because side by side with the teaching of science there is the teaching of the "humanities." The remarks conclude with a statement of the amount allotted from the public funds to university colleges. Out of the sum available under the Local Taxation Act about £600,000 a year is devoted to technical education, but only £23,854 was given to fourteen university colleges in England and Wales in 1892-3 by twenty local authorities, in addition to a sum of £29,550 provided by the Treasury, of which nearly half (£13,306) went to the three Welsh colleges alone. The support certainly seems insufficient for the great services rendered by the colleges to the nation.

THE third Report of Mr. J. A. Bennion, the Director of Technical Instruction in the County Palatine of Lancaster, was presented to the County Council a few days ago. It is clear from the report that every effort is being made by the Committee to expend judiciously the funds at their disposal. A sum of £28,500 was distributed among the urban and rural districts of the county last year. The following amounts were voted for work in special subjects:—Navigation, £250; Sea Fisheries, £300; University Extension Lectures, £500; Horology, £250; Mining, £500; Silk Industry, £500; Plumbing and Sanitary Science, £750; Horticulture and Bee-keeping, £500; Practical Agriculture (including Veterinary Science, Poultry-keeping, and allied subjects), £1000. In addition to the ordinary sums allotted to each district, special grants, amounting to nearly £1000, were made for the purpose of purchasing apparatus and appliances. University College, Liverpool, and the Owens College, Manchester, each received a grant of £400 for the same purpose. Classes in horology are held at Prescot, but they are quite inadequate for the whole county; and do not impart the thorough teaching, either theoretical or practical, that is given on the continent. A deputation from the Committee visited some of the Continental Schools of Horology, and as a result of their inspection they strongly recommended the establishment of a County School of Horology, similar to the school at Geneva. It was afterwards resolved at a large and representative conference that "it is desirable to establish a Technical School of Horology and Scientific Instrument-making, including electrical, optical, and mechanical instruments, both practical and theoretical, for the County of Lancaster." Efforts are now being made to put this resolution into effect. The establishment of a school to afford effective teaching in subjects relating to the silk industry is also under consideration. It is proposed to found the school upon the model of the Seidenweb Schule of Wipkingen, in Zürich. For the purpose of providing instruction in practical agriculture, a farm and farm buildings, covering nearly 150 acres, has been acquired at Hulton, near Preston. A vote of £650 was made to the Harris Institute for special courses to agricultural students; and a number of lectures on subjects relating to agriculture were delivered in various parts of the county, while agricultural experiments were carried on in several districts.

SCIENTIFIC SERIALS.

Wiedemann's Annalen der Physik und Chemie, No. 7.—Absorption spectrum of pure water for red and infra-red rays, by E. Aschkinass. The "extinction coefficients" of water for the various wave-lengths at the red end of the spectrum were determined by the bolometer, and calculated by the formula

$$J' = Je^{-\epsilon d},$$

where J is the intensity of the incident, and J' that of the transmitted light, d the thickness of the layer in *cm*, e the basis of the Napierian logarithms, and ϵ the "extinction coefficient," which therefore means the reciprocal of the thickness which a ray must traverse in order to be reduced to $1/e$ of its original intensity. Of these extinction coefficients 200 are given, for wave-lengths extending from 0·4500 μ to 8·49 μ. The minimum is at $\lambda = 0{\cdot}5375$, being 0·00005, and the maximum of 2733 is attained at $\lambda = 3{\cdot}02$ μ. A second maximum occurs at 6·09 μ, but between 6·7 and 8·5 the values of the extinction coefficients vary only between 700 and 900.—Absorption of radiant heat by liquids, by Charles Friedel. The liquids investigated were carbon compounds contained in cells between an iron block and a thermopile. Among the results obtained are the following:—Whenever, in a chemical compound, H, O, HO, or N are replaced by S or halogens, the transmittance of the solution is considerably increased. In homologous series the transmittance is regularly changed by every addition of CH_2, but the direction of this change depends upon the nature of the other atoms contained in the molecule. The absorptive power of a compound does not essentially depend upon the size of the molecule, but seems to be a property of the constituent atoms. The greatest influence is always due to H, N, and also O. In isomeric compounds the diathermancy is different, and the difference is not only connected with the difference of atomic volume of the elementary atoms, but also with the difference of linkage of the atoms amongst each other; in saturated compounds the diathermancy (transmittance) always increases with the atomic volume. The determination of the diathermancy is the most delicate test available for the purity of organic liquids or salts which are soluble in highly diathermanous liquids.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Horticultural Society, June 25.—Mr. McLachlan in the chair.—Mr. Wilson exhibited a pot containing some seedling plants, in blossom, of the North British species *Primula scotica*, which is found in pastures of Orkney, Caithness, and Sutherland. The flowers are homomorphic, not having the stamens and pistils of different lengths as in most other Primulas.—Mr. Jackman exhibited small trees of *Fagus sylvatica*, with the leaves small, entire, and round. As the trees exhibited an erect form, with short branches, it would seem to be the result of some check to growth, the form of the leaf representing a less developed state than that of the ordinary type of tree.—Mr. Colinette, of Guernsey, forwarded some hazel wood found in peat near the coast of Guernsey, containing flint implements, stone rings, and pottery, presumably neolithic. No hazel is now known to be indigenous to Guernsey.—Mr. McLachlan exhibited specimens of *Melanostoma scalare* attached to flowering stems of a grass, *Glyceria fluitans*.

July 23.—Dr. M. T. Masters described a curious case of *Cypripedium* malformed, received from Messrs. Sander and Co., in which the sepals were normal, but the two petals and lip were absent.—Dr. Masters also drew attention to a peculiarity in the venation of the lobed leaves of *Lavandula dentata*.—Dr. Ch. B. Plowright forwarded specimens of the parasitical fungus *Æcidium nymphæoidis*, with the following observations:—"This Æcidium has been stated by Chodat to be connected with the Puccinia on *Scirpus lacustris*. In November 1877, *Puccinia scirpi* was found floating in the river Ouse at King's Lynn. During the past winter I found it on the bulrushes (*S. lacustris*) in the 'Old Bedford' at Earith, Huntingdonshire. On revisiting the spot this July the Æcidium on Villarsia was met with in great abundance." Dr. Plowright also sent specimens of the fungus *Æcidium chenopodii*, with some remarks upon them.—With reference to the specimens of flies attacked by a fungus, brought before the last meeting by Mr. McLachlan, it was reported from an examination made at Kew that "the fungus is *Empusa conglomerata*, Thaxter (a somewhat rare species), parasitic on Diptera, especially the larvæ and imagines of Tipulæ. Distrib.—Europe and United States. This is the first record for Britain."—MM. Letellier et Fils forwarded from Caen some growing plants of thornless gooseberry, from which they have issued four kinds, raised by M. Ed. Lefort, of Meaux, France. The usual triple spines were either quite absent, or represented by mere rudiments only.—Mr. Cannell sent some trusses, with small jagged-edged petals of a crimson colour, approximating the original wild form. They appeared among his long-selected beds of sweet williams, the margins of the petals being rounded and smooth.

PARIS.

Academy of Sciences, August 5.—M. Marey in the chair.—Experimental study of the transverse vibrations of cords, by M. A. Cornu. The complex vibrations of strings produced as in actual musical instruments have been studied. The transverse vibrations of a string, excited in any way whatever, are always accompanied by torsional vibrations, the torsional elasticity of the cord taking effect in the same way as the transverse component of the tension. Not only is the actual vibration complicated by these torsional vibrations, but, in many cases, the transverse vibrations are themselves rendered more complex by the fact that strings are seldom or never symmetrical about their axes. The vibrations have been studied by means of very

light mirrors attached preferably to the portion of the string near one of its points of attachment or a node. Light figures similar to Lissajous' figures have been obtained. With the mirror attached parallel to the axis, all the components of the vibration are effective; when its plane is perpendicular to the axis, the torsional vibrations are eliminated.—Some considerations on the construction of great dams, by M. Maurice Lévy.—The international committee on glaciers. A note by M. F. A. Forel. From the observed facts it is deduced that the general behaviour of glaciers is individual and special to themselves. There are some traits, however, which appear in certain cases in connection with the whole of the glaciers of a country. The duration of the oscillations of glaciers is measured in years by tens, the mean being at least thirty or forty years. The same variations are met with in other glacier regions as well as in the Alps. The committee ask the co-operation of scientific observers to ascertain whether there is coincidence, alternation, or lack of agreement in glacial variations: (*a*) In the different glaciers of the same continent; (*b*) in the glaciers occurring in the same hemisphere; (*c*) in the glaciers of all parts of the earth. —On the Brownian movement, by M. C. Maltézos. The conclusion is drawn that the Brownian movement is a capillary phenomenon.—Lighting by luminescence, by M. A. Witz. Lighting by means of a vacuum tube in circuit with a Holtz machine or Ruhmkorff coil is proved to give a smaller proportion of heat in relation to the quantity of light developed than any other means of obtaining light, yet the light so obtained requires the expenditure of much more energy per candle-power than ordinary sources, and hence the disposition of apparatus will require to be very much modified before light can be produced commercially at a low temperature.—On the nuclei of the Uredinieæ, by MM. G. Poirault and Raciborski.—On diphtheritic anti-toxin, by MM. Guérin and Macé. The active substance appears to be of the same nature as the soluble ferments classed under the name "diastase."—On a toxic substance extracted from the suprarenal capsules, by M. D. Gourfein.—Instantaneous hyperglobulia, by peripheric stimulation; consequences, by M. Jules Chéron. Hypodermic injection of artificial serum or stimulating actions on the sensitive skin surface (such as a cold douche, massage, &c.) cause an immediate loss of the anæmic symptoms in patients suffering from anæmia. The result is probably produced by a stimulation of the central nervous system, followed by a bracing up of the vascular system as evidenced by the increase in arterial pressure. The apparent increase in the numbers of red corpuscles is caused by the greater extravasation of serum brought about under the greater pressure.

NEW ZEALAND.

Philosophical Institute of Canterbury, May 1.—Mr. C. W. Purnell, on "true instincts of animals." The definition of the term "instinct" has been greatly narrowed of late years. Formerly every act of an animal betokening intelligence was ascribed to "instinct," but the term is now restricted to acts which are performed in an apparently mechanical manner by generation after generation, and seem to be prompted by some other faculty than intelligence. The author thought that the definition could be still further restricted. Writers upon the subject had not taken sufficiently into account how much the young animal might be taught by the old, and how much it might learn from imitation. The migratory habits of certain birds, for example, were always set down to instinct, but birds usually migrated in flocks, and, in any case, with the young bird it was "follow my leader." The same remark applied to the periodical migrations of the Norwegian lemming, the salmon, and other animals. The nest-building habits of birds could be similarly explained; and even such extraordinary habits as that of the Australian Megapodidæ, which formed immense mounds of vegetable and other matter, and deposited their eggs in the midst, leaving them to be hatched by the heat evolved from the fermentation of the decaying mass. The beaver's remarkable habit of constructing dams and canals, some of which are of great antiquity, and which, if constructed by human beings, would be deemed proofs of considerable engineering skill, illustrated the author's argument. The young beaver remained in the parental lodge until the summer of its third year, when it began housekeeping for itself, so that it had abundant opportunity, during its youth, of receiving instruction from its elders, in the peculiar ways of beaverdom, and when it did make a start in life upon its own account, it still enjoyed opportunities of receiving instruction and of gaining skill by experience. Cats, dogs, and monkeys instructed and corrected their young; and the adult carnivora taught their offspring how to capture and kill their prey. Some of the most remarkable so-called instincts displayed by animals could be accounted for in the same way, and when we came to analyse these instincts, we found them to be nothing more nor less than racial habits, transmitted from generation to generation, and acquired in a similar way to that in which the racial habits of mankind are acquired. Mr. Purnell then referred to the singular instinct of the huanaco, which, in the southern part of Patagonia, resorted to ancient dying places, whither all individuals inhabiting the surrounding plains repaired at the approach of death. Mr. Hudson, author of "The Naturalist in La Plata," attributes this practice to the possession by the huanaco of "a fixed immutable instinct, a hereditary knowledge, so that the young huanaco, untaught by the adults," goes alone and unerringly to the dying place. Mr. Purnell considered this an unwarranted assumption, and that it was a far more likely supposition that, if a young huanaco was *in extremis*, the older members of the herd expelled it from their ranks, as other sick or wounded animals are usually expelled by their fellows, and indicated to it whither it should go. Traditional and tribal memories, perpetuated by communication from old to young, would account for such habits as the hive-constructing habits of the bee and the domestic and military habits of the various species of ants, which were so commonly regarded as typical of the more wonderful development of instinct in the lower animals. The fact that many so-called instinctive acts were really the products of education and experience, did not clash with the view that animals might be and probably were born into the world with a hereditary predisposition to certain tribal habits which rendered instruction in those habits easier and more effective. The mental, like the bodily, structure of any individual animal was the sum and outcome of all its progenitors' faculties, and just as its bodily organisation was better fitted to perform certain acts than others, so its mental organisation was better fitted for certain mental operations than others. Body and mind were correlated and developed in unison. The web-building spiders secreted web-building material in their bodies, and possessed highly specialised organs enabling them to produce the material in such manner and quantity that it can be used in the construction of snares, and just as this specialised anatomical structure has gradually been evolved from simple beginnings, so the mental faculty required for the construction of snares has been evolved with it. The spider is, so to speak, endowed with mental as well as with anatomical spinnerets. If we eliminated all such habits as might have been acquired from teaching or observation, there were left comparatively few fixed habits of animals which, in the present state of our knowledge, could not be accounted for by the individual having received instructior from its fellows, or gained knowledge from its own observation, and it was to such habits that the author proposed to confine the term "instinct." For the purposes of this paper, he would call them "true instincts." These true instincts were found almost solely amongst insects. By way of illustration, he would take the case of the caterpillar of a butterfly (*Thekla*), which fed within the pomegranate, but when full-grown gnawed its way out, and then proceeded to attach with silk threads the point of the fruit to the branch of the tree, so that the fruit could not fall before the metamorphoses of the insect was complete. Here, there was apparently no means by which the caterpillar could receive instruction, since no visible intercourse took place between the butterfly whose offspring the caterpillar was and the caterpillar. In considering this problem, we must firmly grasp the fact that, although the caterpillar, the pupa, and the imago were, to outward seeming, three distinct animals. in reality they were but varying phases of the same animal. Therefore the insect possessed the power of inheriting memories We could understand how the memory of an inherited habit useful and common to one phase of the animal's existence, might readily be transmitted from the perfect insect to its offspring through the various stages of that offspring's existence. The order in which these memories were transmitted would be the order in which they would manifest themselves in the new life cycle. Did, then, the Thekla possess the power of transmitting the habit referred to? It appeared not unreasonable to suppose that such a habit might become (metaphorically speaking) so ingrained in the mental constitution of the animal as to be capable of transmission from parent to offspring. The life of an insect was short and monotonous, and its range of locomotion limited; its world was a small world; it enjoyed little scope for

variation of habit, and its ways of life consequently tended to become stereotyped upon its mental system, and so transmitted from generation to generation. As the mental nature of the animal grew more complex, instincts became more rare, because the animal exercised more choice in its actions. The fact that the nervous system of the Invertebrata was materially different from that of the Vertebrata, was full of significance in this connection. Amongst true instincts he would class such acts of protective mimicry as those performed by the Phasmidæ; although their alleged practice of shamming death might possibly be constitutional lethargy, which had misled observers. The fear which young animals, including children, usually manifested towards what was really dangerous to them, might also be classed amongst true instincts; although recent experiments by Prof. Lloyd Morgan proved that the fear was not universal. Mr. Purnell next discussed Spalding's experiments with newly-born chickens, ducks, pigs, &c., which went to show that the young of these animals were capable of performing many acts, apparently intelligent, without instruction. It must be borne in mind that the young fowl, duck, or pig came into the world with its intelligence pretty fully developed, although it grew wiser as it grew older, and all the acts mentioned by Spalding were intelligent acts, not acts performed in an unvarying fashion, but acts varying with surrounding circumstances. He therefore concluded that these acts could not be attributed to instinct, but were directed by intelligence. What he had denominated "true instincts" suggested an analogy with reflex actions, but the analogy was fallacious. Singleness was of the very essence of a reflex action. The action might be complex in its manifestation, but it was essentially one act, of which active consciousness and reflex action were contradictory terms. A true instinct commonly involved a sequence of acts, directed towards a definite end, while the acts were consciously performed.

NEW SOUTH WALES.

Linnean Society, June 26.—Prof. T. W. E. David, Vice-President, in the chair.—(*a*) Notes on the Omeo Blacks; (*b*) on the Monaro Blacks, with a description of some of their stone implements; (*c*) a native burial-place, near Cobbin, Monaro, by R. Helms.—Descriptions of some new *Araneidæ* of New South Wales (No. 5), by W. J. Rainbow. Three new species of orb-weavers of the genus *Nephila* from New England and Sydney were described. The fact was recorded of a young bird (probably *Estrilda temporalis*) having been caught in a web of *N. ventricosa* in the vicinity of Sydney; also that Mr. A. J. Thorpe, of the Australian Museum, had seen an emu wren (*Stipiturus malachurus*) entangled in the web of one of the *Nephilæ* at Madden's, near Belle Plains (N.S.W.); also at Cape York, several of the blue warblers, notably *Malurus brownii* (Vig. et Hors.) and *M. amabilis* (Gould). It was pointed out that it is only young birds and those of weak wing-power that are arrested by such webs; and doubt was expressed as to the correctness of the assertion of some writers that birds so caught are devoured by the spiders. The author also pointed out that each web is placed in position by the unerring instincts of the spider, simply because the situation is such as will assure abundance of food in the shape of insects, and that it is merely an accident when a bird becomes entangled in the toil. The paper concluded with a description of the mode of coition in the *Nephilæ*, and a list of the previously described Australian species of the genus.—On the methods of fertilisation in the *Goodeniaceæ* (part ii.), by Alex. G. Hamilton. Eleven species of *Dampiera* were treated. Of these four are usually cross-fertilised by the aid of insects, but in the remaining seven while cross-fertilsation is possible by insect aid, yet self-fertilisation must occur more commonly.—On a new fossil mammal allied to *Hypsiprymnus*, but resembling in some points the *Plagiaulacidæ*, by Robert Broom. The remains described under the name of *Burramys parvus* are those of a small marsupial not larger than an ordinary mouse. The form is specially interesting in having but three true molars in each jaw; and a very large grooved premolar with serrate edge very similar to that found in the Eocene genus *Neoplagiaulax*. Its affinities were dealt with at some length, and an endeavour was made to trace its relationship phylogenetically.—On some new or hitherto little-known land shells from New Guinea or adjacent islands, by C. F. Ancey. Three new Papuan species, viz. *Hemiplecta granigera*, *Papuina tuomensis*, and *Pupina beddomei*, were described, and other known land shells from German New Guinea were discussed.—Plants of New South Wales illustrated. No. viii. *Acacia lanigera*, A. Cunn., by R. T. Baker. This is by no means a rare plant in New South Wales, and yet of the several descriptions that have been published from time to time, not one is sufficient in detail to accurately determine the species; in the specimens described in the Flora Australiensis the pod was incorrectly matched. The author gave the results of an examination of perfect material from many localities, and his paper should prove of assistance in the future in the elucidation of cognate species which at present are not easy of determination.—Description of a new species of *Acacia* from New South Wales, by J. H. Maiden and R. T. Baker.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten*, Part 2 for 1895, contains the following memoirs of scientific interest:—

February 9.—W. Voigt: Some applications of the thermodynamic potential. Franz Meyer: On the structure of discriminants and resultants of binary forms (second note).

February 23.—E. Ritter: On the representation of groups of functions by means of one base.

March 9.—J. Orth: On mucous tissue and myxomata, with special reference to the hydatidiform mole.

March 23.—A. von Koenen: On the relation of river-valleys to erosion and to the deposit of diluvial and alluvial formations. O. Mügge: On the plasticity of ice-crystals.

May 11.—O. Wallach: Researches from the University Laboratory of Göttingen. (1) On a method of preparing ketones; (2) on derivatives of piperonal (heliotropin); (3) the oxidation-products of terpinol; (4) the reduction-products of carbon. R. Dedekind: On an extension of the symbol (a, b) in the theory of moduli. E. Netto: On the structure of the resultants of binary forms.

BOOKS, PAMPHLET, and SERIALS RECEIVED.

BOOKS.—Traité de Mécanique Générale: H. Resal, Deux. Edtn. Tome 1 and 2 (Paris, Gauthier-Villars).—L'Arithmétique Amusante: E. Lucas (Paris, Gauthier-Villars).—Traité D'Arithmétique: C. A. Laisant et E. Lemoine (Paris, Gauthier-Villars).—Philip's Handy-Volume Atlas of the World: E. G. Ravenstein (Philip).—Philip's Systematic Atlas, School Edition: E. G. Ravenstein (Philip).—A Glossary of Greek Birds: Prof. D. W. Thompson (Oxford, Clarendon Press).—Descriptive Catalogue of the Spiders of Burma preserved in the British Museum: T. Thorell (London).

PAMPHLET.—Baby Buds: E. Ethelmer (Congleton, Mrs. W. Elmy).

SERIALS.—Engineering Magazine, August (Tucker).—Journal of the Anthropological Institute, August (K. Paul).—Strand Magazine, August (Newnes).—Himmel und Erde, August (Berlin, Paetel).—Sitzungsberichte der Physikalisch-Medicinischen Societät in Erlangen, 26 Heft, 1894 (Erlangen).—Journal of the Franklin Institute, August (Philadelphia).—American Journal of Science, August (New Haven).—American Naturalist, August (Philadelphia).

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