tion as speed can be lost or gained by any particle of matter.

Fourth, by collision paths can be changed, but motion as speed cannot be transmitted.

Fifth, in molar motion there is an apparent creation and annihilation of motion, but this appearance is known to be an illusion. It has been explained as due in part to collision and in part to the transmission of motion. Acceleration, therefore, must be something else than an increase of speed. It is known to be in part deflection and can all be thus explained; and if the first law of motion is valid it is thus explained. Therefore:

1. Molar acceleration is deflection of molecules.

2. Speed of motion in matter is constant.

3. The direction of motion is variable.

4. Speed is inherent in matter and is not imposed upon it from without.

5. The path of motion is controlled by environment.

The laws of motion propounded by Newton can be more simply stated as follows:

Law I. The velocity of motion is persistent.

Law II. By the collision of two bodies the direction of their motions is changed in equal components.

Vis inertia is the power which particles have of deflecting each other by collision, due to their persistent motion.

Every particle has perpetual motion as speed which can not be increased or diminished, and the absurdity of perpetual motion should be called the absurdity of perpetual collision. The particles collide because of impinging paths; they are deflected and their paths are turned apart and they cannot be made to collide again until other external collisions bring their paths together. If the particle A after one collision is once more deflected, another collision is necessary. It is thus that the absurdity of perpetual collision can be simply demonstrated. After such an analysis the explanation of gravity as the mutual protection from impinging particles becomes simple, the doctrine of virtual velocities self evident; and there are many other consequences of this law which, properly understood, would make many propositions of physics self-evident.

It must be clearly understood that the above argument does not deny that the motion of a body cannot be accelerated in speed; such a denial would be an absurdity. Every particle of which we have knowledge is a constituent of many bodies in a hierarchy of bodies and what is here affirmed is that the acceleration of a body in speed is deflection of its particles, and that embodiment itself is always a result of deflection in the particles embodied. A molar body may have its molar motion increased or diminished in speed by deflecting its molecular motions. If the speed of a molar body be changed, the direction of its molecular particles must necessarily be changed. This proposition is self-evident. The third law of motion is equally simple. The law here demonstrated affirms that acceleration in one embodiment is deflection in another and it makes valid Newton's law, which would be an absurdity were the law here demonstrated untrue; and if untrue the persistence of motion is an absurdity, and with it the persistence of energy falls to the ground.

J. W. POWELL.

SCIENTIFIC NOTES AND NEWS.

ASTRONOMY.

THE *Astronomische Nachrichten* of February 22d contains an article by Dr. H. F. Zwiers, giving a new method of computing double-star orbits, and an application of it to the orbit of Sirius. The author does not claim great precision for his orbit of his star, and it is given simply as an illustration of his method of computation. We do not think, however, that the method will commend itself very greatly to astronomers. Glasenapp has pointed out (*Orbites*

des étoiles doubles, p. q.), that the application of graphical methods to the problem in question ought to cease with the drawing of the apparent ellipse. After this has once been drawn, the computation by Kowalski's elegant formulæ does not require more than half an hour.

THE same journal contains an account of some very interesting experiments which have been made at the Munich Observatory, by Dr. Schwartzschild. A new form of micrometer has been constructed, using the principle first employed in 1891 by Michelson for the measurement of the satellites of Jupiter. This new micrometer has been applied with the help of a ten-inch telescope to the measurement of a number of close double stars. Briefly stated, the new instrument consists of a movable plate, pierced with several slits, and mounted outside the object glass of the telescope. This produces a series of spectra of both the principal star and the companion in the field of view of the telescope. By revolving the slit plate until the spectra of both stars are all in a straight line in the field of view, it is possible to measure the position angle. Similarly, by a sliding motion of the slit plate, the spectrum of the companion can be made to appear exactly midway between two neighboring spectra of the principal star. From a reading of the scale attached to the slit plate it is then possible to compute the angular distance of the component from the principal star. The whole apparatus is very simple and inexpensive, and could be applied easily to any equatorial provided with a position micrometer. Thirteen stars have been measured with this instrument by two observers. The distance for the closest double is 0″.86, while the greatest distance measured was 4″.25. Distances over five seconds could not be measured accurately, because at this distance the spectra begin to show too much color for accurate observation. The probable errors of these observations compare very favorably, indeed, with those obtained for other forms of micrometric apparatus, especially in the case of very small distances. But as is well known, the very close doubles are the ones most important to measure.

THE last number of the *Astrophysical Journal* contains an account of the progress made with the new observatory of the University of Chicago. An interesting feature of the new institution is to be a complete optical and mechanical instrument maker's outfit. And an optician as well as an instrument maker are to be permanently attached to the observatory staff.

H. J.

MARINE ORGANISMS.

THE Friday evening discourse at the Royal Institution on February 29th was delivered by Dr. John Murray, of the Challenger expedition, who spoke on 'Marine Organisms and their Conditions of Environment.' According to the report in the London *Times* Dr. Murray pointed out that in the distribution of marine organisms temperature was a more important factor than in the case of air-breathing and warm-blooded animals on the land surfaces, although in the ocean the extreme range of temperature never exceeded 52 deg. Fahr. In the surface waters of the ocean there were five well-marked temperature areas—an Arctic and an Antarctic circumpolar belt with a small range and a low temperature, a circumtropical belt with a small range but a high temperature, and two intermediate areas with large annual ranges of temperature. The waters of the ocean might be divided into two great regions—the superficial region down to about 100 fathoms, and the deep-sea region. In the former, and especially in the marginal zone surrounding the land, there was great variety of conditions and an abundant fauna and flora, whereas under the uniform conditions found in the deep-sea plant life was absent, though there was animal life in abundance. In the warm surface waters of the tropics there were many species, but relatively few individuals, while the reverse condition was found in polar areas. Again, in tropical pelagic regions organisms secreting carbonate of lime were abundant, but gradually disappeared towards the poles. In the warm waters the pelagic larvæ of bottom-living species were always found, but in the cold appeared to be absent. The lecturer was of opinion that the various facts in the distribution of marine organisms might be accounted for by supposing that in early geological times

there was a uniform climate over the whole surface of the globe and an almost universal fauna and flora. The coral reefs that flourished within the Arctic Circle in the Palæozoic period were formed when the water in the polar regions had probably a temperature approaching 70 deg. Fahr., and when cooling set in those animals with pelagic larvæ and those which secreted carbonate of lime would either succumb or be forced to retire to warmer waters, those having a direct development surviving. Cold water descending from the poles into the deep sea would carry oxygen with it and render the deep regions habitable, thus initiating migrations from the mud line. The elimination of the same elements, in the manner indicated, from the two polar faunas would account for their resemblance and even identity, as well as for the similarity of the polar and deep-sea faunas and the absence of truly ancient types in the deep sea.

GENERAL.

IT is expected that there will be present an unusual number of foreign guests at the Liverpool meeting of the British Association (Sept. 16–23). A special scientific excursion to the Isle of Man has been provided. The geology of this island is varied and interesting, especially as regards igneous and glacial formations, and fossil-bearing carboniferous limestones; the Prehistoric, Scandinavian and other early remains are celebrated, the marine fauna and flora are abundant, and the presence of the Liverpool Marine Biological Station at Port Erin will be a special attraction to all naturalists. Prof. W. A. Herdman, of University College, Liverpool, is chairman of the local committee.

THE Polarizing Photochronograph devised by Lieut. G. O. Squier, U. S. A., and Mr. Albert C. Crehore, has been recognized by the Franklin Institute of Philadelphia, which has given them the John Scott endowment medal for 1895.

THE life of Prof. A. W. von Hoffman, founder and long president of the German Chemical Society, will be written by a committee of the Society, composed of his successor, Prof. E. Fischer, Dr. Martius and Prof. F. Tremann.

THE scholarships for some time maintained at the Naples Zoölogical Station by the Universities of Oxford and Cambridge are to be continued.

PROF. SIMON NEWCOMB has been elected a member of the Royal Academy of the Lincei at Rome, and also made an officer of the French Legion of Honor.

PROF. H. A. ROWLAND, of Johns Hopkins University, has been made an officer of the French Legion of Honor, foreign correspondent of the French Academy of Sciences, and foreign member of the Italian Society of Spectroscropists.

ALL teachers of natural science are invited to join in a movement to raise the requirements in science for admission to college, by attending the next meeting of the National Educational Association at Buffalo, July 3–11, 1896. At the Denver meeting, 1895, a Department of Natural Science Teaching was organized, as a regular part of the National Educational Association, with the following officers: Prof. C. E. Bessey (Lincoln, Neb.), President; Prof. Wilbur S. Jackman (Cook County Normal School), Vice-President; Prof. Chas. S. Palmer (Boulder, Colo.), Secretary. The Western States have taken the lead, but it is hoped that all college and high-school teachers of science will unite in the movement. A good program, including special papers on the various topics in physics, chemistry and biology, is now being arranged and will soon be published.

PROF. M. I. PUPIN, of Columbia University, will lecture in the New York Academy of Sciences on March 23d, on 'Röntgen's Discovery.' The lecture will be illustrated by experiments and lantern views.

MACMILLAN & Co. have issued cards of the standard library size giving the publications of the Columbia University press. In addition to the ordinary bibliographical details each card contains a synopsis of the contents of the volume. The cards need to have only the library reference number added and can then be placed without further copying in the card catalogue.

A BRONZE memorial tablet in memory of the late Prof. George Huntingdon Williams, who

occupied the chair of inorganic geology at the Johns Hopkins University, will be placed in the Williams memorial room of the geological laboratory, which contains the collections made by Prof. Williams.

Garden and Forest states that the Puget Sound University owns what is called a residence park of some twelve hundred acres southwest of the city of Tacoma, and it is proposed to devote some two hundred acres of this, where the soil is most suitable, to an arboretum of such trees as will grow in the remarkable climate of that region. The amount of land available is so ample that room can be given for a large collection. Some ten thousand young plants of two hundred and fifty species, native and foreign, already form the nucleus of the proposed tree museum.

The first two papers of Vol. VIII., of the Bulletin of the American Museum of Natural History are by Mr. Frank M. Chapman, and discuss the changes of plumage in the Dunlin and Sanderling and in the Snowflake. Herr Gätke says that the change of color in the Dunlin and Sanderling takes place without molt and is due to changes in the feathers themselves, but Mr. Chapman shows that in passing from winter to summer plumage the Dunlin undergoes a complete molt of the body feathers and scapulars, but retains the rectrices and remiges; the change in the Sanderling is also due to molting. In regard to the Snowflake, Mr. Chapman states that they molt once a year, after the breeding season, and that the difference between the dress of September and that of the following spring is due to a wearing away of the edges of the feathers by which both their shape and color are changed.

M. Deperret, professor at Lyons, has described before the Paris Academy remains of dinosaurs found in Madagascar twenty-five miles south of Majunga. These seem to show close affinities with the fossils of British India.

As we have already had occasion to state, the work of a large proportion of the physicists of the world seems to have contributed but little to the results published by Prof. Röntgen, though an exception should be made in the case of the paper presented to the Royal Society by Prof. J. J. Thomson. It is perhaps not surprising that the daily newspapers should publish all sorts of reports, even seriously explaining how at the College of Physicians and Surgeons, New York, the Röntgen rays are used to reflect anatomical diagrams directly into the brains of students, making, we are informed, much more enduring impressions than the ordinary methods of learning anatomical details. It seems, however, unfortunate that *Nature* should publish from its 'American correspondent' unconfirmed newspaper reports and that the Paris Academy should admit five consecutive papers on 'dark light,' apparently without scientific validity.

It is stated in *Electricity* that, in connection with the Electrical Exposition to be held in New York during May, arrangements have been made for an interesting historical and loan exhibit, to which it is intended to devote considerable space on the main floor. A committee composed of T. Comerford Martin, Dr. Park Benjamin and E. L. Morse has charge of the exhibit. Dr. Benjamin has one of the finest libraries in the world of early books on electricity, and these will be shown in cases arranged chronologically, with explanatory notes, portraits, autographs, etc. Mr. Morse, the son of Prof. S. F. B. Morse, is the possessor of an invaluable collection of telegraphic relics, curios, documents, etc., including his father's note books and sketches, all of which will be shown. Mr. Martin, besides owning many objects of interest connected with the early days of electricity, has secured from Mr. Tesla, Prof. Elihu Thomson, Mr. Edison, Mr. Edward Weston, Mr. Stieringer and others the loan of early and interesting apparatus.

At the anniversary meeting of the Geological Society of London, on February 22d, the officers for the ensuing year were elected as follows: President, Henry Hicks; Vice-Presidents, Prof. T. G. Bonney, Prof. A. H. Green, R. Lydekker and Lieutenant-General C. A. M'Mahon; Secretaries, J. E. Marr and J. J. H. Teall; Foreign Secretary, Sir John Evans; Treasurer, W. T. Blanford. The Council were also appointed. The retiring President, Dr. Henry Woodward, delivered his anniversary address, which dealt

with the life history of the crustacea in later palæozoic and in neozoic times. The Wollaston medal was awarded to Prof. E. Suess, the Murchison medal and part of the proceeds of the Murchison fund to T. Mellard Reade, and the Lyell medal and part of the proceeds of the Lyell fund to A. Smith Woodward.

THE Academy of Science of the University of Oregon was organized at Eugene, Ore., on January 10th. A constitution was adopted and Prof. Condon was elected President; Dr. T. W. Harris, Vice-President, and Prof. F. L. Washburn, Secretary and Treasurer. At the first regular meeting, which was held on January 25th, Prof. Condon read a paper on 'Two recently discovered fossils,' and several informal communications were presented.

PROF. AGASSIZ and his party, which includes Dr. W. McM. Woodworth and Dr. A. G. Mayer, are now in San Francisco, and will sail shortly for Australia in the steamship Monowai. A steamer has been chartered in Australia for the expedition to the Great Barrier Reef.

MR. J. B. HATCHER, of Princeton College, special agent and collector for the Bureau of Ethnology at Washington, and Mr. O. A. Peterson, collector for the American Museum of National History, New York, have embarked for Patagonia on the steamship Galileo.

A PARISIAN company has placed pneumatic tires on twenty of its cabs. It is claimed that these not only add greatly to the comfort of those using them, but also effect an actual economy. The average cost for repairs on a Paris cab is about 50 cents a day, and it is said that the pneumatic tires reduce this to one-half. The weight saved in the tires is about 100 lbs. and the whole vehicle may be built more lightly. It is also probable that even apart from the decrease in weight it is easier for a horse to draw a carriage with pneumatic tires.

WE take from *Natural Science* the following items: An expedition of sixteen men, headed by Dr. Cook, has started in two small vessels of 100 tons each for the bay of Erebus and Terror. Six of the men are students of science. The naturalists, Messrs. Austen and Cambridge, on the Siemens telegraph expedition to the Amazon, have already begun successful operations, the fact that the 'Faraday' was stuck for a whole week on a mud-bank at the west end of Parana de Buyassu in no wise interfering with the aims of the collectors. The chief find at present has been two specimens of *Peripatus*, belonging apparently to different species. The naturalists decided to stay at Santarem, while the 'Faraday' proceeded to Manaos, which place it reached on February 8th, all well. Prof. H. de Lacaze Duthiers will, as in former years, conduct an excursion at Banyuls during the Easter vacation, that is, from March 28th to April 11th. Those joining the party can obtain return tickets from Paris to Banyuls for 46 francs. Among those who will attend are Professors Von Graff, of Graz; Pruvot, of Grenoble, and Yung, of Geneva, and probably some naturalists from Barcelona. The Professor desires to extend through us a cordial invitation to any English naturalists. The hydrographical exploration of the Skagerack has just been begun under the auspices of the Swedish government and the direction of Prof. O. Pettersson.

UNIVERSITY AND EDUCATIONAL NEWS.

THE bill establishing a National University of the United States has been reported favorably by the Senate committee. It grants a charter to the University, provides for its government, grants it the ground in the city of Washington designated by President Washington as a site for a national university, and appropriates $15,000 for the fiscal year ending on June 30, 1897, and $25,000 for the year following.

AT the recent meeting of the Board of Trustees of the College of New Jersey at Princeton it was voted to change the charter name of the institution to Princeton University. The fund which is being raised in commemoration of the Sesquicentennial next October is already over $900,000, a large proportion of which, it is said, will be devoted to the development of the graduate department.

AT a special meeting of the Yale corporation it has been decided to construct a new dormitory on York street to cost $100,000.

PROF. JAMES SETH, now of Brown Univer-