a series of experiments on a tree-shrew, *Tupaia ferruginea*, and on a bull-frog, *Rana tigrina*, but the results do not appear to be very conclusive.

DR. L. MESHCINELLI, of Vicenza, has issued a prospectus of a proposed Iconograph of all Fossil Fungi at present known. It will be published, probably in the earlier half of the present year, in the form of a quarto volume, with an atlas of more than thirty plates. The price to subscribers will be 30 francs, delivered free.

IN a paper in *Natural Science* for August 1897, Mr. G. W. Bulman adopts very much the view of Prof. Plateau, that bees are not primarily attracted to flowers by their conspicuous colour, especially that they have no special partiality for blue. He also contests the statement that either honey-bees or wild bees are constant in their visits to the same species. Somewhat similar results appear to have been arrived at by Mr. Albert Gale from observations in Australia, of the record of which we find a commencement in the *Agricultural Gazette of New South Wales* for November 1897.

IN our recent review of the "Vita Medica" of the late Sir B. W. Richardson, the author's part in emphasising the distinction between "enteric and typhoid (*sic*) fevers" was alluded to (p. 265). Our readers perceived at once, no doubt, that the name "typhoid" had crept into the text in place of typhus.

UNDER the title of *The Home University*, the publication of a magazine and note-book for private students of various branches of knowledge has just been commenced. The idea of the editors of the new periodical is to give the home-student assistance on difficult points, and furnish him with aids to memory. "We shall assume," it is added, "that, in addition to a knowledge of their own language, our readers possess the rudiments of French, Latin, German, and Greek, and that respecting Geography, History, Poetry, and the Natural Sciences they have made some kind of a beginning." The editors purpose not so much to try to increase knowledge as to convey it, and we wish them success in their undertaking, notwithstanding the fact that science takes a minor place in the first number of their educational medium. The periodical is published by the Educational Museum, Haslemere, and by Messrs. West, Newman, and Co.

THE additions to the Zoological Society's Gardens during the past week include a Red Fox (*Canis fulvus*) from North America, presented by Mr. F. C. Ingram; four Virginian Opossums (*Didelphys virginiana*) from North America, presented by Mr. J. D. Sprunt; two Secretary Vultures (*Serpentarius reptilivorus*) from South Africa, presented by Mr. J. E. Matcham; a Laughing Kingfisher (*Dacelo gigantea*), a Lace Monitor (*Varanus varius*), a Blue-tongued Lizard (*Tiliqua scincoides*), two Stump-tailed Lizards (*Trachydosurus rugosus*) from Australia, presented by Mr. J. D. Waley; a Leopard (*Felis pardus*) from Ceylon, a Derbian Wallaby (*Macropus derbianus*) from Australia, deposited; two Uvæan Parrakeets (*Nymphicus uvæensis*) from the island of Uvea, Loyalty Group; two Black-headed Caiques (*Caica melanocephala*) from Demerara, an Ashy-black Ape (*Macacus ocreatus*) from the East Indies, three Curlews (*Numenius arquata*), three Oyster-catchers (*Hæmatopus ostralegus*) from Holland, purchased.

OUR ASTRONOMICAL COLUMN.

THE SOLAR ECLIPSE.—Mr. F. W. Dyson, the Chief Assistant at the Greenwich Observatory, has sent the following letter to the press:—"Prof. Turner telegraphs from Bombay that the observations of the solar eclipse were very successful. The photographs taken by the Astronomer Royal, Prof. Turner, Captain Hills, Mr. Newall, and Dr. Copeland, have all been developed, and the results are excellent. Captain Hills has succeeded in photographing the spectrum of the reversing layer, and Prof. Turner has obtained marked results as to the amount of polarisation of the corona."

LARGE AND SMALL PROPER MOTIONS.—In the *Astronomische Nachrichten* (No. 3466) Prof. Kapteyn announces the discovery of a star with an exceedingly large proper motion; this is the star in the Cordoba Zone Catalogue 5·243h., of about the 8th magnitude, but probably slightly variable, and having an orange-yellow colour. Its position from the "Cape" observations of 1897·8 for epoch 1875 is $\alpha = 5\text{h. } 6\text{m. } 56\cdot0\text{s.}$, and $\delta = -44^\circ\ 60'\cdot530$, which position is in the constellation of Pictor. The result of the investigations of Mr. Innes, of the Cape Observatory, and Prof. Kapteyn, gives the proper motion in a great circle as $8''\cdot7$, or in R.A., + 0·621s., and Decl. $-5''\cdot70$, which will be seen is even greater than that of the "runaway" star 1830 Groombridge, the proper motion of which, it will be remembered, is $7''\cdot05$ in a great circle, or in R.A. + 0·346s., and Decl. $-5''\cdot78$. We shall await with interest the determination of the parallax of this remarkable star, in order to discriminate whether its large proper motion is real or chiefly due to its close proximity to our system.

In contrast with the above, Mr. J. G. Porter has re-computed the proper motion of the star Bradley $2444^a = 3250$, availing himself of a much longer series of observations than those from which Dr. Auwers deduced the values +0·0040s. and $+0''\cdot128$; and while Mr. Porter's result of + 0·0024s. and $-0''\cdot030$ (as given in the *Astronomical Journal*, No. 422) confirms the small motion in right ascension, it negatives entirely the motion in declination; he therefore suggests that Dr. Auwers' result seems to have been due to a wrong reduction of the declinations of D'Agelet and Lalande.

THE COMET OF 1892 II.—It is not often that an opportunity occurs of basing the determination of a comet orbit on observations extending over so long a period as that available in the present instance. The series commenced in 1892, March 19, and ended 1893, January 12, during which period the comet passed over about 107° of true anomaly. The definitive orbit in this case proves to be hyperbolic, and the final result is entitled to considerable weight. The only unsatisfactory feature about it is the amount of the residuals in some of the normal places. Dr. L. Steiner, of O'Gyalla, who has made the calculations, bases them on Dr. Schorr's elements, from which he derives by comparison with his computed ephemeris, twelve normal places, necessarily varying considerably in point of accuracy. The solution of the equations of condition founded on these normal places gives for the excentricity the value 1·0004404. The residuals to which we have referred as not being quite satisfactory do not occur at the end of the series, when the comet would necessarily be faintest and the observations scarcest, but in the middle of the series, practically from June to October. This is to some extent perhaps to be explained by the fact, that the comet was about that time very faint in telescopes of moderate size, and these observations, made with difficulty, may have had an injurious effect on those derived from the use of larger instruments. This explanation is not entirely satisfactory, for in one instance the normal place rests entirely on the measures made at one Observatory, that of Bordeaux. Dr. Steiner tries by alterations of the assigned "weights" to reduce these residuals, but the result is not quite satisfactory. Under the best circumstances, and when the excentricity is brought down to 1·000345, the sum of the squares of the residuals in the hyperbola is $103''\cdot2$, while on the assumption of parabolic motion the same sum is $279''\cdot5$. The orbit is almost perpendicular to the plane of the ecliptic.

WINNECKE'S COMET = *a* 1898.—From further observations made by Prof. Perrine at the Lick Observatory a new ephemeris of this comet has been determined; this, together with the elements, are given in the *Astronomical Journal* (No. 424) as follows:—

Elements.

T = 1898 March 20·392 G.M.T.

$\omega = 173^\circ\ 21'\ 10''\cdot0$
$\Omega = 100\ 51\ 45\cdot5$ } 1898·0
$i = 16\ 59\ 34\cdot0$

log *e* = 9·854161
log *a* = 0·510521

Ephemeris for Greenwich Midnight.

1898.	App. α	App. δ	log Δ
	h. m. s.	° ′ ″	
Feb. 1·5 ...	17 25 1·63 ...	−10 53 56·4	
3·5 ...	34 33·95 ...	11 17 21·0 ...	0·1527
5·5 ...	44 14·66 ...	11 39 50·2	
7·5 ...	17 54 3·34 ...	−12 1 18·5 ...	0·1457

The nearest bright star to the comet during this period is ρ Serpentis, which rises about four hours in advance of the sun.

ROWLAND'S TABLES.—In the December number of the *Astrophysical Journal*, tables of *corrections* and *additions* to Prof. H. A. Rowland's table of solar spectrum wave-lengths are given. The errors in wave-length have been carefully determined for the whole table, but the identification of solar lines with the lines of the elements in the spectrum of the electric arc has been revised only from wave-length 3722 to 4175. Therefore the corrections and additions to the identifications have been given only for the most important lines between these limits. A few small solar lines have been added to the table.

The changes in wave-length are few, most of them being additions to the identifications.

NEBULÆ NEAR CASTOR.—Prof. Barnard records in the *Astronomical Journal* (No. 422) a list of new nebulæ which he found with the 12-inch equatorial when he first went to Mount Hamilton, and which have remained unpublished until now. There are five within less than a degree of Castor, whose positions here given are reduced to 1860·0—the epoch of Dreyer's New General Catalogue.

No.	α	δ	Description.
	h. m. s.	° ′	
1 ...	7 24 23 ...	+31 44·4 ...	Close p. 10 mag. star.
2 ...	7 24 43 ...	+31 35·5 ...	Small, faint.
3 ...	7 25 12 ...	+31 40·5 ...	Small, 3 S ∗s in curve 2′ p. ±
4 ...	7 25 27 ...	+31 40·5 ...	Very, very faint.
5 ...	7 25 59 ...	+31 31·0 ...	Small, faint.

Prof. Barnard remarks that he has discovered several nests of these nebulæ, but in most other cases the individual nebulæ are very much smaller.

DR. KARL NECKER.—The name of yet another astronomer has to be added to the death roll of last year. Dr. Karl Necker, who occupied the position of assistant in various observatories, was unfortunately killed in a railway accident at Cairo, to which town he had removed for the benefit of his health. Born in 1867, and with his University career only completed in 1893, he entered first the Strassburg Observatory as a temporary assistant, but after a few months removed to Vienna, and in the Küffner Observatory devoted himself to making a series of observations on the prime vertical. When Dr. Halm left Strassburg to occupy his present position at Edinburgh, Dr. Necker returned to fill the vacancy thus created, and was engaged in the fundamental meridian work. But his health compelled him to take long rests, and finally he was recommended to reside in Cairo, where he hoped to secure a position in the Khedival Observatory. This hope was defeated by his tragic death, while making a short excursion to the Sinai Peninsula.

INSTINCT AND INTELLIGENCE IN ANIMALS.[1]

BIOLOGY is a science not only of the dead but of the living The behaviour of animals, not less than their form and structure, demands our careful study. Both are dependent on that heredity which is a distinguishing characteristic of the organic world. And in each case heredity has a double part to play. It provides much that is relatively fixed and stereotyped; but it provides also a certain amount of plasticity or ability to conform to the modifying conditions of the environment. Instinctive behaviour belongs to the former category; intelligent behaviour to the latter. When a caterpillar spins its silken cocoon, unaided, untaught, and without the guidance of previous experience; or when a newly-mated bird builds her nest and undertakes the patient labours of incubation before experience can have begotten anticipations of the coming brood; we say that the behaviour is instinctive. But when an animal learns the lessons of life, and modifies its procedure in accordance with the results of its individual experience, we no longer use the term instinctive, but intelligent. Instinct, therefore, comprises those phases of active life which exhibit such hereditary definiteness as fits the several members of a species to meet certain oft-recurring or vitally-important needs. To intelligence belong those more varied modes of procedure which an animal adopts in adaptation to the peculiar circumstances of its individual existence. Instinctive acts take their place in the class of what are now generally known as congenital characters; intelligent acts in the class of acquired characters.

But the study of instinct and intelligence in animals opens up problems in a different field of scientific investigation. They fall within the sphere not only of biological but also of psychological inquiry. And in any adequate treatment of their nature and origin we must endeavour to combine the results reached by different methods of research in one harmonious doctrine. This involves difficulties both practical and theoretical. For those invertebrates, such as the insects, which to the naturalist present such admirable examples of instinctive behaviour, are animals concerning whose mental processes the cautious psychologist is least disposed to express a definite opinion. While the higher mammalia, with whose psychology we can deal with greater confidence, exhibit less typical instincts, are more subject to the disturbing influence of imitation, and, from the greater complexity of their behaviour, present increased difficulties to the investigator who desires carefully to distinguish what is congenital from what is acquired.

Nor do the difficulties end here. For the term "instinct" is commonly, and not without reason, employed by psychologists with a somewhat different significance, and in a wider sense than is necessary or even desirable in biology. The naturalist is concerned only with those types of behaviour which lie open to his study by the methods of direct observation. He distinguishes the racial adaptation which is due to congenital definiteness, from that individual accommodation to circumstances, which is an acquired character. But for the psychologist instinct and intelligence comprise also the antecedent conditions in and through which these two types of animal activity arise. The one type includes the conscious impulse which in part determines an instinctive response; the other includes the choice and control which characterise an intelligent act. When a spider spins its silken web, or a stickleback builds the nest in which his mate may lay her eggs, the naturalist describes the process and seeks its origin in the history of the race; but the psychologist inquires also by what impulse the individual is prompted to the performance. And when racial and instinctive behaviour is modified in accordance with the demands of special circumstances, the naturalist observes the change and discusses whether such modifications are hereditary; but the psychologist inquires also the conditions under which experience guides the modification along specially adaptive lines. Each has his part to play in the complete interpretation of the facts. And each should consent to such definitions as may lead to an interpretation which is harmonious in its results.

In view, therefore, of the special difficulties attendant on a combined biological and psychological treatment of the problems of animal behaviour, I have devoted my attention especially to some members of the group of birds in the early days of their life. And I shall therefore draw my examples of instinct and intelligence almost entirely from this class of animals. The organisation and the sensory endowments of birds are not so divergent from those of man, with whose psychology alone we are adequately conversant, as to render cautious conclusions as to their mental states altogether untrustworthy; when hatched in an incubator they are removed from that parental influence which makes the study of the behaviour of mammals more difficult; while the highly developed condition in which many of them first see the light of day affords opportunity for observing congenital modes of procedure under more favourable circumstances than are presented by any other vertebrate animals. Even with these specially selected subjects for investigation, however, it is only by a sympathetic study and a careful analysis of their behaviour that what is congenital can be distinguished from what is acquired. For from the early hours of their free and active life, the influence of the lessons taught by experience makes itself felt. Their actions are the joint product of instinct and intelligence, the congenital modes of behaviour being liable to continual modification in adaptation to special circumstances.

[1] A Friday evening discourse delivered at the Royal Institution, on January 28, by Prof. C. Lloyd Morgan.