griseus), European, an Antarctic Skua (*Stercorarius antarcticus*) from the Antarctic Seas, presented by the Hon. Walter Rothschild; two Senegal Touracous (*Corythaix persa*) from West Africa, presented by Mr. I. J. Roberts; three Blackcaps (*Sylvia atricappilla*), a Nightingale (*Daulias luscinia*), British, presented by Mr. Poynter; a Wall Lizard (*Lacerta muralis*) from Sicily, presented by Mr. A. M. Amster; a Dwarf Chameleon (*Chamæleon pumilus*) from South Africa, presented by Mrs. S. Jackson; two Squirrel Monkeys (*Chrysothrix sciurea*) from Guiana, a Spotted Eagle (*Aquila nævia*) from India, three Weka Rails (*Ocydromus australis*), four Tuatera Lizards (*Sphenodon punctatus*) from New Zealand, deposited; two Grisons (*Galictis vettata*), a Coypu (*Myopotamus coypus*) from South America, two Western Boas (*Boa occidentalis*) from Paraguay, purchased.

OUR ASTRONOMICAL COLUMN.

SUN-SPOT OBSERVATIONS IN 1894.—In a *Separatabdruck aus der Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich*, Jahrgang 4, 1895, Dr. A. Wolfer brings together some results relating to the sun-spot statistics made in Zürich and elsewhere for the year 1894. The pamphlet opens with a determination of the constants for reducing the observations of each observer to one scale.

The mean observed relative number of spots for 1894 came out as 78·0 as against 84·9 in 1893, showing a distinct decrease. The secondary variations were also very prominent during this year; further, between two very low minima there occurred a prominent maximum lasting from May to July. Nevertheless there was on the whole a general decrease, making it possible to determine the epoch of the last important maximum. Having plotted the relative number of observed sun-spots for the three years 1892–94, and connected them together, the smoothed curve indicated a maximum at 1894·0. The length of the elapsed period, that is, from maximum to maximum, became

$$1894{\cdot}0 - 1883{\cdot}9 = 10{\cdot}0,$$

and the interval between the last minimum and the present maximum

$$1894{\cdot}0 - 1889{\cdot}6 = 4{\cdot}4.$$

Dr. Wolfer makes a comparison of the sun-spot numbers with the variations of the magnetic declination. Here there seems to be a very good agreement, and the curves for both are very similar. The epoch of the maximum magnetic variation, independently determined, occurs in August 1893 or 1893·6, which coincides exactly with the secondary rise of the curve of relative spot numbers. This secondary rise in the curve occurs just before the time of maximum deduced from the smoothed curve, and suggests rather that the former date should represent the chief sun-spot maximum. Dr. Wolfer, however, is not of this opinion, and prefers to hold to the date gathered from the mean curve. The pamphlet concludes with a tabular statement of each of the observers' individual observations for the year 1894, together with reference to the literature.

PLANETARY PERTURBATIONS.—In No. 3312 of the *Astronomische Nachrichten*, Prof. A. Weiler gives another paper on the subject of long-period and secular perturbations. The particular case considered is that of the disturbance of a planet, having a mean motion approximately twice that of the disturbing planet, and is really a special case of the more general problem of perturbations already treated in earlier numbers of the same journal. We cannot indicate here the mathematical formulæ which are given, and much of which would be unintelligible without the earlier papers, but attention may be called to one of his results.

When the commensurability in the periods of the disturbed and disturbing planets becomes very close, that is if $\delta = 1 - 2\mu$ be very small, where μ is the ratio of the two mean motions, the series by which the perturbations are expressed is not convergent, and the problem is apparently insoluble. Such a result is inconsistent with the regularly observed motions of the planets, and therefore points to some error in the assumptions on which the solution of the problem is founded. This error Prof. Weiler traces to the treatment as constant of the semi-axis major of the disturbed planet's orbit. The justice of this remark is illustrated by a reference to the arrangement of the asteroids in space, whose distribution offers peculiarities explicable on the hypothesis that the mean daily motion is variable if the approximation to commensurability oversteps a definite limit. Taking a list of twenty-five asteroids, wherein the value of $\delta = 1 - 2\mu$ is less than one-fifteenth, he shows that none have a period giving a mean daily motion very approximately twice that of Jupiter (598″·3). The mean daily motion of these twenty-five lies between 562″·2 and 640″·2, but none come between 572″·6 and 614″·4; that is, the mean motions separate on both sides of twice that of Jupiter. The force of this illustration is somewhat impaired if the list be made to comprise those more recently discovered. The asteroids Nos. 332 and 381 have mean motions of 605″·5 and 613″·5, respectively, and it should further be remembered that in the whole list of asteroids, there are only five whose means approach the lower limit of 562″. This remark simply refers to the value of the illustration, not to the accuracy of the fact it is called in to support.

THE SYSTEM OF α CENTAURI.—The meridian measures of the positions of α_1 and α_2 Centauri, made at the Cape in 1879–1881 have been utilised by Mr. A. W. Roberts for a determination of the relative masses of the two stars, and other data connected with the system (*Ast. Nach.* No. 3313). The place of the centre of gravity for 1880 is given as R.A. 14h. 31m. 27·537s., declination − 60° 20′ 20″·63 ± 0″·13; proper motion in declination (1880) = + 0″·750 ± 0″·005; proper motion in R.A. (1880) = − 7″·291 ± 0″·032. For the relative masses of the two stars, the values derived are 51 to 49 ± 1/50 of the amount.

According to the results obtained by Mr. Roberts, α_2 Centauri is very slightly heavier than the sun, while α_1 is about two-hundredths lighter. Since α_2 is now between five and six times brighter than α_1, it must have by far the brighter surface. Taking a mean of the different values which have been obtained for the sun's brightness in relation to the stars, "it would appear that α_2 Centauri is as bright as our sun, while α_1 is about five times fainter. α_1 Centauri is accordingly some distance on the downward track from the dignity of a sun to that of an ordinary planet; while α_2 Centauri is, as regards light, size, and mass, a twin-brother of our sun." Spectroscopic observations will furnish another method for determining the relative masses, but, in order to improve on our present knowledge, the observations of velocities must be accurate to within one or two tenths of a mile per second.

HOLMES' COMET.—This comet, which has presented such peculiarities both in its physical structure and the form of its orbit as to make it one of the most remarkable comets of short period, has been made the subject of an elaborate investigation by Dr. H. J. Zwiers. Taking into account the action of Jupiter and Saturn, but neglecting that of the Earth, to which, owing to the great perihelion distance of the comet, it cannot make any close approach, Dr. Zwiers is led to fix the date of the next perihelion passage on April 27, 1899, and gives an ephemeris commencing on February 16, 1898, the earliest date at which a search is likely to be successful. The theoretical brilliancy is then 0·0063, and when last seen in 1893, the brilliancy was expressed by 0·0118. In April and May, when the comet will be well situated for observation in the southern hemisphere, this latter quantity will be exceeded, and will approach that, that the comet possessed in January 1893, when it underwent such a remarkable change in its appearance. If the comet retains its stellar-like character, the difficulty in detection will no doubt be increased, but an early discovery is eminently desirable.

ON THE HABITS OF THE KEA, THE SHEEP-EATING PARROT OF NEW ZEALAND.

THE kea, the mountain parrot of New Zealand (*Nestor notabilis*), has earned considerable notoriety from its remarkable habit of attacking living sheep. It is commonly stated that the natural food of this bird consists of insects, fruit, and berries; and that it has developed a taste for a carnivorous diet only during the last thirty years. Mr. Taylor White, however, has recently pointed out (*Zoologist*, August 1895) that the various statements on the habits of this bird have all been derived from second-hand information; and, as the habitat of the parrot is on the tops of Alpine ranges, owners of sheep and shepherds who in winter and summer search the mountain tops for their stock, are the men best fitted to tell us about the habits of the bird. On observations made during such experiences Mr. White bases his own account. In the district with which this writer was acquainted, the kea always lived high up on the mountains, among rocks and boulders, a long distance above the forest-line; in such a situation, of course, berries and fruits were out of the question, and the bird appeared to live on lichen and any insects it could find. Even when the ground was covered with several feet of snow, and when roots and other food were out of reach, lichen growing on steep rocks would still be obtainable by the bird. The view that the diet of the kea generally consists of fruit and berries would thus appear to be erroneous.

It will be remembered that Wallace and others state that the kea regards the kidneys of sheep as a "special delicacy," and that it attempts to burrow into its victim in such a way as to reach this part. Mr. White, however, opposes this prevalent view, and regards it as probable that the bird desires to obtain the blood of the sheep rather than the kidneys; and in support of this view states that he has never seen a dead sheep attacked by keas. The fact that the kea so frequently pierces the body of a sheep in the region of the kidneys is due to the position it takes on the back of its victim to maintain a firm hold—a position from which it cannot be easily dislodged, as it could from the head or rump of the sheep. In corroboration of this Mr. White mentions that sheep with long wool are more frequently attacked than animals with short wool; as apparently the long wool gives the bird better facilities for holding on with his feet when drilling a hole into the back of the sheep. It is not very easy to conjecture how this habit of attacking sheep was first acquired by the kea. In winter time the sheep are covered with snow, and often have icicles hanging to their wool; and it is suggested by Mr. White that keas may have mistaken sheep so disguised for snow-covered patches of rock. It may further have happened that when searching the supposed rocks for insects the birds in some cases would taste the blood of the sheep. "When some of the birds had once found out that the blood of the sheep was good for food, others were soon initiated into the performance." It is possible that in some such manner the kea may have gradually acquired this curious and unattractive habit which renders the bird such a pest to the New Zealand farmer.

W. GARSTANG.

THE PENETRATION OF ROOTS INTO LIVING TISSUES.

THE capacity possessed by the roots of certain parasites, such as *Cuscuta*, to penetrate into the tissues of their host, is apparently an unique, not to say a remarkable phenomenon. A little reflection, however, upon the powers of roots in general, leads us to doubt whether this property is really as restricted as the first glance would lead us to imagine; and when we peruse Prof. Pfeffer's work upon the pressure of the root, and find that, for instance, the root of the common bean exerts during its growth a pressure of some 400 gms., we realise that this mechanical action alone might suffice to drive the growing root of most plants into living tissue, if circumstances necessitated such an expediency. This is evidently an important point, and touches upon the evolution of the higher parasites; it is only remarkable that it has so long remained untouched. We must now thank George Peirce for taking up this neglected subject, and placing it upon a sure basis (see *Bot. Zeit.* September 1894). The question first to be decided was whether the pressure which Pfeffer had found in the growing roots was in itself sufficient to force the roots through living tissue. For the determination of this, iron models of roots weighted up to 270 gms. were employed. The apices of these were placed upon a cube cut from a potato, and the whole surrounded with damp sawdust to keep the living substance fresh. After an interval of twenty-three hours, it was found that the iron point had penetrated $1\frac{1}{2}$ m.m. into the potato. Again, a similar model weighted to 320 gms. was driven in twenty-four hours through the cork layer and 2 m.m. of parenchyma of an uncut potato. Also a root-model placed on the stem of *Impatiens sultani*, one and a half centimetres thick, pierced this in less than twenty hours when 300 gms. weight were employed.

Thus a pressure inferior to that found by Pfeffer in the root of *Vicia faba* was sufficient to drive an iron model an appreciable distance through the living tissues of the potato.

It was far from certain, however, whether a pressure which was ample to impel a rigid iron rodlet against a considerable resistance would have equal efficiency in the case of a root, the pressure in which arose from so uncertain and inextricable a source as its life.

There were many facts both *pro* and *contra*.

The acid substance or substances, which it would seem that most roots excrete during their growth, might possibly facilitate the root's power of penetration. Just as many fungi eat their way, as it were, into the solid wood of their host by means of ferment-like substances which they secrete and pour out upon their substratum, so might the roots perhaps be expected to soften and prepare their way by means of their acid excretions. Against the supposition could be raised the fact, already broached, that the forces, impelling the root-apex forward, are derived from the vital activities of that structure, and than these nothing can be more sensible to change of surroundings, or less to be reckoned upon by us, whose conceptions of anything dealing with life are yet shrouded over with the darkest obscurity.

But to pass from speculation to facts, we find that Peirce tested this point by experiments on the seedlings of *Brassica napus* and *Sinapis alba*. He took a potato, and split it in half; on one of the halves he cut a number of small slits, into each of which he inserted a seed of the plant under observation. He then placed the potato-halves together, binding them tightly with string. The whole contrivance was placed in a vessel containing damp sawdust, care being taken that the cut surfaces of the tuber lay horizontally. After an interval of twelve days the specimens were examined, and although some were found to have grown between the cut surfaces (for nearly all had germinated), yet others had pushed their rootlets vertically downwards so as to penetrate the substance of the potato. In some instances so vigorous had been the growth that the rootlet had traversed the whole thickness of parenchyma, pierced the hard corky layer of the surface, and then reached the sawdust without.

Anatomical examination of the root and surrounding potato tissue showed several peculiarities. In the first place, the young root was almost devoid of the customary clothing of hairs; secondly, the cells of the potato had undergone alteration, inasmuch as those which were in immediate contact with the advancing root were much contorted and torn, whilst two or three layers neighbouring on the injured elements had undergone division by walls parallel to the long axis of the root, and had subsequently become corky in nature. By this means the intrusive rootlet was enclosed within a corky cylinder or sheath, cutting it off more or less perfectly from the living, unharmed tissue of the tuber. The starch grains were in every case unaltered, but Prunet, in his research on *Cynodon*, and Peirce, in his examination of one of his specimens of *Pisum*, noticed certain grains in the neighbourhood of the root apex which were partially disintegrated. This, however, is not a necessary consequence of ferment action; indeed, a check experiment of Peirce's leaves little doubt that the disintegration results in these cases from the activities of bacteria which had gained an entrance with the root. Glass tubes closed and pointed at one end were sunk, like the iron models already mentioned, into potato tissue. In one instance the apex of the glass was surrounded by "corroded" starch-grains. Here there could be no question of ferment formation, and evidently bacteria were adherent to the apex.

"So far the experiments had proved that the thin, delicate, and pointed roots of rape and white mustard are able to penetrate living tissues. Peirce carried the matter further by testing the powers of the blunt rootlets of *Pisum* and *Vicia faba* to do likewise. The rootlets of germinating seeds of these were placed in glass tubes into which they accurately fitted, and their apices placed in contact with the surface of a cube of potato. The seed and glass tube were rigidly held by layers of gypsum, in which a gap was left for the extension of the plumule. The whole was kept moist by damp sawdust. After three days the roots were found to have pierced the living tissue to the extent of 7·5 m.m.

Other experiments were made on the same plants in which other tissues, such as stem of *Impatiens sultani*, leaves of Echevaria and Aloe, petioles of Rheum, &c., were substituted for the potato. These also were penetrated by the rootlets.

In some instances, however, such as leaves of Aloe and petioles of *Rheum officinale*, the pabulum was evidently unsuited to the healthy existence of the root, for after a short