the grating, and that the rays which come to a focus on the slit plate are those the wave-length of which is half way between the wave-lengths compared.

Linnean Society, December 17.—Mr. Frank Crisp, LL.B., Vice-President and Treasurer, in the chair.—*Heritiera littoralis*, var. *macrophylla*, Dr. Masters showed a branch with leaves and fruit, received from Prof. Cornu, of the Jardin des Plantes, Paris. The adult leaves, of very large size, are dark green above, and silvery white beneath. The latter, due to an investment of shining, peltate, membranous scales, has given rise to the name "Looking-glass tree." This Sterculaceous tree is a native of the tropics of the Old World, in the vicinity of coasts, and occurs inland in the hills of Eastern Bengal. Kurz considered the species and its variety as quite distinct, a view not held by Dr. Masters.—Mr. Charles Stewart exhibited the stridulating organ of a Spiny Lobster (*Palinurus*); he showed under the microscope the file-like bow and its two tubercles, also, by means of a softened specimen attached to the carapace, he produced the peculiar grating noise which the animal makes during life.—Mr. J. G. Baker exhibited specimens of *Lycopodium complanatum*, collected by the Rev. A. Lawson on the Somersetshire side of Exmoor, near Porlock, thus corroborating those who have ascribed a British habitat to the species in question.—Mr. Clement Reid drew attention to a series of fossil seeds and plants from the "Forest Bed" of the Cromer district, Norfolk; their very excellent state of preservation enabled their comparisons with living plants to be easily made out, and thus a clue given to the history of our present flora.—Mr. Thos. Christy exhibited a plant of *Angræcum sesquipedale* in flower, and a plant of *Catasetum purum*, showing flowers erect and reversed in the same spike. In none of the flowers was the ovary visibly twisted, but in long ovaried orchids it is often very difficult to detect the twisting of the ovary by the external aspect. This

specimen illustrated the fact that light or the absence of light was not the cause of the alteration of position.—The following specimens were exhibited from Mr. E. M. Holmes, viz. :—(1) *Ustilago marina*, Dur., a fungus new to Britain, having been discovered by Mr. Holmes, last autumn, growing on *Scirpus parvulus* at Studland Bay, Dorset, on ground covered by brackish water ; (2) fruit of *Afzelia cuangensis* from Limpopo, Natal, sent him as the pod of a mahogany-tree ; (3) fruit of *Trichilia Dregei*, from the same district,—oil is obtained from the seeds by boiling, and with this insecticide the Kaffirs anoint their bodies.—Mr. F. R. Cheshire gave an epitome of his late researches on the tongue of the bee, describing the structure and mode in which he believes suction of nectar takes place.—A paper was read, on Entomostraca collected by Mr. A. Haly in Ceylon, by Prof. G. S. Brady. The freshwater forms were obtained at Colombo ; the marine species were dredged at a depth of two fathoms in the Gulf of Manaar. The freshwater Copepoda and Cladocera approach well-known European species. Among the Ostracoda is a curious new generic form, *Cyprinotes*. Additional information is also given by the author respecting *Cypris cylindrica* (*Malcolmsonia*) and *C. subglobosa*.—Mr. H. N. Ridley read a paper on orchids from Madagascar. The collection (fifty in number) was obtained by Mr. Fox in the neighbourhood of Imerina. Among them are three genera new to the flora of the island, viz. *Arnottia*, indigenous to the Mauritius ; *Brownleea*, hitherto only known from South Africa ; *Holothrix*, an East African representative. Another interesting novelty is *Satyrium gigas*.—Two other papers, read in abstract, were : a monographic revision of the recent Ephemeridæ, part iv., by the Rev. A. Eaton ; and Colombian species of the genus *Diabrotica*, part ii., by Mr. Joseph Baly.

Anthropological Institute, December 8.—Mr. Francis Galton, F.R.S., President, in the chair.—Mr. H. H. Johnston exhibited a collection of photographs of African natives and scenery.—Mr. H. W. Seton-Karr exhibited a number of photographs of North American Indians, taken by him during his recent visit to Canada.—Mr. Joseph Hatton exhibited several ethnological objects collected by his son, the late Frank Hatton, in North Borneo. Mr. W. M. Crocker also exhibited some objects from Borneo ; and Mr. R. Meldola exhibited some photographs of Nicobarese.—A paper by Mr. E. H. Man, on the Nicobar Islanders, was read, in which the author described the wild race inhabiting the interior of Great Nicobar and called by the inhabitants of the other islands of the group "Shom Pen." It appears certain that they are the descendants of a very ancient aboriginal population of Mongolian origin. The height of the males appears to range between 5 feet 2 inches and 5 feet 8 inches ; their skin is fairer than that of the generality of the coast people, who on their part are less dark than the Malays ; the hair is straight, and is commonly worn uncut and unkempt. Their dwellings are small and erected on posts ; the floors being raised six or seven feet above the ground necessitates the use of ladders. Mr. Man hopes before long to be able to supplement in many particulars the meagre information that has hitherto been obtainable regarding the Pen, but the task is one of considerable difficulty.

Royal Meteorological Society, December 16.—Mr. R. H. Scott, F.R.S., President, in the chair.—Mr. J. Hartnup, Mr. A. W. Preston, Mr. R. Sheward, and Mr. W. B. Worthington were elected Fellows of the Society.—The following papers were read :—On the influence of forests upon climate, by Dr. A. Woeikof, Hon.Mem.R.Met.Soc. The first step towards a scientific investigation of the influence of forests upon climate was taken by the establishment of the Bavarian Forest Meteorological Stations. This example was followed by Germany, France, Switzerland, Italy, and other countries. As a general result it was found that during the warmer season the air and earth temperatures were lower in the forest, as compared with contiguous woodless places ; that their variations were less ; and that the relative humidity was greater. Dr. Woeikof's discussion of this question shows that in the western portions of the Old World extensive forests materially influence the temperature of neighbouring localities, and that the normal increase of temperature from the Atlantic Ocean towards the interior of the Continent is not only interrupted by their agency, but they cause the summer to be cooler in regions situated further in the interior than those nearer the sea. Hence, forests exert an influence on climate which does not cease at their borders, but is felt over a greater or less district, according to the size, kind, and position of the forests. From this it naturally follows that man, by clearing forests in one place and planting others in another, may considerably affect the climate.—Report on the phenological observations for 1885, by the Rev. T. A. Preston, M.A., F.R.Met.Soc. The year has been a very dry one, and this has acted in such a manner on vegetation that, although the winter was mild, plants were very late in flowering, and lasted only a short time. The bloom was often profuse, and, as bees and other insects could visit them, the crop of fruit was unusually great—the apples, for instance, being often spoilt in quality from the enormous number on the trees ; whilst in the case of wild fruits the brilliant colour of the bushes when in fruit was quite as beautiful as when in bloom. But at the same time the drought acted very prejudicially, especially to root-crops and bush-fruit, as well as strawberries. In the case of the root-crops, the seed had great difficulty in germinating, and the weak plants were at once overpowered by insect pests, so that the crops of turnips were generally complete failures. The insect pests also did much damage to bush-fruit, while the drought prevented the strawberries from swelling. The corn did not suffer to any great extent, the dry season allowing the land to be prepared : and, although the straw was often short, the yield was not unsatisfactory. A general absence of butterflies was noticed in some places. In the south of England the white butterflies were most abundant at one time, but the autumn butterflies were not so plentiful as usual.—Etudes sur les crépuscules rosées, by Prof. A. Ricco, of Palermo.—The storm of October 15, 1885, at Partenkirchen, Bavaria, by Col. M. F. Ward, F.R.Met.Soc. This was the most destructive storm which has occurred in this valley since the winter of 1821–22. The storm burst suddenly at 7 p.m., and lasted about half an hour, but in that short period nearly every house was unroofed, and it is computed that in one forest alone above 250,000 trees were laid prostrate.

Geological Society, December 2.—Prof. T. G. Bonney, F.R.S., President, in the chair.—Charles Dawson, Francis J. Ede, Lewis Edmunds, Henry A. Gordon, George Frederick Harris, Samuel Learoyd, John Main, Mansfeldt Henry Mills, Rev. Thomas Randell, James Radcliffe, Andrew Edmund Castlestuart Stuart, Tudor Gruffydd Trevor, and Arthur Smith Woodward were elected Fellows of the Society.—The following communications were read :—On some borings in Kent ; a contribution to the deep-seated geology of the London Basin, by W. Whitaker, B.A. (Communicated by permission of the Director-General of the Geological Survey.) Seven deep borings in the eastern part of Kent were described, all of them reaching to the Gault. The chief one is at Chatham Dockyard, where, after passing through the whole thickness of the Chalk, the Gault was found to be 193 feet thick, whilst the Lower Greensand was only 41 feet, and was underlain by Oxford Clay, a formation not before known in Kent. These parts involve the thinning of the Lower Greensand from 200 feet at the outcrop a few miles to the south, and the entire loss of the whole of the Wealden series, which, further south, exists in great force, the Weald Clay being 600 feet thick, or perhaps more, and the Hastings Beds 700 feet or more. Still further south, in the central part of the Wealden district, there are outcrops of the Purbeck Beds, whilst the Subwealden boring continues the series downwards. We have thus an addition to the beds wanting at Chatham of some 400 feet of Purbeck and Portlandian, of over 1100 feet of Kimeridgian, and of nearly 500 feet of Corallian, &c. In a section of 32 miles, therefore (the distance between the Subwealden and the Chatham borings), we have a thinning of beds to the extent of over 3400 feet, or at the average rate of about 100 feet in a mile. This northerly thinning agrees with the facts that have been brought before us from other deep borings in and near London ; but the Chatham boring is the first in the London Basin in which a Middle Jurassic formation has been found. The teaching of the deep borings, as a whole, is that north of the Thames older rocks rise up beneath the Cretaceous beds, whilst on the south newer rocks come in between the two. The question of the finding of the Coal-measures beneath parts of the London Basin seems to admit of a hopeful answer, whilst the lesson of the deep borings as regards water-supply is that there is small chance of getting water from the Lower Greensand at great depths underground. It would be well if underground exploration could be conducted on a systematic plan, with proper regard to both topographical and geological considerations, and not left any longer to the

chance work of people in search of water.—Note on some recent openings in the Liassic and Oolitic rocks of Fawler in Oxfordshire, and on the arrangement of those rocks near Charlbury, by F. A. Bather; communicated by Prof. J. Prestwich, F.R.S. The River Evenlode rises in the Lower Lias of the Vale of Moreton, traverses the range of Oolites, and joins the Isis opposite Wytham Mill. Lias is exposed to about three-quarters of a mile below Fawler, where Great Oolite is brought down by a fault; and in the Geological Survey map Lower Lias is brought down the valley to within half a mile of Charlbury railway station. In this paper the author gives reasons for believing that the distribution of the different beds constituting the Lias in the Evenlode Valley do not agree with the Geological Survey map, nor with Prof. Hull's description; recent sections and borings made for clay, used in brick- and pottery-making, having exposed Lower Lias clay in a brick-yard at Fawler, Marlstone and Upper Lias clay in a neighbouring coombe, and in a long section 100 yards north of the brick-yard Inferior Oolite comes in upon the Upper Lias clay. On examining the banks of the Evenlode, north of Charlbury, it was found that clays referred in the Survey map to Lower Lias are really Upper Liassic, being above the Marlstone, sections of which are exposed near Culsham Bridge. It was shown how these corrections in the mapping of the ground are explained by the section along the line of the Evenlode and by the dips of the beds.

Royal Microscopical Society, December 9.—A. D. Michael, F.L.S., Vice-President, in the chair.—Mr. Swift's large photo-micrograph of the tongue of the blow-fly, which had obtained the prize medal at the recent Exhibition of the Photographic Society, was exhibited. The plan adopted was to take an enlarged photograph from a small image obtained by a paraffin lamp by artificially strengthening the image where required.—Mr. Crisp exhibited Prof. Klein's microscope for observing crystals when heated to a high temperature; also an apparatus for enabling four photo-micrographs to be taken of the same object, so as to give a different length of exposure to each or to photograph different parts of an object rapidly.—Dr. Maddox exhibited a series of photographs of inked surfaces covering pencil lines. Mr. Crisp referred to a curious case in which a forger wanted to add some words to a bond which had been originally written with very pale ink. The added words were darker, and he therefore retraced the whole of the original writing to make it look all alike, but examination with the microscope at once detected the forgery.—Dr. E. Crookshank read a paper on the cultivation of bacteria, which he illustrated by numerous drawings and by a series of preparations. He also exhibited and described a collection of apparatus of the latest and most approved construction for the cultivation of bacteria and the preparation of the media employed.—Mr. Robertson described a method of preparing a section of spinal cord by soaking in picrocarmine before cutting.—Mr. Meates's note on a new highly-refractive medium for mounting sulphide of arsenic was read.—Mr. Cheshire read a paper on the pulvillus of the bee, calling attention to a notch found upon the leg of the bee, and explaining what he considered to be its function as opposed to the explanations given by some other observers.—Mr. J. W. Groves exhibited some mounted sections cut by the large Barrett microtome to show how large good sections could be made with the machine.—Eleven new Fellows were elected and proposed.

Dublin

Royal Society, November 18.—Physical and Experimental Science Section.—Prof. W. F. Barrett in the chair.—On the beryls and iolite of Glencullen, co. Dublin, by J. Joly, B.E. The beryls of Glencullen, while presenting the angles and faces of normal beryl, are found, on microscopic examination, to consist of a mixture of beryl and orthoclase. The latter mineral amounts sometimes to 72 per cent. of the entire crystal. There is evidence that this phenomenon was produced by alteration, not by inter-crystallisation in the first instance. The orthoclase contains much iolite in sharp well-defined crystals. The beryls of the Dublin granite lose all colour when heated for a few days to a temperature of about 300° C. An hour's heating at 350° C. deprives them of colour. The bearing of this phenomenon on the history of the granite is pointed out by the author.—On the absolute weights of the chemical atoms, by G. J. Stoney, D.Sc., F.R.S.—On a new form of instrument for determining the magnitudes and colours of stars, by John Ballot; communicated by Howard Grubb, M.E., F.R.S. The apparatus consists of an arrangement attachable to the draw-tube of a telescope, by means of which an image of small illuminated apertures can be thrown into the field of the eye-piece and viewed by an observer at the same time as the image of the star formed by the objective. The light is supplied by a small incandescent Swan's light condensed by a reflector, and is passed through four sets of slides or revolving wheels, the first containing a wedge of neutral-tinted glass, the second a set of microscopic apertures of varying sizes, and the third and fourth sets of seven coloured glasses. By those four slides it is possible to regulate the size, colour, and intensity of the ghost-star, and thus form a standard by which the magnitude and colour of any star can be determined. The two coloured slides are supplied in order that secondary tints may be obtained by combination of any two primary colours. The accuracy of the instrument depends of course on the constancy of the lamp. This constancy can be obtained, within moderate limits, by proper electrical contrivances, but reference should occasionally be made to standard stars. Even though the source of light be not absolutely constant, it appears probable that a better result will be obtainable by such an apparatus than by any in which the constancy of sensitiveness of the human eye has to be depended upon from observation to observation.—Thomas Edmondson exhibited the new circular calculating-machine invented by Joseph Edmondson, Halifax.—Howard Grubb exhibited Wilson's new sunshine-recorder.

Natural Science Section.—Presidential Address to the Royal Geological Society of Ireland by Prof. J. P. O'Reilly, C.E., M.R.I.A., &c.—Note on *Halcampa chrysanthellum*, Peach, by Prof. A. C. Haddon. A full and critical note on this species, which is shown to embrace *H. vittata*, Kef., *H. bilateralis*, Kef., *H. kefersteini*, Andr., and *H. adresii*, Hadd.—On certain sense-organs occupying the perforations in the shell of the Brachiopoda, by Prof. Sollas, D.Sc., &c. The cæcal processes occupying the canals in the Brachiopod shell are extensions of the outer epithelium of the mantle. At the outer end, which lies immediately beneath the chitinous periostracum, each terminates in a large cell with a large nucleus and nucleolus, invested by other smaller cells. The large cell is continued into a nerve-fibril, which runs axially down the cæcal process, and enters the nervous layer of the mantle. This is the structure of a sensory end-organ, which in this case seems to transfer luminous radiations.—Additional note on *Macrozamia denisonii*, by Prof. W. R. McNab, M.D. This Cycad, known in gardens as *M. denisonii*, but which botanically is *M. perowskiana*, Miguel, has recently produced a fine female cone in the Royal Botanic Garden, Glasnavin, and was noticed at the June meeting of the Society. The cone was cut on September 1, and shows in a very beautiful manner the close series of small sterile scales which form the whole base of the sessile cone. Although the cone looked a terminal structure, it forms a lateral branch, and now (November) the young leaves are developing from the growing axis.—On New Zealand Coleoptera, by D. Sharp, M.B. No beetles from New Zealand were known to Linnæus, and up to 1867 about 150 species had been noted; now about 1500 species are known to the author, who estimates that the Coleoptera of New Zealand will probably number from 3000 to 3500. In the present paper a special scrutiny is made of the Pterostichini and Otiorhynchini. The Coleopterous fauna is analogous to that of Europe and other continental regions, but contains a large proportion of forms which are to be regarded as little evoluted. Cetoniadæ are wanting, and the Buprestidæ are represented by two minute and obscure forms. The Phytophaga, which, like the two preceding groups are remarkable for the brilliancy of their colouring, are few in number, small in size, and dull coloured. So also with the weevils. There are no Longicornes with tufted antennæ, and no horned Lamellicornes. The Coleopterous fauna is remarkable for the number of isolated forms which have little or no connection with the ordinary forms of the island. The Coleopterous fauna of New Zealand seems to have most affinity with that of Chili and Patagonia, and but little with the Australian fauna, many of the most characteristic Australian forms being wholly unrepresented in New Zealand.

Sydney

Royal Society of New South Wales, August 5.—Prof. Liversidge, F.R.S., President, in the chair.—The Rev. P. MacPherson, M.A., read a paper on some causes

of the decay of the Australian forests. Photographs of a tree near the Lane Cove Road, which measured about 25 feet in circumference at a height of 30 feet from the ground, were shown by Mr. H. C. Russell, B.A. He thought that such a rare relic of a past era in the forest-growths of Australia should not be lost, and moved that the Government be asked to reserve the ground on which it stands.

PARIS

Academy of Sciences, December 14.—M. Jurien de la Gravière, Vice-President, in the chair.—Movements of the molecules of the so-called "solitary wave" propagated on the surface waters of a canal (continued), by M. de Saint-Venant.—On a method of analysis applicable to the study of the hydrocarburet mixtures of the aromatic series, by MM. C. Friedel and J. M. Crafts. By the process here described all the four isomeric bodies answering to the formula C_8H_{10} (ethylbenzene and the three xylenes) become transformed to substances as easily separable as most bodies dealt with in mineral analysis. Not only is this effected without loss of matter, but the combinations when finally analysed are found to possess from five to seven times the weight of the hydrocarburet used in the analysis.—Remarks on the new specimens recently deposited in the Palæontological Department of the Museum, by M. Albert Gaudry. Amongst these is the entire skeleton of a fossil edentate (*Scelidotherium leptocephalum*) from the Buenos Ayres district, apparently a contemporary of the Megatherium and Glyptodon; also a remarkably well-preserved Mystriosaurus, and castings of a New Zealand Megalania, of a Russian Elasmotherium, and of some Dinoceras from the Rocky Mountains.—Claim of priority for the use of the sulphate of copper against brown rust vindicated for M. Benedict Prevost, by M. de Lacaze-Duthiers.—On a new theory of algebraic forms, by Prof. Sylvester.—On the propagation of the movement in an indefinite fluid (second part), by M. Hugoniot.—Remarks on the *Annuaire* for the year 1886, presented to the Academy on behalf of the Bureau des Longitudes, by M. Faye.—Remarks on MM. Faudel and Bleicher's "Materials for the Study of Prehistoric Alsace," presented by M. Hirn.—Observations of Fabry's comet and of Barnard's comet made at the Observatory of Algiers with the 0·50m. telescope, by M. Trépied.—Observations of Barnard's new comet made at the Paris Observatory equatorial of the West Tower), by M. G. Bigourdan.—Note on the construction of the large double-meridian circles, by M. Gruey.—On a new class of integrable linear differential equations, by M. Halphen.—On a new method of generating unicursal algebraic curves, by M. G. Fouret.—On the movement of a point in a plane and on imaginary time, by M. L. Lecornu.—On certain geometrical surfaces of the third order possessing an infinite number of umbilici, by M. A. de Saint-Germain.—On the construction of machines intended for the electric transmission of power in connection with the electric machines at present working between Creil and Paris, by M. Marcel Deprez.—An inquiry into the causes that have momentarily arrested the experiments on the transmission of power between Creil and Paris, by M. A. Sartiaux. The accident, the first recorded for over a month, was shown to be caused by defective isolation along the line of transport resulting from accidental communications with the earth, which may easily be avoided in future.—Note on the relations existing between the absorption of light and the emission of phosphorescence in compounds of uranium, by M. H. Becquerel. The molecular state of these compounds causes them to exercise on light an elective absorption of harmonic radiations, while some of them emit by phosphorescence inferior harmonic luminous radiations of the absorbed rays. The absorption seems due to vibratory motions caused by the influence of the incident radiations, and apparently synchronous with the absorbed rays.—Spectrum of the nitrogen bands: its origin, one illustration, by M. H. Deslandres. With the aid of M. Cornu's photographic apparatus, the author has determined beyond all doubt the origin of a whole group of these ultra-violet bands, which form the spectrum of a nitrogen and oxygen compound, so far confirming Angström's well-known view.—Note on the diffusion of heat, by M. Léon Godard.—A study of the hydrates of arsenic acid ($AsO_5,3HO$, and $AsO_5,2HO$), by M. A. Joly.—Researches on the formation of the vast deposits of nitrate of soda in certain parts of South America, by M. A. Müntz. This nitrate appears to be the result of a double decomposition between the nitrate of lime and marine salt. But it was not formed in the places it at present occupies, where it has been gradually concentrated under divers outward influences.—Fresh researches on the various compounds of proteine, by M. Paul Schutzenberger.—Note on the preparation of benzoylcyanacetic ether and of cyanacetophenone, by M. Haller.—On the accumulation of nitrogen in ground kept constantly under grass, by M. P. P. Dehérain.—Note on a microbe whose presence seems to be connected with the development of rabies, by M. H. Fol.—On the construction of the jaw-bones of vertebrate animals, by M. A. Lavocat.—On the development of the basin in the cetaceans, by M. H. P. Gervais.—On the development of the horny layer in the gizzard of poultry, and of the glands secreting it, by M. Maurice Cazin.—On the development of the tonsils in mammalians, by M. Retterer.—Researches on the comparative anatomy and physiology of the trigeminal, facial, and cephalic sympathetic nerves in birds, by M. Laffont.—Remarks on two species of Balanoglossus (*B. hacksi*, from Japan, and *B. talaboti*, from the district of Marseilles), by M. A. F. Marion.—On the skeleton of the extinct genus Scelidotherium, recently deposited in the Paris Natural History Museum, by M. P. Fischer.—On the action of chlorophyll on the carbonic acid outside the vegetable cell, by M. P. Regnard.—Note on the stratigraphic structure of the Menez Hills, Brittany, by M. Charles Barrois.—A chemical study of the substances brought up during the soundings of the *Travailleur* and *Talisman* Expeditions: constant presence of copper and zinc in these deposits, by M. Dieulafait.—On the non-nitrous or slightly nitrous diet usually recommended in the case of diabetes, by M. Boucheron.—Note on some fresh documents advanced to support the theory of a cosmic origin of the late crepuscular glows, by M. José J. Landerer.

CONTENTS