the marsupials. Dr. A. F. A. King read a paper on Septennial Periodicity, drawing attention to the phenomena of menstruation, œstration in animals, gestation, contagions, epidemics and climax of fevers. He was partially supported by Mr. Goode, who said that since the lunar month of four weeks had such an important bearing upon tides, etc., there is no absurdity in supposing that the same cause may have been at work through myriads of years to bring about periodicity as indicated in the paper. Professor Riley, Mr. Ward, the President, Dr. Prentiss, and others, took the opposite side of the question.

THE ANTHROPOLOGICAL SOCIETY.—Major J. W. Powell, the President, being in the Chair, the following papers were read: "Politico-Social Functions," Lester F. Ward; "The Savage Mind in the presence of Civilization," by Otis T. Mason. Mr. Ward first drew attention to the schism which ever manifests itself between theory and practice. Political philosophy taught in the schools is one thing, political rules and maxims of society are quite another. The speaker criticised the interpretation of the old legal school of politics as well as the modern naturalistic school. The latter, in holding that nature's fixed laws cannot be violated, forgot to include in nature the struggles of human reason. This is well exemplified in the anecdote concerning Plato. When about to flog a slave for stealing, the latter thought to get off by crying, "It is my fate to steal." The philosopher quickly reminded the slave that it was also his fate to get thrashed for his theft. The paper took the ground that Society was tending more and more to protection, and, from a large collection of statistics showed that gradually new interests were passing under control of the State. Major Powell warmly endorsed Mr. Ward's remarks, and affirmed that the conviction had been growing upon him in favor of the following view: Society begins with the kinship tie, passes on to the property basis of organization, and culminates in the evolution and protection of industries. Mr. Mason's paper was partly theoretical and partly practical. Under the first head it was maintained that the conflicts of the human family in all time had brought the different races of men face to face with higher and better methods, and from these much aid had been received in their own advancement. The practical portion of the paper related to the education of our Indians. The speaker had gone over the history of the subject, had corresponded with every respectable school and college in the country, and had collected the statistics of government operations from the Indian Bureau. The conclusion arrived at was that much had been wasted through ignorance of anthropological methods, and that the organization of a Bureau of Ethnology had been the wisest scheme the government had undertaken in this regard.

MICROSCOPY.

We have received from Dr. William Hailes, of the Pathological Laboratory, Albany Medical College, specimens of injected preparations cut with his improved microtome, which was figured and described on page 187, vol. 1, of "SCIENCE." The sections are from the kidney of the cat, and are very perfect, showing the excellence of his microtome and his own methods of manipulation. Dr. Hailes also sends us three photographs of magnified specimens of the Embryo of the Chick, taken, respectively 24, 36, and 72 hours after commencement of incubation. These photographs are highly interesting, and may be seen at our office by those pursuing such studies.

Messrs. Lennis and Duncker, both of Berlin, have published an interesting paper in the Zeitschrift für Mikroskopische Fleischschau on a new parasite with which they have met while performing their official duty. In examining pork for trichinæ they discovered a vermicular *diatomea* imbedded between the muscular fibres which they describe in the following terms: It is exceedingly thin and transparent, of a greyish color, and of about the size of the cyst-wall of a trichina.

Professor Leuckardt is inclined to consider its presence in the pork as accidental, and believes that it is of little importance to government inspectors of meat in their official work.

A WRITER in *Nature* makes the following observations on the minute structure of metals hammered into thin leaves which are quite instructive. Notwithstanding the great opacity of metals it is quite possible to procure, by chemical means, metallic leaves sufficiently thin to examine beneath the microscope by transmitted light. Such an examination will show two principal types of structure, one essentially granular and the other fibrous. The granular metals, of which tin may be taken as an example, present the appearance of exceedingly minute grains, each one being perfectly isolated from its neighbors by still smaller interspaces. The cohesion of such leaves is very small.

The fibrous metals, on the other hand, such as silver and gold, have a very marked structure. Silver, especially, has the appearance of a mass of fine, elongated fibres, which are matted and interlaced in a manner which very much resembles hair. In gold this fibrous structure, although present, is far less marked. The influence of extreme pressure upon gold or silver seems to be, therefore, to develop a definite internal structure. Gold and silver, in fact appear to behave in some respects like plastic bodies. When forced to spread out in the direction of least resistance their molecules do not move uniformly, but neighboring molecules, having different velocities, glide over one another, causing a pronounced arrangement of particles in straight lines.

A new edition of Messrs. Beck's catalogue corrected to the first of this month has been received. It is a work of 176 pages, well illustrated and appears to cover all the wants of a microscopist. Mr. W. H. Walmsley, the manager of the American branch of this house, informs us that there is a large demand for microscopes at this time, and that orders are in advance of their means of producing instruments. We notice some change in the prices and that the "Economic" has been raised to $40 including objectives. Messrs. Beck & Co. have been very successful in producing good models for their microscopes, and their workmanship is excellent. Both Mr. Beck and Mr. Walmsley are accomplished microscopists, and can thus anticipate the requirements of their customers.

ASTRONOMY.

VARIABLE STARS OF SHORT PERIOD.*

Under the above title, Professor Pickering has read before the American Academy of Arts and Sciences, the second of two papers, both of which are to be regarded as preliminary, rather than final discussions, upon the causes of variability in the light of fixed stars. In the preceding paper (Proc. Amer. Acad. XVI., 1.) the following classification of variables was made:

I. Temporary stars. Examples, Tycho Brahe's star of 1572, new star in Corona 1866.

II. Stars undergoing slight changes according to laws as yet unknown. Examples o Ceti and χ Cygni.

III. Stars whose light is continually varying, but the changes are repeated with great regularity in a period not exceeding a few days. Examples, β Lyrae and δ Cephei.

IV. Stars which every few days undergo for a few hours a remarkable diminution in light, this phenomenon

* Proceedings of the American Academy of Arts and Sciences, Vol. XVI.

recurring with great regularity. Examples, β Persei and δ Cephei.

In order to avoid all prejudice, the present discussions are made to depend entirely on the work of previous observers, while awaiting the completion of more precise observations now in progress at Harvard College Observatory.

An investigation was given in the article referred to above, of stars of the fourth class. It was shown that in the case of β Persei at least, the observed variations could be very satisfactorily explained by the theory that the reduction in light was caused by a dark eclipsing satellite.

Variables of the third class are considered in the present paper. Perhaps the most natural supposition of the variability of a star of short period, is that it is due to rotation around its axis. The difference in brightness of the two sides of a star, which such an explanation demands, may be due to spots like those of our sun, to large dark patches, or to a difference in temperature. The theory that variation is due to the absorption of a rotating mass of gas, does not appear probable for stars of the third class, since no evidence of absorption is in general shown in their spectra, beyond the appearance of lines such as are seen in our sun. For the stars of the second class, however, this view seems more reasonable, since many of them exhibit spectra which are strongly banded.

"One great advantage of the study of the stars by physical instruments, as the spectroscope and photometer, is that some clew is given to certain laws, for our knowledge of which we must otherwise depend on theoretical considerations alone. While the conclusions to be drawn from micrometric measurements are, in general, much more precise, and the effects of the errors can be more certainly computed, they fail entirely to aid us in studying such laws as are here considered. For example, the present investigation serves to study the following important problem in cosmogony, to which micrometric measures contribute nothing, and which can otherwise only be examined from the standpoint of theory.

If we admit a common origin to the stars of the Milky Way, a general coincidence in their axes of rotation seems not improbable, especially as such an approximate coincidence occurs in the members of the solar system. If the coincidence was exact, the direction must be that of the poles of the Sun, or, approximately, that of the pole of the ecliptic. On the other hand, since the stars of the Milky Way are supposed to be arranged in the general form of a flattened disc, we should more naturally expect that the axes of rotation would be symmetrically situated with regard to it, or would coincide with its shortest dimension. According to this theory, then, the axes of rotation would be directed towards the poles of the Milky Way. If now we suppose that a great number of variable stars were distributed over the heavens, it is evident that those seen in the direction of their axes would not appear to vary, since, as they turned, they would always present the same portions of their surfaces to the observer. Those at right angles to this direction would show the greatest variation, and, other things being equal, would appear to be more numerous, since they would be more likely to be detected. If then the axes are coincident, we should expect that most of these variable stars would lie along the arc of a great circle whose pole would coincide with their axes of rotation."

"Thirty-one stars are known whose period is less than 72 days. Of those, six belong to the fourth class, or that of β*Persei*, in which the variation is probably due to the interposition of an opaque eclipsing satellite. Of the remainder, seven may be excluded, since they are red, and may belong to the second class, or that of *o Ceti*. Eighteen remain, whose periods vary from less than a day to 54 days, and which may be placed in the third class. All lie within 16° of a circle whose pole is in R. A. 13h, Dec. + 20°. The distances of eleven are from 0° to 5°, of five at distances of 8° and 9°, one at 14° and one at 16°. The average distance is 5.°5, while, if the stars were distributed at random it should be 30°."

THE dome erected by Sir Henry Bessemer for the reception of his new and powerful telescope is now nearly finished. The telescope itself has arrived from the makers, and is now ready to be set up. It has been constructed on a plan devised by Sir Henry Bessemer, which it is believed will permit of telescopes being made on a much larger and more powerful scale than even the present one, which is the largest in the world. The present instrument is capable of being directed to any part of the heavens at the option of the observer. The upper portion of the dome is made of glass, with windows facing in every direction, and within there will be placed mirrors of silvered glass, which is part of the new invention, silvered glass being used in place of metal. The room and dome with its windows will revolve and keep pace automatically with every motion of the telescope, and the upper end of the instrument will reach a height of about forty-five feet.

WASHINGTON, *March* 24. W. C. W.

DISCREPANCY IN RECENT SCIENCE.

There are two classes of statements in current scientific literature that do not harmonize. Their teachings are opposite; yet, the sayings are daily used by men who believe both to be true. One series of doctrines is known as the "Conservation of Energy;" the other, the "Nebular Hypothesis." The structure of nature rests on one, while the history of cosmic evolution is based on the other. Then they should agree. Men are fascinated with cosmogony, and for ages have sought the laws by which the Universe developed. This research culminated in the existing Nebular Hypothesis. Other fields of study were opened, man scrutinized his environment, analyzed matter, searched for its ruling laws and summed up results in the doctrine of the Conservation of Force, Now the laws by which nature was in the past evolved, and is in the present governed, must be, and are the same. Such does not seem to be the teaching of some late popular books on science.

By a generalization of late research it is annnounced that the Universe is a unit. All suns visible in the telescope are composed of similar material, since they emit light, having like properties, and are dominated by the same laws of gravity and motion as rule the solar system.

Like matter, like laws, is the postulate of nature for all time. Some scientists ignore this apparent truth, as will be seen in comparing ideas advanced in recent works.

The fundamental axiom in the law of the interaction of force is, that when one mode of energy appears, another vanishes, and vice versa.

No form of force can become sensible without the retirement of another of equal intensity. This mutual displacement never ceases for an instant, and the system of nature is kept up by the flow, interchange and conversion of force. Conservation is the law of energy, and no one force can long act without waning and giving rise to another. Gravity, motion, electricity, magnetism, chemism, heat and light, are forms in which energy exists; yet one never can work eternally by itself, but must suffer conversion into another mode of power. Motion in molecules evolves heat, and heat acting upon still molecules appears as motion. Chemism acts, gives rise to heat and in doing so expires; or it may exhaust its energy in conserving electricity, which in turn may develop into heat. Numberless like instances might be given to prove the conservation of energy, were they necessary, but they are not; this great law is universally accepted by students of nature throughout the world, and the closest reasoner cannot find objection to this deduction of science. Among many facts revealed by the discovery of the laws of force, one only is