at which oxygen liquefies. Its unexpectedly low critical temperature and boiling point seem to have some relation to its unexpectedly simple molecular constitution.

After the reading of the three foregoing papers, a discussion followed, of which we give the most important parts.

Dr. H. E. Armstrong said that the case for the existence of the new constituent was undoubtedly a very strong one, and would, no doubt, meet with very considerable criticism throughout the world. But, apart from the facts which were brought forward, there was a portion which was of a wildly speculative character: viz. the portion dealing with the probable nature of this new element. Apparently the authors were not entirely satisfied with the evidence to be adduced from the application of the Clausius method for the determination of the atomicity of the gas. It was quite conceivable that the condition which Prof. Ramsay pointed out as being the only alternative to the one which was apparently accepted by the authors of the communication, is a conceivable condition. It was quite likely that the two atoms existed so firmly locked in each other's embrace, that there was no possibility for them to take notice of anything outside, and that they were perfectly content to roll on together without taking up any of the energy that is put into the molecule. The spectroscopic evidence was not sufficient to justify the conclusion that the new gas was a mixture. The great difficulty in accepting the conclusion that the gas was an element having a molecular weight of 40, and an atomic weight of 40, arose from the difficulty of placing an element of that kind. All these matters, however, would have to be discussed later on more fully: they were matters which could only be discussed very gradually, as more was learned about the new substance.

Prof. A. W. Rücker said that the one certain fact which came out indisputably from the facts described by Prof. Ramsay was, that in spite of the doubt which may have existed on the matter for the last few weeks or months, it was certain that they had now a new constituent of the atmosphere. It seemed to him that one of the most interesting results arrived at from the physical point of view was the fact that the gas was monatomic, arguing from the determined ratio of the specific heats. The experiments carried out by Lord Rayleigh and Prof. Ramsay made it certain that the element had the particular ratio of specific heats mentioned. Well, then the question arose, What followed from this? In order that this ratio might be obtained it was necessary that the atom with which they were dealing should be regarded as spherical. In conclusion, he said that whatever the effect might be upon the great chemical generalisation of Mendeléeff, that was, after all, an empirical law based at present upon no dynamical foundation. If it held its own in this case, it would, of course, strengthen the belief in it, but, on the other hand, the law did not stand on the footing of those great mechanical generalisations which could not be upset without upsetting the whole of our fundamental notions of science.

Prof. Roberts Austen remarked that in the Bessemer process alone some ten tons of iron were put into a vessel called a converter. During the conversion no less than 100,000 cubic feet of air passed through the fluid iron. Therefore 1000 cubic feet of argon went somewhere. He had taken Bessemer-blown metal which had not been treated with ferro-manganese, and pumped out forty times its volume of gas, of which one-twentieth was nitrogen. In that nitrogen he had not been able to detect any argon that could not have come from the water which was necessarily used in the manipulation. It remained to be seen whether the argon found its way into the iron, and if it stayed there, whether certain peculiarities that made Bessemer metal different from other kinds of steel could be traced to some of this 1000 cubic feet of argon, which had either passed into the air or into the iron.

Lord Rayleigh, in the course of his remarks, referred to the argument in favour of the monatomicity of the gas. Of course, what was directly proved by the experiment was that the whole, or nearly the whole, of the energy put into the gas, when it was heated, was devoted to increasing the energy of its translatory motion, and that no margin remained over to be attributed to intermolecular or interatomic motion. At first sight it seemed rather a strange thing that there should be no rotation in the molecules of the gas. That condition was met by the suggestion which had been put forward, and which had also been communicated by Prof. Fitzgerald, in the following words: "The reason why the ratio of specific heats of 1·66 is supposed to prove monatomicity in a gas is because in a monatomic gas there are no internal motions of any consequence. Now, if the atoms in a molecule are so bound together that hardly any internal motions exist, it would, so far as specific heat is concerned, behave like a monatomic element. That the atoms in argon may be very closely connected seems likely from its very great chemical inertness. Hence the conclusion from the ratio of its specific heats may be, not that it is monatomic, but that its atoms are so bound together in its molecule that the molecule behaves as a whole as it it was monatomic." It was difficult to conceive the possibility of such an eccentrically-shaped atom as that to move about without acquiring a considerable energy of rotation. He therefore thought that the only interpretation was that the gas was monatomic.

Lord Kelvin remarked as to the condition under which the ratio of the specific heats could be exactly 1·66, that he did not admit that a spherical atom could fulfil that condition. A spherical atom would not be absolutely smooth. In other words, it must be a Boscovitch point. In fact, the only kind of atom that could be conceived as giving, in the dynamical theory of heat, rigorously the ratio 1·66 for the specific heat, was the ideal Boscovitch mathematical point endowed with the property of inertia, and with the other property of acting upon neighbouring points with a force depending upon distance.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—A meeting was held on Monday last, in the rooms of the Regius Professor of Medicine, at the University Museum, and was attended by all the scientific professors and teachers of the University, with the exception of one or two, who, being unable to be present, expressed their concurrence by letter. It was unanimously resolved that a memorial connecting Sir Henry Acland's name in a permanent manner with the University Museum should be established. Sympathy was generally expressed with the scheme already before the public, but it was felt that a more distinctly personal memorial in the Museum was desirable. The future consideration of the proposal will be the subject of a second meeting to be held shortly.

Mr. A. Trevor Battye delivered a lecture before the Ashmolean Society, on Monday last, entitled "Ice-bound in Kolgnev." The lecturer narrated his personal experiences, and gave an account of the manners and customs of the Samoyedi, illustrated by numerous lantern-slides and specimens, and he also described the ornithological features of the island.

The Sibthorpian Professor of Rural Economy, Mr. R. Warington, F.R.S., gave his inaugural lecture to a large audience in the University Museum on Monday afternoon. The subject chosen was "The Present Relations of Agricultural Art and Natural Science." He deplored the want of really good agricultural and horticultural libraries.

CAMBRIDGE.—The election to the Sadlerian Professorship of Pure Mathematics, vacant by the death of Prof. Cayley, will be held on Monday, February 25, at 2.30 p.m. The names and testimonials of candidates are to be sent to the Vice-Chancellor by Monday, February 18. The electors are the Vice-Chancellor (Mr. Austen Leigh), Dr. Phear, Dr. Ferrers, Dr. Taylor, Sir G. G. Stokes, Sir R. S. Ball, and Prof. G. H. Darwin.

The Observatory Syndicate propose the appointment of a Second Assistant Observer, at a stipend of £100 a year. The appointment will be for five years, and will be made by the Director, with the consent of the Vice-Chancellor.

SCIENTIFIC SERIALS.

American Meteorological Journal, January.—Solar magnetism in meteorology, by Prof. F. H. Bigelow. This article contains some general remarks on the present state of the problems arising out of the relations that have been traced by the author's study of solar magnetism and its influences upon meteorological phenomena. Prof. Bigelow endeavours to show that the usually accepted mode of propagation of energy from the sun to the earth is not the only one that exists, and suggests that another possible mode is due to polarised solar magnetic force, such as surrounds a magnet. The progress of the investigation was made in three distinct stages: (1) the detection of the true period of the sun's rotation; (2) the determination of

the intensity of the solar magnetic field from meridian to meridian of the sun; (3) the discovery of the inversion of the solar magnetism in certain periods. The author expresses the opinion that the convectional hypothesis of cyclones is untenable, and endeavours to show, from an examination of the American meteorological curves for the years 1878-93, that the three systems—the one at the sun, that of the magnetic field in the northern hemisphere, and that of the American meteorological field—vary together in block from year to year.—Variations in the character of the seasons, by H. Gawthrop. The division of the year into four seasons is traditional, but when measured as phases of weather, it is not possible to fix these periods within definite limits. The author's investigation leads him to conclude that the primal cause for the variations in the character of the seasons must be traced back through all the effects of diurnal and seasonal insolation, and of the cyclonic storms in the lower atmosphere.

Wiedemann's Annalen der Physik und Chemie, No. 1, 1895.—Electromagnetic pulling force, by Max Weber. An iron wire whose length is very great in comparison with its thickness, experiences a pulling force proportional to the field intensity, its magnetisation, and its sectional area, when its end lies in a magnetic field, and its axis is parallel to the lines of force. If the lines of force are perpendicular to the axis of the wire, it also experiences a pulling force along its axis, which is, however, smaller in iron than the former force. The ratio of the pull along the lines of force to that across it is about 100 in moderate fields (such as H = 100), but with increasing strength of field it quickly decreases, and appears to approach unity.—Different forms of multiple resonance, by V. Bjerknes. The conclusion usually drawn from Sarasin and de la Rive's experiments with electric waves propagated along wires, that there are as many stationary wave systems as nodal systems are exhibited by the resonator, is erroneous. These periods are due to the resonator, which resounds to a simple sine oscillation at different points. The only reliable method is to study the wave systems with "indifferent" indicators, such as spark micrometers, electrometers, bolometers, and small thermo-couples. The difference between electric waves and light waves is that the latter are continually maintained, while the former are damped.—Total reflection of light in dense crystalline substances, by R. Camerer. The measurement of the index of refraction of substances of a crystalline structure by total reflection is attended with various difficulties. In some cases, there is no well-defined limit of total reflection, as in the case of paraffin or beeswax planed or cast on mercury. When the same substances are cast or pressed on the surface of the prism, two limits, polarised at right angles to each other, are observed. The author explains this by supposing that in the latter case the substances crystallise in a uniaxial form, with their optical axes perpendicular to the surface, while in the former case they are biaxial.—Elastic behaviour of zinc at different temperatures, by Erich Zimansky. It appears that the suddenness or otherwise of the cooling of cast zinc has no very decided influence upon its brittleness. It is not hardened by rapid cooling to anything like the extent that iron is.

Bulletin de la Société des Naturalistes de Moscou, 1894, No. 2.—On the Mastodons of Russia, and their relations to the Mastodons of other regions, by Mme. Marie Pavlova, being a summing up of her larger work, now ready for print. Its conclusions are: (1) It is the group *Mastodon Zygolophodon*, represented by *M. Borsoni*, *M. ohioticus*, and their varieties, which had a very great spreading in south-west Russia during the Miocene and the Pliocene periods. (2) None of these forms is specific to Russia, all having been widely spread in West Europe and North America. (3) The group of *M. Bunolophodon* is only known till now through a very limited number of specimens of *M. arvernensis*, while this group is widely represented in West Europe, Asia, and America. (4) The close resemblance between the Mastodons of Eurasia and America confirms once more the connection which existed between the two continents during the Tertiary period.—The Post-pliocene mammals of East Russia, by Prof. Stuckenberg (in French). They are: *Rhinoceros, tichorhinus*, Fischer, and *Rh. Merckii*, Jaeger; *Elasmotherium Fischeri*, Desmarest, which has never been found in Perm, Ufa, Vyatka, Kazan, Nizhni Novgorod, and Simbirsk, but only further south, *i.e.* in Samara, Penza, and Saratoff; *Equus caballus*, very common—the fossil horses having already been made the subject of special studies by Mme. Pavlova; *Cervus tarandus*, *C. elaphus*, *C. alces* (*Alces palmata*), and *C. megaceros* (*Megaceros hibernicus*), Owen; *Antilope saiga*, Pallas; *Bos priscus*, and *Bos primigenius*, the latter very rare; *Ovibos moschatus*, Blainville (*O. fossilis*, Rütimeyer); *Sus*, sp.; *Elephas primigenius*, very common—some molars offering great divergences from the usual type—and another yet undetermined species of *Elephas*, of which one molar is kept in the museum of Kazan; though like as a whole to a mammoth tooth, it has well-defined peculiarities of structure; *Castor fiber*; *Ursus arctos*; and an undetermined species of *Canis*. All these remains have rarely been found *in situ*, but chiefly in remodelled river deposits.—The second part and conclusions of the work of B. Lwoff, on the embryology of mammals. The current theory of gastrulation is shown not to be supported by direct observation, and a new theory is proposed.—On the use of Bouguer's formula in the study of gravitation anomalies, by Prof. Th. Sloudsky (in French).—On some land shells collected by M. Krishtafowitsch on the Vorobievy Hills, near Moscow, by Dr. Zickendrath. They belong to species now quite common in Middle Europe (*Hyalinia*, *Helix*, *Cionella*, *Pupa*, *Succinea*, &c.), and originate from the period when the Vorobievo plateau was covered with thick marshy forests; they can by no means be considered as belonging to any ice period.—Entomological and botanical notes from Sarepta, by Alex. Becker (in German).

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, January 9.—Dr. Henry Woodward, F.R.S., President, in the chair.—The formation of oolite, by E. B. Wethered. In previous communications the author has described pisolites formed by the growth of *Girvanella*, and some true oolitic granules having a like origin. He had previously expressed the opinion that all oolitic granules are of organic origin, and the facts described in the present paper give support to this view. He described the form of the granules, which frequently exhibit a series of concentric layers of calcium carbonate around a nucleus, and also dark striæ and patches, the former placed more or less at right-angles to the nucleus. The concentric layers often exhibit an irregularity which the author maintained to be incompatible with their chemical origin. Again, granules are found made of calcium carbonate occurring in two forms—a clear crystalline portion representing the organic structural part, and an amorphous portion consisting of ordinary carbonate of lime, which is either infilling or secreted material, possibly both. In discussing the origin of the crusts around the nuclei the author treated of the radial structure which is so marked a feature in the crust of oolitic granules. This structure has the appearance of light and dark striæ when seen by reflected light: the light are tubules which have grown at right-angles to the nucleus, while the dark are secondary formations. He referred to Rothpletz's description of the oolitic granules of the great Salt Lake, which are stated to have originated from the growth of lime-secreting algæ, and thinks it possible that the fossil forms are of like origin, though not necessarily due to organisms allied to algæ, and possibly even lower in the scale of life. In his opinion *Girvanella*—the first type of oolite-forming organism discovered—is simply a tubule. A long discussion followed the reading of the paper. The President thought that the author had placed evidence before the meeting sufficient to prove the organic origin of many of his oolitic granules. Mr. G. F. Harris believed that while most geologists would possibly agree as to the organic nature of the tubules in the pisolites referred to, they would not be unanimous in recognising the tubular structure in many of the oolitic granules shown. Many of the features presented by oolitic granules, and brought forward by the author as evidence of the organic origin of oolite, could be explained by the alteration effected in them since their original formation. Mr. E. T. Newton agreed with the author that the irregular tubules termed *Girvanella*, and seen sometimes within and sometimes on the outside of oolitic granules, were of organic origin, but he thought that the characteristic concentric and radiated structure of oolitic granules was entirely different, and not due to concentric tubules. Dr. G. J. Hinde did not think that the author was right in his interpretation of the concentric layers so common in ordinary oolitic grains as tubular forms of growth. In his (the speaker's) opinion these concentric lines might indicate