Dr. F. Katzer; some curious geological effects produced by wind-borne sand, by Prof. J. N. Woldřich; the anatomy and development of the brain of vertebrates, by F. K. Studnička; the development of Stylomatophora, by J. F. Babor; determination of the altitude of the celestial pole by means of photography, by Prof. V. Láska; on *Baculus elongatus* (Lubbock) and *Lernæa branchialis*, a contribution to the anatomy of Lernæadæ, by A. Mrázek; studies of isopoda, by B. Némec; on electrolytic superoxide of silver, by Dr. O. Šulc; studies of the Coccidæ, by K. Šulc (this paper is summarised in English); the histology and histogenesis of the spinal cord, by Dr. F. K. Studnička; and new vertebrates from the Permian formation of Bohemia, by Prof. A. Fritsch.

The additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*, ♀) from India, presented by Mrs. Bouveri; two Slow Lorises (*Nycticebus tardigradus*), a —— Toad (*Bufo asper*) from Penang, a Roseate Cockatoo (*Cacatua roseicapilla*) from Australia, a Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*) from Moluccas, two Spinose Land Emys (*Geomyda spinosa*), a Black-spotted Toad (*Bufo melanostictus*) from Singapore, presented by Mr. Stanley S. Flower; two Hairy Armadillos (*Dasypus villosus*) from Uruguay, presented by Messrs. FitzHerbert, Bros.; a Coati (*Nasua rufa*) from South America, presented by Mr. Ernest Brocklehurst; two Herring Gulls (*Larus argentatus*), two Black-headed Gulls (*Larus ridibundus*) British, presented by Baron Ferdinand de Rothschild; a Javan Porcupine (*Hystrix javanica*, white var.) from Java, a Leopard Tortoise (*Testudo pardalis*), a Natal Python (*Python sebæ*, var. *natalensis*) from South Africa, a Cunningham's Skink (*Egernia cunninghami*) from Australia, deposited; a Japanese Deer (*Cervus sika*, ♂), a Red Deer (*Cervus elaphus*, ♀), two Thars (*Capra jemlaica*, ♀ ♀), a Huanaco (*Lama huanacos*, ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

Occultation of Jupiter.—On the evening of June 14 there will be an occultation of Jupiter and his satellites. The planet will disappear at 9h. 52m. G.M.T. at an angle of 113° from the north point towards the east, and reappear at 10h. 43m. at the position angle 293°. The moon will be about three and a half days old, but as it will set at 10h. 56m. the reappearance will occur under unfavourable conditions of observation. The sun will pass below the horizon of Greenwich at 8h. 16m. on the 14th.

Comet Swift.—The following elements for comet Swift, 1896, have been derived by F. Bidschof (*Ast. Nach.*, No. 3356).

T = 1896 April 17·68237 (Berlin M.T.)

$$\left.\begin{array}{l} \omega = 1^\circ\ 43'\ 55''\cdot 3 \\ \Omega = 178\ \ 15\ \ 28\cdot 1 \\ i = 55\ \ 33\ \ 42\cdot 8 \end{array}\right\} 1896\cdot 0$$

$$\log q = 9\cdot 753076$$

The following is a short ephemeris, the unit of brightness being that on April 19:—

	R.A. h. m. s.	Decl. ° ′	Brightness.
June 11	22 17 17	+72 43	0·05
15	21 52 31	72 21	0·05
19	21 29 5	71 46	0·04
23	21 7 20	70 57	0·03
27	20 47 29	69 57	0·03
July 1	20 29 38	+68 45	0·03

The last published observation is that of Dr. Engelhardt on May 11 (*Ast. Nach.*, No. 3353), when the comet was reported "faint."

Spots and Markings on Jupiter.—During the past seventeen years Prof. Hough, of the Dearborn Observatory, has made an almost unbroken series of observations of the markings of Jupiter, with the special aim of studying the phenomena by means of micrometrical measures of size and position, rather than by sketches. He considers that for the proper interpretation of the changes taking place, such measurements, extending over a long period of time, are absolutely necessary, while the study of latitude variations is likely to lead to results as important as those of rotation period (*Ast. Nach.*, No. 3354). Photographs have been regarded as capable of giving results as accurate as micrometric measures in the telescope, but long experience has led Prof. Hough to doubt this conclusion. Notwithstanding its varying visibility, the size and shape of the great red spot have changed very little since 1879, though during recent years it was possibly 1″ shorter than when it was most conspicuous. The very slight change in the latitude of the spot during the last seventeen years seems to indicate that this object is the most stable of any of the markings. The average length of the spot, reduced to mean distance, has been 11″·61 or 37°·2. Measures of the equatorial belt and of several spots are also given, and it is worth noting that there are many advantages in Prof. Hough's method of expressing latitudes in direct measures of angular distance. A very suggestive observation was made on February 13, 1895. The third satellite was then observed in transit, at first as a black spot, but afterwards as a white disc; "after emersion, when the distance from the limb of the planet was 0″·4, the outline was sharply defined, and there was an absence of glow around the disc as though the satellite was immersed in a medium which absorbed some of its light."

Comet Perrine-Lamp (1896 I.), which attracted considerable attention in the early part of the year, has probably now passed out of reach of even the largest telescopes. M. Schulhof has computed hyperbolic elements for this comet; but while the hyperbolic character of the orbit is still uncertain, it is established that the comet is not one of short period.

THE RELATIVE LENGTHS OF POST-GLACIAL TIME IN THE TWO HEMISPHERES.

Some interesting observations on underground temperature have recently been made at Cremorne, near Port Jackson, in New South Wales.[1] The bore is 2939 feet deep, the mean temperature at the surface is 63° F., and the temperature at the depth of 2733 feet was found to be 97° F. The observations having been made with great care, the resulting gradient of 1° F. per 80 feet would appear to be "a good approximation to the truth." The rocks of the district down to a depth of about 3000 feet consist of sandstones, shales and conglomerates, and therefore, so far as conductivity is concerned, seem to be not unlike the rocks penetrated by the shafts of coal-mines in the north of England, or those in which Forbes' rock-thermometers were sunk in the neighbourhood of Edinburgh.

The estimates of the relative lengths of post-Glacial time in the two hemispheres, given on p. 138, are based on the following assumptions, the first three of which, it is needless to say, are only rough approximations to the truth. It is supposed (1) that in each hemisphere the gradient beneath the ice-sheet at the close of the Glacial period was the same[2]; (2) that the gradient at the surface may now be taken as equal to the average gradient over the whole boring; (3) that when the ice-sheet disappeared, the mean temperature of the district rose *suddenly* to its present value; and (4) that, previously to its disappearance, the temperature of the ground at the base of the ice-sheet was that of the freezing-point of water due to the pressure of the ice above, say 30°·5 F.[3]

The change in the gradient near the surface after a lapse of t years, due to a rise of b degrees in mean surface temperature, is $b/\sqrt{(\pi\kappa t)}$, where κ is the conductivity of rock expressed in terms of its own capacity for heat.[4] Now, the mean temperature over England averages 49°·5 F., so that b is here 19°, and the temperature gradient in the north of England is 1° per 49 feet.[5] Hence,

$$\frac{19}{\sqrt{t}} = \sqrt{(\pi\kappa)}\left(\frac{1}{x} - \frac{1}{49}\right),$$

[1] Report of B. A. Underground Temperature Committee, 1895.

[2] This implies that the Glacial period was of the same—or, if not, of very great—length in each hemisphere.

[3] See a paper "On the Effect of the Glacial Period in changing the Underground Temperature Gradient" (*Geol. Mag.*, vol. ii., 1895, pp. 356-360).

[4] Rev. O. Fisher, *Phil. Mag.*, vol. xxxiv., 1892, p. 339.

[5] Sir J. Prestwich, "Controverted Questions of Geology," p. 203.

where 1° per x feet is the unknown gradient at the end of the Glacial period. At Port Jackson, b is 32°·5, and the gradient 1° per 80 feet. If t' be the corresponding value of t, we have

$$\frac{32\cdot5}{\sqrt{t'}} = \sqrt{(\pi\kappa)}\left(\frac{1}{x} - \frac{1}{80}\right),$$

and therefore

$$\frac{32\cdot5}{\sqrt{t'}} - \frac{19}{\sqrt{t}} = \sqrt{(\pi\kappa)}\left(\frac{1}{49} - \frac{1}{80}\right).$$

Lord Kelvin, making use of Forbes' observations, finds κ to be 400, so that the last equation reduces to

$$\frac{65}{\sqrt{t'}} - \frac{38}{\sqrt{t}} = 0\cdot56.$$

This is satisfied if t and t' are both 2325 years, but so small a length of post-Glacial time is of course inadmissible. But, if t be increased beyond this value by any amount, it may be shown that t' is increased by a smaller amount; that is to say, the length of post-Glacial time must be greater in the north of England than at Port Jackson.

The following table contains some numerical estimates of the relative lengths of post-Glacial time in these districts, calculated from the last equation:—

North of England. Years.	Port Jackson. Years.
10,000	4,800
20,000	6,100
30,000	6,900
40,000	7,500
50,000	7,900
100,000	9,100

Too much stress should not of course be laid on these figures. The second and third, especially, of the assumptions on which they are based, must certainly be far from true. But, at any rate, it seems clear that the ice must have left the neighbourhood of Port Jackson much more recently than it left the north of England.

Whether this conclusion points to an alternation of the Glacial periods in the two hemispheres, and so furnishes an argument in favour of Croll's theory, is perhaps doubtful. But it shows, I think, how important it is, from a geological point of view, that further temperature observations should be made in the coal-mines and other borings of Australia, New Zealand, and South Africa.

C. Davison.

PLANT-BREEDING.

We are most of us now-a-days so much accustomed to see our gardens or our houses bedecked with flowers, and our tables supplied with vegetables and fruit, that we take these things for granted, and do not trouble to inquire whence they come or how they are produced. But if we look back even a few years, we shall see how much larger a share plants have now in our lives than they had then. We shall see, moreover, that while there has been enormous numerical increase, there has also been in many cases continued progression in form and other attributes. We are not concerned here with the introductions from foreign countries, important though they are; our business for the moment lies with the changes resulting from the natural processes of variation as controlled by the art of the gardener. The garden roses of to-day, for instance, are not the roses of a dozen years ago, and as to the sorts that were grown by our fathers and grandfathers, they have, with some few exceptions, utterly gone. It is the same with peas and potatoes, and with most other plants that are grown on a large scale. True, there are some exceptions; there are some "good old sorts," which seem to show by their persistence that they are the fittest to survive under existing conditions. The black Hambro' grape is an illustration, the old double white Camellia is another; but these plants are not reproduced by seed, and therefore do not invalidate the rule, that each succeeding generation of plants differs in some degree from its predecessor. At first the differences are slight, and it may be imperceptible to all but the trained expert; but they become more accentuated as time goes on, till at length they eventuate in forms so different from that from which they sprang, that they would undoubtedly be considered of specific, if not of generic, rank, were not their history known. The Jackman Clematis and its near allies may be cited as cases in point, and still more remarkable are the tuberous Begonias, which, like the Clematis just mentioned, have been created, so to speak, within the last quarter of a century, and which are so different from anything previously known amongst Begonias, that they have actually been raised to the dignity of a genus by M. Fournier, a French botanist. Pansies and Auriculas—garden productions both—are now, morphologically speaking, as good species as are most of the groups of individuals to which this rank is assigned by naturalists. Of their seedlings a large proportion comes true—that is, the parental characteristics are so far reproduced that there is no greater amount of variation among the offspring of many of these artificially-made species than there is in the progeny of natural species. If, as is the case in some Auriculas and the gold-laced Polyanthus, we find little change has occurred during the last few years, may not this relative invariability be the result of the gradual assumption of a degree of stability which we usually associate with the idea of a species? Again, it often happens that these high-bred, close-fertilised plants become sterile, so that their continuance can only be ensured by cuttings, or some means of vegetative propagation. Is not this analogous to the retrogression and ultimate extinction which occur in natural species? It is not necessary here to cite more illustrations; our concern lies rather with the way in which these changes are brought about. This leads us to what is called the improvement of plants, or plant-breeding. There seems to be a growing tendency to make use of the latter term; but if it is to be adopted, it must be taken in a broad sense, and not limited to the results of sexual propagation.

The two methods, made use of by gardeners and plant-raisers for the improvement of plants, are selection and cross-breeding—the latter, as far as results are concerned, only a modification of selection. The natural capacity for variation of the plant furnishes the basis on which the breeder has to work, and this capacity varies greatly in degree in different plants, so that some are much more amenable and pliant than others. The trial-grounds of our great seedsmen furnish object-lessons of this kind on a vast scale. Very large areas are devoted to the cultivation of particular sorts of cabbage, of turnips, of peas, of wheat, or whatever it may be. The object is two-fold—primarily to secure a "pure stock," and secondarily to pick out and to perpetuate any apparently desirable variation that may make itself manifest.

The two processes are antagonistic—on the one hand, every care is taken to "preserve the breed," and to neutralise variation as far as possible, so that the seed may "come true"; on the other hand, when the variation does occur, the observation of the grower marks the change, and he either rejects the plant manifesting it as a "rogue," if the change is undesirable, or takes care of it for further trial, if the variation holds out promise of novelty or improvement. It is remarkable to note how keen the growers are to observe the slightest change in the appearance of the plants, and to eliminate those which do not come up to the required standard, or which are not "true." Where the flowers lend themselves freely to cross-fertilisation by means of insects, as is the case with the species and varieties of Brassica, it is essential, in order to maintain the purity of the offspring, to grow the several varieties at a very wide distance apart. In passing along the rows or "quarters," the plant-breeder not only eliminates the "rogues," and retains what he thinks may be desirable variations, as we have said, but he specially marks those plants which most conspicuously show the characteristic features of the particular variety he desires to increase, and he takes care to obtain seed from the plants so marked. The variety thus becomes "fixed," but it is obvious that that word is only used relatively; really, there is a constant change, which may be either in a retrograde direction, or which may be looked on as an amelioration. Thus, in the seedsmen's advertisements we see announcements of this character: "So-and-so's *Improved* Superlative Cucumber" or whatever it may be. This "improvement," when it exists, is the result of the careful scrutiny, elimination, and selection exercised by the raiser. These are repeated season after season, till a degree of fixity is attained and a good "strain" is produced.

Fierce competition and trade rivalry forbid the growers to relax their efforts, and thus it happens that the pea or the potato of to-day is not the same, even though it may be called by the same name as its predecessors. To the untrained eye, the primordial differences noted are often very slight; even the botanist, unless his attention be specially directed to the matter