

The compound molecule explanation is a good working hypothesis, which I think may account for the facts, while it does not postulate the rather heroic alternative of calling into existence eight or nine new elements to explain the phenomena. However, I submit it only as an hypothesis. If further research shows the new element theory is more reasonable, I shall be the first person to accept it.

Neither of these theories agrees with that of M. Lecoq de Boisbaudran, who also has worked on these earths for some time. He considers that what I have called old yttrium is a true element, giving a characteristic spark spectrum, but not giving a phosphorescent spectrum *in vacuo*. The bodies giving the phosphorescent spectra he considers to be impurities in yttrium. These he says are two in number, and he has provisionally named them  $Z\alpha$  and  $Z\beta$ . By a method of his own, differing from mine, M. de Boisbaudran obtains fluorescent spectra of these bodies; but their fluorescent bands are extremely hazy and faint, rendering identification difficult. Some of them fall near lines in the spectra of my  $G\beta$  and  $G\delta$ . At first sight it might appear that his and my spectra were due to the same bodies, but according to M. de Boisbaudran the chemical properties of the earths producing them are widely distinct. Those giving phosphorescent lines by my method occur at the yttrium extremity of the fractionation, where his fluorescent bands are scarcely shown at all; whilst his fluorescent phenomena are at their maximum quite at the terbium end of the fractionation, where no yttrium can be detected even by the direct spark, and where my phosphorescent lines are almost absent.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Girton College has withdrawn from the arrangement by which it was hoped that a united scholarship for men and women might be established in geology and palæontology out of the Harkness fund. The council of Girton do not consider that the scheme proposed fulfils the essential condition of placing students of Girton and Newnham on the same terms as members of the University. A scheme has consequently been propounded for men alone, open to B.A.'s of not more than four years' standing. The electors are to be the Vice-Chancellor, the Woodwardian Professor, the Examiners in Geology in the Natural Sciences Tripos for the current and the preceding year, and an additional elected examiner. The electors are to take any steps they think desirable to ascertain the qualifications of candidates, and in making the award they are to have regard to proficiency in geology and palæontology, and to promise of future work. One scholar is to be elected annually; but in case no person shall be deemed worthy of election, the income for the year is to go to a reserve fund, to be given, when advisable, to scholars to aid them in prosecuting geological or palæontological researches.

The acceptance of the John Lucas Walker Studentship for the furtherance of original research in pathology, which has been offered to the University by the Attorney-General, is to be voted on in the Senate to-day. The amended regulations provide that the studentship shall be usually tenable for three years, with power of further prolongation for two years more when exceptionally valuable work has been done by the student. The fund, consisting of about 8300*l.* 4 per cent. debentures, is to be managed by the Professor of Pathology for the time being, the Professors of Physic and Physiology, and the President of the London College of Physicians. The studentship is not to be awarded by competitive examination, but any other mode of ascertaining qualifications may be taken. After full announcement of a vacancy, the Professor of Pathology is to nominate the best qualified candidate, but the other electors may overrule the nomination if they are unanimous in favour of some other candidate. The student shall not necessarily be a member of Cambridge University, and may be of either sex. No occupation interfering with pathological research may be followed by the student, who is also to vacate his studentship if elected to a professorship or fellowship. At least three terms of study are to be pursued at Cambridge. Exhibitions or prizes not exceeding 50*l.* may from time to time be awarded by the managers to any person, except the student for the time being, in respect of any essay, discovery, or meritorious service connected with or conducing to the science of pathology, and grants may be made for the furtherance of original research in the science.

The amended regulations for the Mechanical Sciences Tripos also come to a vote to-day.

The Senate has accepted the subscription of 500*l.* offered through Prof. Newton to enable the University to become a Governor of the Marine Biological Association.

The following new appointments of electors to various Professorships have been made: Botany, Mr. Thiselton Dyer; Political Economy, Right Hon. A. J. Balfour, M.P.; Experimental Physics, Dr. D. MacAlister; Downing Professorship of Medicine, Dr. A. Macalister; Mental Philosophy and Logic, Prof. A. Marshall; Surgery, Dr. A. Macalister. The remaining appointments are re-elections.

#### SCIENTIFIC SERIALS

*American Journal of Science*, February.—Kilauea after the eruption of March 1886. Under this general heading are grouped three separate papers, disposed in chronological order, describing the appearance of the volcano at different times since the great outburst of last March. The first is a communication to Prof. W. D. Alexander, Surveyor-General of the Hawaiian Islands, by J. S. Emerson, assistant in the Survey, dated August 27, and embodying a series of observations ranging from March 24 to April 14. This paper is illustrated by a plate showing the crater and new lake drawn to a scale of 1 : 20,000. The second, by L. L. Van Slyke, Professor of Chemistry, Honolulu, describes the general appearance of the volcanic district during the month of July, when considerable changes had already occurred, including a general upheaval in the centre of Halema'uma'u, and the reappearance of liquid lava in three different places. The third comprises a report to Prof. Alexander by Mr. Frank S. Dodge, on the survey of Kilauea in the last week of September and the first of October, with a plate of the crater on a scale of 1 : 6000. This observer expects that perhaps in a few months the great central pit will again fill up and overflow, as it did prior to the last eruption.—Volcanic action, by James D. Dana. The general question of igneous disturbances is discussed in connection with the recent eruptions of Kilauea, Vesuvius, and Tarawera. The author's conclusions on the causes of these phenomena, as summed up in his "Manual of Geology" (1863), are mainly confirmed, being attributed to the hydrostatic pressure of the column of lava; the pressure of vapours escaping in underground regions from the lavas, or produced by contact with them, acting either quietly or catastrophically; and the pressure of the subsiding crust of the crust forcing up the lavas in the conduit.—On the Coahuila meteorites, by Oliver Whipple Huntington. It is shown that the assumed new meteorite discovered near Fort Duncan, Maverick County, Texas, and recently described by Mr. W. E. Hidden, is really one of the "Coahuila irons," described by J. Lawrence Smith, and supposed to belong to one fall, although found on the opposite side of the Rio Grande from Maverick County.—A new rhizomatous Medusa from New England, by J. Walter Fewkes. This is a large acraspedote jelly fish, not only new to New England, but also unlike any yet captured on the Atlantic coast of North America. It was captured in September 1886 in New Haven harbour, and is allied to a common species found on the west European seaboard, *Pilema (Rhizostoma, auth.) octopus*, Haeck., and to *P. pulmo* of the Mediterranean.—A short study of the atmosphere of  $\beta$  Lyræ, by Orray T. Sherman. The author's observations lead to the conclusion that in stars known to possess a spectrum comprising bright lines, these lines, while persistent in place, are not persistent in intensity. Comparing Lockyer's result in the study of the atmosphere with his own, he draws a general conclusion regarding the condition of the stellar atmosphere, describing it as consisting of an outer layer of hydrogen positively electrified, an inner layer of oxygen negatively electrified, and between them a layer of carbon mingling on its edge with the hydrogen. The electric spark passing through the mixture forms the hydrocarbon compound, whose molecular weight carries it into the oxygen region where combustion ensues with the formation of carbonic acid and aqueous vapour, both of which descending under the influences of their molecular weight are again dissociated by internal heat, and return again to their original positions.—Phenacite from Colorado, by Samuel L. Penfield, with notes on the locality of Topaz Butte, by Walter B. Smith. Some interesting facts are communicated with regard to the crystallisation of this remarkable mineral, the occurrence of which in the United States (Pike's Peak, El Paso County, Colorado), was determined by Messrs. Cross and Hillebrand.

Topaz Butte, five miles north of Florissant, marks the southern limit of the "crystal beds" whence have come most of the specimens labelled *Pike's Peak*. The largest phenacite ever found in this locality is a rough lenticular crystal about 15 mm. in diameter.—The norites of the Cortlandt series on the Hudson River, near Peekskill, New York, by George H. Williams. In continuation of his memoir on the peridotites of the Cortlandt series (*American Journal of Science*, 1886, p. 26) the author here begins a petrographic description of the massive rocks of this system. The present paper deals with the non-chrysolitic rocks, norite proper and hornblende norite. He designates all rocks in which one-half or more of the non-feldspathic constituents are hypersthene as norite, and names varieties of this after the prevailing accessory component.—A method for subjecting living protoplasm to the action of different liquids, by George L. Goodale. An apparatus is described by means of which the necessity is obviated of transferring specimens from the litre-flask to the stage of the microscope, all handling being thus avoided, while the object can be placed under the action of as large a quantity of liquid as may be desirable.—On the topaz from the Thomas Range, Utah, by A. N. Alling. The topaz crystals here under examination are from the cabinet of Prof. Brush, vary in length from 3 mm. to 10 mm., and are perfectly clear and colourless.—On a simple and convenient form of water battery, by Henry A. Rowland. A simple, convenient, and cheap form of water battery is described, which the author has had in use for many years.

*Bulletin des Sciences Mathématiques*, tome x. December 1886, tome xi. January 1887, Paris.—We single out these two recently issued parts, as they contain papers on subjects intimately connected with notices of Greek geometry, which we have from time to time communicated to NATURE when giving an account of Dr. Allman's contributions to *Hermathena*. In the *Mélanges* of the earlier number M. Paul Tannery has two notes: one of nine pages, entitled "Démocrite et Archytas" (see Gow's "History," p. 129, and NATURE, vol. xxxiv. p. 548); the other, of eleven pages, on "Les Géomètres de l'Académie." The latter part has an article of, twelve pages, by the same writer, on "La Technologie des Éléments d'Euclide." All three are quite up to M. Tannery's well-known excellent form for thoroughness of research and soundness of inference. The rest of the matter consists as usual of reviews (*inter alia*, of the French translation of Clerk Maxwell's "Electricity and Magnetism" and Mr. Greenhill's "Differential and Integral Calculus"), and of useful abstracts of papers in the various Continental and British mathematical journals.

## SOCIETIES AND ACADEMIES

### LONDON

Royal Society, February 24.—"Problems in Mechanism regarding Trains of Pulleys and Drums of Least Weight for a given Velocity Ratio." By Prof. H. Hennessy, F.R.S.

As trains of wheels, pulleys, and drums are frequently employed in machinery for the transformation of large and small velocities of rotation, it appeared to the author desirable to inquire into the conditions which would favour the greatest economy of weight of the parts forming such trains. Eighty years since Dr. Thomas Young had arrived at a theorem for the minimum number of teeth in a train of wheels and pinions with a given velocity ratio, and when the pairs of wheels and pinions are similar. By investigating the question of minimum volume or minimum weight of trains the author has been led to the following results, which are fully demonstrated in his paper: namely, that for a train of cylindrical pulleys composed of similar pairs the ratio of the diameter of a large to that of a small pulley should be as 19 to 10. For drums composed of hoops supported by disks of the same thickness, and with the breadth of each hoop equal to the radius of the small drum, the ratio of the diameters should be 11 to 5. If the hoop was supported by spokes whose volume taken together would be half the volume of a complete disk, the ratio would be 51 to 20. With regard to a train of pulleys, it was shown that a single pair possessing the same velocity ratio as a series with the ratio of diameters found for minimum volume, the latter would be considerably less than the former. Thus, with five pairs whose velocity ratio would be nearly  $24\frac{1}{2}$ , the volume would be less than the  $1/26$  of a single pair possessing the same velocity ratio. A model constructed in brass of such a train, with all the large pulleys 1.9 inches in diameter,

and all the small 1 inch, weighed 18.34 ounces. A train of four pairs of drums illustrative of the last problem solved weighed 16.788 ounces, the large drums being 2.55 inches, and the small 1 inch diameter, while all the hoops were half an inch broad. The velocity ratio of this train is  $42.2825$ , or a little more than 42.

March 3.—"The Etiology of Scarlet Fever." By E. Klein, M.D., F.R.S., Lecturer on General Anatomy and Physiology at the Medical School of St. Bartholomew's Hospital, London.

The investigation, the results of which I now record, was commenced at the end of December, 1885. It arose out of an inquiry into the prevalence of scarlatina in different quarters of London, undertaken by the Medical Department of the Local Government Board as a part of its business of investigating local epidemics. That inquiry had demonstrated milk from a farm at Hendon as the cause of the scarlatina, and had adduced strong circumstantial evidence that the scarlatina had been distributed, not in the whole, but in certain sections of the Hendon milk, and further that the ability of the sections of milk service to convey the disease had been related to a malady affecting particular cows. This evidence against particular cows at the Hendon farm could not and did not aim at furnishing direct and definite proof of the connection of this cow disease with scarlet fever of man, for the inductive methods usually employed by the Medical Department of the Local Government Board when applied to inquiries about epidemic spread of scarlatina can for obvious reasons yield but circumstantial evidence. As on various former occasions, so also on this, the Medical Department sought to put the above conclusions to the test of scientific experiment. This task was delegated to me by the Board. The first part of this work has been published in the recently issued volume of the Reports of the Medical Officer of the Local Government Board for 1885-86. I have therein shown that the suspected cows from the Hendon farm that had been made the object of special study, showed besides a skin disease—consisting in ulcers on the udder and teats, and in sores and scurf patches and loss of hair on different parts of the skin—also a general disease of the viscera, notably the lungs, liver, spleen, and kidney, which resembled the disease of these organs in acute cases of human scarlatina. I have further shown that the diseased tissues of the ulcers on the teats and udder produced on inoculation into the skin of calves a similar local disease, which in its incubation and general anatomical characters proved identical with the ulceration of the cow; and further, that from the ulcers of the cow a species of micrococcus was isolated by cultivation in artificial nutritive media, which micro-organism in its mode of growth on nutritive gelatine, on Agar-Agar mixture, on blood serum, in broth, and in milk, proved very peculiar and different from other species of micrococci hitherto examined. With such cultivation of the micrococcus I have produced by subcutaneous inoculation in calves a disease which in its cutaneous and visceral lesions (lung, liver, spleen, and kidney) bears a very close resemblance both to the disease that was observed in the Hendon cows as well as to human scarlatina.

The second part of the work, carried out during 1886-87 for the Medical Department, had for its object to investigate whether or no the disease, human scarlatina, is associated with the identical micrococcus, and whether this, if obtainable from the human subject, is capable of producing in the bovine species the same disease as was observed in the Hendon cows and in the calves experimented upon from the latter source. The definite and clear proof that this is really the case has now been obtained, and the evidence I now bring to the notice of the Royal Society.

On examining acute cases of human scarlatina—for which opportunity I owe great thanks to Dr. Sweeting, the Medical Superintendent of the Fulham Fever Hospital—I soon ascertained the fact that there is present in the blood of the general circulation a species of micrococcus, which on cultivation in nutritive gelatine, Agar-Agar mixture, blood serum, and other media, proved to be in every respect identical with that obtained from the Hendon cows. Out of eleven acute cases of scarlet fever examined in this direction, four yielded positive results: three were acute cases between the third and sixth day of illness with high fever temperature, and the fourth was a case of death from scarlatina on the sixth day. In all these four cases several drops of blood were used, after the customary methods and under the required precautions for establishing cultivations in a series of tubes containing sterilised nutritive gelatine, and generally only a very small number of these tubes revealed after an incubation of several days one or two colonies of the micrococcus. This