After line 20 from the bottom of column 2 on p. 264, ending with the words "known as," and before the next printed line beginning "twins," there should have appeared a line reading "amethyst. There are two well-marked kinds of quartz". Also the adjacent Fig. 14 should be vertically inverted.

OUR ASTRONOMICAL COLUMN.

SCHAUMASSE'S COMET, 1911h.—MM. Fayet and Schaumasse publish a set of elements and an ephemeris for comet 1911h in No. 4542 of the *Astronomische Nachrichten*. The ephemeris gives the positions of the comet to the end of March, 1912, and shows that the object should attain its greatest apparent brightness about the beginning of February, when it should be of about the tenth magnitude; the following is an extract:—

Ephemeris 12h. M.T. Paris.

1912		α	δ	$\log r$	$\log \Delta$	$1/r^2 \Delta^2$
	h.	m.	°			
Jan.	1	15 17.5	— 1 49	0.1116	0.2008	0.24
„	9	15 52.4	— 3 43	0.0953	0.1899	0.30
„	17	16 27.7	— 5 28	0.0822	0.1835	0.30
„	25	17 3.0	— 7 2	0.0732	0.1813	0.31
Feb.	2	17 37.5	— 8 21	0.0689	0.1830	0.31
„	9	18 10.9	— 9 25	0.0696	0.1877	0.30

This path lies through the southern parts of Serpens and Hercules, then through Ophiuchus and Aquila; the comet will pass about 3° north of Altair on March 9, 1912, and will remain a morning object throughout.

BROOKS'S COMET, 1911c.—Prof. Millosevich publishes an ephemeris, extending to March 3, for comet 1911c in No. 4542 of the *Astronomische Nachrichten*. The comet is now too far south for observation in our latitude, but was observed by Dr. Ristenpart at Santiago on December 9; its magnitude then was 7.5, and the observed position gave corrections of +7.6s. and +3.0' to the ephemeris position.

In the same journal Dr. H. E. Lau records the magnitude observations made at the Treptow Observatory during the period August 26 to October 10. Comparing the observed with the calculated magnitudes, he finds that the former fit $1/r^2 \Delta^4$ better than $1/r^2 \Delta^2$; there is also a suggestion of a periodic oscillation in the observed magnitudes. Other magnitude observations are given, and Father Iniguez also gives the wave-lengths of the lines observed photographically and visually in the spectrum of the comet.

OBSERVATIONS OF MARS.—A telegram from M. Antoniadi to the *Astronomische Nachrichten* (No. 4542) states that the large telescope at Meudon revealed, on December 6, a singular brown spot to the areographic west of Argyre. On November 14 the same observer and M. Bosler were struck by the decided citron hue of the planet's surface, even the polar snows appearing yellowish. On December 4 and 6 the Solis Lacus region was seen, under good conditions, to be as it was in 1909, but the "lake" itself was more intense. It was on the second date that the large brown spot was seen situated in the western part of the M. Erythraeum. Such a spot, although much weaker and uncertain, has been seen during previous oppositions, but never so plainly as now; it is about 600 kilometres long, and its coloration is entirely different from that of any other feature on the planet.

THE TOTAL SOLAR ECLIPSE OF APRIL 17, 1912.—In a paper read before the British Astronomical Association, and published in the current *Journal* (vol. xxii., No. 2), Mr. G. F. Chambers gives a number of interesting particulars he has collected concerning possible facilities for seeing the total solar eclipse of April 17, 1912. According to the different almanacs, maximum duration, which occurs in Portugal, will be from 0.6s. to 8.0s., the former being given by *The Nautical Almanac*, the latter by the *Berliner Jahrbuch*; the *Connaissance des Temps* gives 6.3 seconds. Mr. Chambers gives the times of sailing of ships to various ports in the peninsula, particulars as to methods of reaching, and accommodation in, the towns near to the eclipse path, and some idea of the cost. From figures supplied by Father Iniguez, the meteorological conditions at the

Spanish stations would probably be unfavourable; and, on the whole, Ovar in Portugal, about eighteen miles south of Oporto, seems to promise the best chance of seeing the transitory phenomena. A party is being organised by Mr. Chambers, and intending participants should communicate with him.

PLANETARY ATMOSPHERES.—An interesting study of the production, the effects, and the disappearance of the atmospheres of planets is published by Prof. Arrhenius in the *Publications de la Société de Chimie Physique*. Starting with each planet as a separated portion of the solar nebula, the author traces out the general method whereby the metals, the hydrocarbons, &c., would become solidified parts of the planet's crust, and then shows how this would operate in the case of the earth. Carbonic acid would be the most resistant impurity of the atmosphere, and under the action of plant life and light would become decomposed. With less CO₂ the radiation would increase and the temperature of the earth's crust would decrease. Volcanic action would then interfere by producing more CO₂, and so an oscillation of temperature and climate would ensue. Prof. Arrhenius is unable to accept the long-period rotation of Venus, and describes a development on that planet which will be richer and more brief than it has been on the earth. Turning to Mars, he likens the conditions there to those obtaining in certain desert districts, e.g. parts of Persia, only the temperature is some 30° below zero according to him. The Martian "lakes" are analogous to the semi-solid *khévirs* found in Persia, and Prof. Arrhenius shows how the colours and the changes on Mars can be fitted with terrestrial equivalents of this type.

INTERNATIONAL SOLAR RESEARCH.¹

THE interesting volume referred to below gives evidence of so much progress since the last meeting of the Solar Union at Meudon in 1907 that it is not possible in a limited notice to do more than mention some of the chief contents.

After giving a list of members of the scientific bodies constituting the union, and the names of those who attended the fourth conference at Mount Wilson, the minutes of each of the four meetings held on August 31, September 1 and 2, 1910, are given verbatim. At the first meeting, with Prof. E. C. Pickering in the chair, Dr. G. E. Hale gave a lengthy address on the recent developments of solar investigation. The preparation of the new sunspot map has been delayed by the necessity of arranging for spectra of greater dispersion to allow of the proper analysis of the Zeeman effect in spot spectra. It was decided that the scale should be not less than 5 mm. to 1 Å the separate sections not exceeding 60 cm. in length. In the progress of work on comparisons between centre and limb, solar chromosphere and other allied problems, the question of the Tertiary standards is important, and it is proposed to undertake their determination in the near future. Dr. Hale also gave a very lucid description of the details of the new large tower telescope and spectrograph. Certain changes detected in the spectra of sunspots were outlined, the differences found being due to the varying strengths of magnetic field in the spot vortices, giving different separation of the components. An important statement is that the record of eruptive phenomena can be carried on with H α better than with the calcium lines, and these eruptive phenomena are likely to be associated with magnetic storms on the earth.

A number of important resolutions by the Wave-length Committee were adopted, from which it is apparent that there is a good prospect of spectroscopists being provided in the near future with a trustworthy table of wave-length standards showing all the lines of most of the known elements on a uniform system. These will be referred to a number of "secondary standard" iron lines which have been determined by Fabry, Eversheim, and Pfund.

At the second sitting, Prof. W. W. Campbell in the chair, reports were presented dealing with solar radiation, spectra of sunspots, eclipse observations, &c. From an exhaustive

¹ "Transactions of the International Union for Cooperation in Solar Research." Vol. iii. (Fourth Conference). Pp. viii+231. (Manchester: University Press, 1911.) Price 7s. 6d. net.

series of pyrheliometric determinations at Washington (sea-level), Mt. Wilson (1800 metres), and Mt. Whitney (4420 metres), Mr. Abbot concludes that the most trustworthy value of the "solar constant" is 1.95 calories per sq. cm. per minute.

An important resolution was adopted providing that in future position angles round the sun's limb should be measured from the north to the east. This is opposite to the procedure followed during the last forty years in Italy, but Prof. Ricco thought that the Soc. degli Spettroscopisti Italiani would now be willing to agree to the change, in order that all observers should have the advantage of a uniform system.

In the reports on sunspot spectra the concurrent result is that the various metallic lines are, on the whole, affected in a systematic manner, such that the arc-flame lines are strengthened, normal arc lines unaffected, and enhanced (spark) lines weakened in spots. Certain elements—vanadium, titanium, scandium, &c.—show greater tendency to strengthening than others. With regard to the question of variation, it is evident that at least during the period of five years about the last maximum, no decided changes have been evident in the general spot spectrum. With instruments of very large dispersion certain changes have been noticed which, as before mentioned, are attributed to variations of intensity in the magnetic field of the spot vortex. Six observers have agreed to subdivide the region B—F for the continuance of visual observations of special phenomena.

The third session, presided over by Prof. E. B. Frost, was occupied with reports on the observations of solar rotation, work with the spectroheliograph, and an address by M. H. Deslandres on the "Motions and Forms of Solar Vapours."

The concluding sitting was mainly occupied with questions of administration, the chief point of interest being the enthusiastic adoption of a motion to extend the scope of the union to include astrophysics. A committee was appointed to examine and report on the question of classification of stellar spectra.

It was announced that in all probability a solar observatory would be established in Japan in the near future.

The next meeting of the Solar Union will be held in Bonn in 1913.

CHARLES P. BUTLER.

THE ORIGIN OF MAMMALS.

AN outstanding feature of the zoological section at the Portsmouth meeting of the British Association was an excellent discussion on the above subject, in opening which Prof. G. Elliot Smith laid special stress on the influence exerted by the evolution of the brain in making mammals what they are and in supplying evidence showing whence they came. He pointed out that while all living marsupials are specialised in greater or less degree, so that no one of them can be looked upon as ancestral to the Eutheria, it must be admitted that the more highly specialised Eutheria must have passed, in the course of their phylogeny, through a stage not very different from that represented by *Perameles*, and that therefore there was a metatherian stage in the ancestry of the Eutheria. The mode of development of the blastocyst and the presence of a shell membrane, the arrangement of the hippocampal formation and cerebral commissure, and many other structural features, indicate that in most respects the marsupials have retained, in far greater measure than the Eutheria, the features distinctive of their common ancestor. Turning to the monotremes, not only is the skin and its hairy and glandular epithelium typically mammalian, but also the alimentary canal and liver, the diaphragm, the auditory ossicles and their mode of development, and the organ of Jacobson; in the brain the complex specialisation of the hippocampal formation and its curious fascia dentata—so peculiarly distinctive of Mammalia—is carried to a degree of differentiation at least as great as in other mammals; the characteristically mammalian neopallium is present, and emits a system of projection fibres forming pyramidal and cerebro-pontine connections, as in other mammals.

These and other facts demonstrate the kinship of monotremes to other mammals, and establish the monophyletic

derivation of the Mammalia. But living monotremes are separated by a wide interval from Meta- and Eutheria. At a very early stage in the history of Mammalia, soon after the acquisition of skin, hair, milk glands, and the appearance of the typical hippocampus and neopallium, the Prototheria divided into two phyla, one of which retained the generalised features and the other specialised. From the former the common metatherian ancestors of all the Metatheria and Eutheria sprang by gradual transformation; from the latter were derived the living monotremes, which display a high degree of specialisation in association with the fixation of certain very primitive phases of mammalian structure, showing what the primitive mammal, just emerged from the reptilian stage, was like. All mammals have sprung from an oviparous prototherian stock, which, though vastly different from living monotremes, still deserved the name Prototheria; and there is an overwhelming mass of evidence—anatomical, embryological, and palæontological—to prove that the mammalian phylum sprang from the Reptilia, although certain features—the occipital condyles, the mesenteric vessels, the epiglottis, the mode of development of the heart, the nature of the skin and its sense organs, the auditory ossicles, and the early phases of the eutherian blastocyst—have been cited as arguments for an amphibian, in opposition to a reptilian, ancestry for mammals. But Hill has demonstrated the thoroughly sauropsidan derivation of the mammalian mode of blastocyst formation, while Osborn, Broom, and others have shown that the bicondylar arrangement of the amphibian occipital bone has persisted in many extinct reptiles, and especially in the Theriodonts, which present such a remarkable series of mammalian resemblances in their skeletons.

The process of differentiation of the mammalian hippocampal formation becomes intelligible only when the preparatory phases, represented in the reptilian brain, are known. In the amphibian brain, on the contrary, the cortical formation has become so specialised, or perhaps so degenerate, in comparison with that of its forerunner—the Dipnoi—or its successor—the Reptilia—that it must be regarded as being off the path which led to the Mammalia. In spite of the certainty that the mammalian brain passed through a reptilian stage in its phylogeny, the brain of no living reptile fulfils the conditions required in the actual ancestor of the Pro-mammalia. The brain of *Sphenodon* represents a blending of primitive features with lacertilian and chelonian characters, but it inclines too decidedly to the Lacertilia to afford a type of the ancestral reptilian brain. The extinct Therapsida (including Cynodontia) present a blend of primitive reptilian and primitive mammalian features, many of the characters of the skull of *Rhynchocephalia*, of the polyprotodont marsupials, and of the Insectivora being reproduced with surprising exactitude, as Watson has recently shown, and in the limbs prototherian peculiarities are often closely foreshadowed. If the actual ancestor be not discovered, the group of Cynodontia provides so many forms presenting mammalian characters of skull and teeth, limbs and trunk, that it is no longer possible to refuse to recognise these extinct forms as the representatives of the order to which the ancestor of the Prototheria belonged. Prof. Elliot Smith held that the ancestor of the Mammalia was scaly and laid eggs provided with a large amount of yolk, to mention only two obvious points among the definitely reptilian characteristics of the Pro-mammalia, and repeated that there is an extinct group of reptiles—the Cynodontia—which includes representatives conforming in almost every detail of structure to what would be expected in the near relatives of the earliest mammals, whereas there is no group of Amphibia which fulfils these conditions.

It seems impossible to derive either reptiles or mammals from the true Amphibia. In the course of evolution from the dipnoan stage the amphibian brain has in great measure lost precisely those features which were essential if it had to develop into the reptilian or mammalian condition. The features of the brain in Dipnoi so definitely foreshadow the conditions seen in the Reptilia that it is difficult to believe the Dipnoi can be far removed from the direct path leading to the Amniota; but the dipnoan brain, in its general plan, though not in the histological detail of