amongst them we must notice Young's catalogue of the bright lines observed in the chromosphere of the sun, which have already reached a goodly number. Under Civil and Mechanical Engineering there are several useful and interesting articles, such as "On Woodworking Machinery," "On the Flow of water in rivers and canals," &c.—Prof. Cooke contributes the first of a series of papers "on the chemical theory of the Voltaic Battery." The present communication, however, deals with preliminary matters; it discusses molecules, atoms, and the quantivalence of elements. The paper which follows is "On some improvements in reflecting Telescopes," by J. A. Hill. The author proposes, in the first instance, to reflect the light from a movable plane mirror placed in the axis of the speculum, which receives the reflected rays; the convergent beam from the speculum passes through an aperture in the centre of the plane mirror, and can be received in a suitable eye-piece; no tubes are used, so that by this method it would be as easy to handle a mirror of 1,000 feet focal length as one of the same size of 50 feet focal length. The observer, too, would remain stationary, and need not be hoisted into mid-air.—Prof. Young continues his Spectroscopic Notes; this month's contribution is "on the construction, arrangement, and best proportion of the instrument, with reference to its efficiency." Under this head come the best angle and material for the prisms, the means of testing for flatness of surface and homogeneity of substance, and the number and arrangement of the prisms; there are also two other sections, "on dispersive efficiency and on luminous efficiency." A suggestion of a new form of chemical spectroscope is given, the dispersive part of this consists of two prisms, which are each concave on one side, and are cemented to the convex object-glasses of the collimator and observing telescope. By this it is hoped to save both material and light.

THE *Geological Magazine* for March (No. 93) opens with a new species of *Rostellaria* (*R. Pricei*) from the Grey Chalk of Folkestone, by the editor, Mr. H. Woodward.—Mr. A. H. Green communicates a paper on the method of formation of the Permian beds of South Yorkshire, in which he discusses the general arrangement and palæontology of these beds, and deduces from them a confirmation of Prof. Ramsay's theory that the Magnesian Limestone and associated beds of this part of England were formed in part by chemical precipitation in an inland sea.—Prof. H. A. Nicholson records the occurrence of the Cephalopod *Endoceras proteiforme* Hall, in Britain; the specimen described and figured was discovered by the author in the mudstones of the Coniston series near Ambleside, a set of rocks in which scarcely any fossils, except Graptolites, have hitherto been found.—Mr. James Geikie gives a fourth paper on Changes of Climate during the Glacial Epoch, in the conclusion of which he sums up his views as to the sequence of climates at this time as follows:—1. A succession of alternate glacial and temperate conditions, but associated with the great Continental ice-sheets; 2, a temperate climate, with removal of the ice-sheets from low grounds; 3, a period of subsidence, with temperate climate, and much denudation of moraines; 4, a period of emergence, with arctic conditions, floating ice dispersing erratics, and deposition of clays with arctic mollusca; and, 5, a period of local glaciers in Britain and Ireland, with gradual amelioration of climate. In future papers the author proposes to discuss the cave-deposits and older river-gravels of England. The post-glacial geology and physiography of West Lancashire and the Mersey estuary, form the subject of an interesting paper, by Mr. T. Mellard Reade; and Prof. T. Rupert Jones and Mr. W. K. Parker give us the corrected nomenclature of the Foraminifera from the English Chalk, figured by the Rev. Henry Eley in 1859.—The number also contains an abstract of an address on subsidence as the effect of accumulation, read before the Liverpool Geological Society, by Dr. Charles Ricketts.

THE *Journal of Botany* for March contains only one original article bearing specially on British Botany, Notes on the British *Ramalinæ* (a genus of Lichens) in the Herbarium of the British Museum, by the Rev. Jas. Crombie. We find also, "On *Symea*," a new genus of triandrous *Liliaceæ* from Chili, by Mr. J. G. Baker, with a plate; recent researches into *Diatomaceæ*, by the Rev. E. O'Meara; and *Castanea vulgaris* grown in Southern China, by Dr. Hance. Mr. Carruthers contributes his important Review of the Contributions to Fossil Botany published in Britain in 1871; and the editor commences in this number a valuable list of the articles contained in the German botanical journals for January.

## SOCIETIES AND ACADEMIES

### LONDON

Royal Society, Feb. 29.—"On the Relative Power of Various Substances in arresting Putrefaction and the Development of Protoplasmic and Fungus Life;" by Dr. F. Crace-Calvert, F.R.S.

March 14.—"Contributions to the History of the Opium Alkaloids," part iv.; by Dr. C. R. A. Wright.—"The Decomposition of Water by Zinc in conjunction with a more Negative Metal;" by J. H. Gladstone, F.R.S., and Alfred Tribe, F.C.S.

March 21.—"On some Heterogenetic Modes of Origin of Flagellated Monads, Fungus-germs, and Ciliated Infusoria," by Professor H. Charlton Bastian, F.R.S. In this communication Dr. Bastian announces results which, whilst confirming the previous observations of MM. Pineau and Pouchet, considerably extend our knowledge concerning the heterogenetic changes liable to take place in the pellicle (composed of aggregated Bacteria) which forms upon an infusion of hay. He describes all the stages by which certain Fungi, Flagellated Monads, and Ciliated Infusoria are produced, as a result of changes taking place in the very substance of the pellicle. Most of the observations were made under a magnifying power of 1,670 diameters, and, although more extensive, are confirmatory of others published in NATURE, No. 35. Dr. Bastian says, "I now wish to describe other allied processes, and the means by which I am enabled to obtain, almost at will, either animal or vegetal forms from certain embryonal areas which are produced in the pellicle." The simplest mode of origin of Fungus-germs and Monads is thus described:—"The pellicle which formed on a filtered maceration of hay during frosty weather (when the temperature of the room in which the infusion was kept was rarely above 55° F., and sometimes rather lower than this) presented changes of a most instructive character. On the third and fourth days the pellicle was still thin, although on microscopical examination all portions of it were found to be thickly dotted with embryonal areas. Nearly all of them were very small; but a few areas of medium size were intermixed. The smallest were not more than $\frac{1}{4000}$" of an inch in diameter, and these separated themselves from the pellicle as single corpuscles; slightly larger areas broke up into two or three corpuscles; and others, larger still, into 4—10 corpuscles. In most of these small areas, the corpuscles were formed with scarcely any appreciable alteration in the refractive index of the matter of which they were composed; this simply became individualised, so that the corpuscles separated from the surrounding pellicle and from their fellows, still presenting all the appearance of being portions of the pellicle, and exhibiting from 4 to 10 altered *Bacteria* in their interior. In some cases the products of segmentation soon developed into actual flagellated Monads in a manner presently to be described; whilst in others they seemed to remain for a longer period in the condition of simple motionless corpuscles. Other solitary corpuscles or small areas began to form in the pellicle in precisely the same manner, though they speedily assumed a highly refractive and homogenous appearance. Why some should undergo such a change, and not others, seems quite impossible to say. One can only assert the fact, and add that these highly refractive ovoid corpuscles were, for the most part, more prone to produce Fungus-germs than Monads. Many of them soon grew out into dissepimented fungus filaments, which rapidly assumed the *Penicillium* mode of growth. The spores, which were abundantly produced in terminal chaplet-like series, were, however, small, homogeneous, spherical, and colourless." In other cases Monads and Fungus-germs are produced from the pellicle in precisely the same manner as that by which they arise within the terminal chambers of certain Algæ or Fungi—that is to say, they result from the segmentation of a mass of homogeneous protoplasm.

In speaking of such a mode of origin of Monads, Dr. Bastian says:—"Contrasting with the very pale fawn-colour of the evenly granular pellicle, there were numerous areas of a whitish colour, refractive, and more or less homogeneous. These areas differed very much in shape and size; some were not more than $\frac{1}{1000}$", whilst others were as much as $\frac{1}{100}$" in diameter. Their shape was wholly irregular. As in the instances previously recorded, the first appreciable stage in the formation of an embryonal area in the pellicle was a local increase in the amount of gelatinous material between the units of this portion of the pellicle, so that they became more distinctly separated from one another than in adjacent parts. Gradually these particles became less sharply defined, and at last scarcely visible, in the midst of

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a highly refractive protoplasmic mass which began to exhibit traces of segmentation. Masses of this kind were seen, which had been resolved by such a process of segmentation into a number of spherical corpuscles about $\frac{1}{4500}$" in diameter. These were at first highly refractive, though they gradually became rather less so, and revealed the presence of two or three minute granules in their interior. In other adjacent areas, a number of densely-packed, pliant, and slightly larger corpuscles were seen actively pushing against one another. When they separated, they were found to be active ovoid specimens of *Monas lens*, about $\frac{1}{3500}$" in length, and provided with a vacuole and a rapidly lashing flagellum."

In other cases embryonal areas of the same nature were formed, which went through similar processes of segmentation; although the units produced, instead of developing into Monads, were seen to become transformed into brown vesicular bodies, which subsequently germinated into Fungus filaments. Whilst affirming that he is now able to determine pretty surely the occurrence of either one of these phenomena, Dr. Bastian says:—

"Experience has shown me, that, if an infusion has been heated for a time to 212° F., the pellicle which forms on its surface very frequently never gives rise to an embryonal area. If the infusion has been prepared at a temperature of 149° — 158° F., the embryonal areas which form will give origin to Fungus germs; whilst in a similar infusion prepared at 120° — 130° F., the embryonal areas, which seem at first to be in all respects similar, break up into actively moving Monads."

Dr. Bastian then proceeds to give an account of the origin of *Paramecia*, laying stress upon the fact that, in order to obtain such organisms, it is necessary to employ a filtered infusion made with cold water. His observations on this subject were, in the main, confirmatory of those of M. Pouchet. Thousands of egg-like bodies, varying in size from $\frac{1}{500}$" to $\frac{1}{350}$" were seen developing throughout the whole substance of a thick pellicle. He says: "It seemed to me that the differentiation took place after a manner essentially similar to that by which an ordinary 'embryonal area' is formed. The small embryos did not appear to represent the earlier stages of large embryos; and it seemed rather that spherical masses of the pellicle of different sizes began to undergo molecular changes, which terminated in the production of *Paramecia* of a correspondingly different bulk. Just as in the previously described embryonal areas masses of different sizes began to exhibit signs of change, so also here, spherical portions of the pellicle, differing within the limits above mentioned, began to undergo other heterogenetic changes. This was first indicated by an increased refractiveness of the area (especially when seen a little beyond the focal distance); and almost simultaneously a condensation of its outer layer seemed to take place, whereby the outline became sharply and evenly defined. At this stage an actual membrane is scarcely appreciable, and the substance of the embryo (when examined at the right focal distance) scarcely differs in appearance from the granular pellicle of which it had previously formed part. So far as it could be ascertained, the individual embryos did not increase in size, although they went through the following series of developmental changes. The contained matter became rather more refractive, and the number of granules within diminished considerably, whilst new particles after a time seemed gradually to appear in what was now a mass of contractile protoplasm. These new particles were at first sparingly scattered, though as they were evolved they continued to grow into biscuit-shaped bodies, which sometimes attained the size of $\frac{1}{1000}$". All sizes were distinguishable; and many of them moved slowly amongst one another, owing to the irregular contractions of the semi-fluid protoplasm in which they were embedded. Gradually the number of homogeneous biscuit-shaped particles increased; and at last a large vacuole slowly appeared in some portion of the embryo. It lasted for about half a minute, disappeared, and then, after a similar interval, slowly reappeared. Much irregularity, however, was observed in this respect. The next change that occurred was the complete separation of the embryo from the cyst which it filled, and the commencement of slow axial rotations. These rotations gradually became more rapid, though they were not always in one direction. The mass became more and more densely filled with the large biscuit-shaped particles, and at last the presence of cilia could be distinctly recognised on one portion of the revolving embryo. Then, as M. Pouchet stated, the movements grew more and more irregular and impulsive, so as at last to lead to the rupture of the thin wall of the cyst—when the embryo emerged as a ciliated and somewhat pear-shaped sac, provided with a large contractile vesicle at its posterior extremity. . . . On emerging from the cyst, all the embryos, although differing somewhat in size, were of the same shape. This closely corresponded with the description given of *Paramecium colpoda* in Pritchard's 'Infusoria,' namely:—'Obovate, slightly compressed; ends obtuse, the anterior attenuated and slightly bent like a hook.' Cilia existed over the whole body, though they were largest and most numerous about the anterior extremity. No trace of an actual buccal cleft could be detected; and (except in the posterior portion of the body, where a large and very persistent vacuole was situated) the organism was everywhere densely packed with the large, homogeneous, biscuit-shaped particles. For many days these most active Infusoria seemed to undergo little change, though afterwards the number of the contained particles gradually began to diminish, whilst the body became more and more regularly ovoid, and a faint appearance of longitudinal striation manifested itself, more especially over its anterior half. At the same time a very faint and almost imperceptible mass ('nucleus') began to appear near the centre of the organism; and when examined with a magnifying power of 1,670 diameters, a lateral aperture (mouth) $\frac{1}{800}$" in diameter was seen, which was fringed by short active cilia, arranged like the spokes of a wheel. These peculiarities correspond very closely with those of an embryo *Nassula*. Very many were seen with similar characters; and multitudes existed in all conditions intermediate between this stage and that of the simpler organism which first emerged from the cyst."

Dr. Bastian concludes by saying:—

"It will, of course, be seen that the phenomena which I have described as taking place in the 'proligerous pellicle' may be watched by all who are conversant with such methods of investigation. We do not require to call in the aid of the chemist; we need exercise no special precautions; the changes in the pellicle are of such a kind that they can be readily appreciated by any skilled microscopist.

"Just as I have supposed that living matter itself comes into being by virtue of combinations and re-arrangements taking place amongst invisible colloidal molecules, so now does the study of the changes in the 'pellicle' absolutely demonstrate the fact that the visible new-born units of living matter behave in the manner which has been attributed to the invisible colloidal molecules. The living units combine, they undergo molecular re-arrangements; and the result of such a process of heterogenetic biocrasis is the appearance of larger and more complex organisms; just as the result of the combination and re-arrangement between the colloidal molecules was the appearance of primordial aggregates of living matter. Living matter is formed, therefore, after a process which is essentially similar to the mode by which higher organisms are derived from lower organisms in the pellicle on an organic infusion. All the steps in the latter process can be watched; it is one of synthesis—a merging of lower individualities into a higher individuality. And although such a process has been previously almost ignored in the world of living matter, it is no less real than when it takes place amongst the simpler elements of not-living matter. In both cases the phenomena are essentially dependent upon the 'properties' or 'inherent tendencies' of the matter which displays them."

Mathematical Society, March 14.—W. Spottiswoode, F.R.S., president, in the chair.—The President made a statement to the effect that it had been desirable to apply for a Charter, and that he had taken the requisite steps for ascertaining the right mode of procedure. The proposal made by the President being unanimously agreed to, the matter dropped.—A vote of thanks was passed to Mr. S. M. Drach for his present to the Society of two early and interesting works by Vieta and Ubaldi respectively.—The papers read were:—Prof. Clifford, "On a new expression of Invariants and Covariants by means of alternate numbers;" Hon. J. W. Strutt, "On the Vibrations of a gas contained within a rigid spherical cone." The former paper was concerned with methods given in "Vorlesungen über die complexen Zahlen und ihre Functionen," by Dr. Hermann Hankel (1867). In the latter paper the problem discussed was one referred to in a paper on the "Theory of Resonance," Phil. Trans., 1871. It is the only case of the vibration of air within a closed vessel which has hitherto been solved with complete generality. A result arrived at was that the pitch is about a fourth higher for the sphere than it is for a closed cylindrical pipe, whose length is equal the diameter of the sphere.—

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Mr. A. J. Ellis, F.R.S., communicated a question which had been forwarded to him by Prof. Haldeman, of Columbia, Pennsylvania, U.S., "The number of lines in a rhymed stanza being given, how many variations of rhyme-distribution does it admit of, suppose no line to be left without a rhyme?"

Victoria Institute, March 18.—Mr. Charles Brooke, F.R.S., in the chair.—Dr. Bateman on "Darwinism tested by recent Researches as to the Localisation of the Faculty of Speech." Having called attention to Mr. Darwin's statement, that the difference between man and the higher animals was only one of degree, and not of kind, he proceeded to show that such could not be the fact, and instanced the faculty of articulate language, a distinctive attribute of which there was no trace in the ape or other animals. After defining articulate language, he demonstrated that it was exclusively man's prerogative, and there was no analogy between it and the forms of expression common to the lower animals. He then stated that it had been thought that a particular part of the brain was the seat of language, and, if it were so, the Darwinian might contend that, as there was a certain similarity between the brain of man and of the ape and other animals, that they had the germs of the faculty. He then cited many cases which had been brought under the notice of German, French, American, English, and other surgeons, to show that even where various portions of the brain had been injured or destroyed, the faculty of speech remained. He concluded by stating that the faculty of articulate speech seemed to be an attribute, the comprehension of which was at present beyond us.

### Glasgow

Geological Society, February 8.—Sir William Thomson, LL.D., was elected president; Messrs. E. A. Wünsch, John Young, and James Thomson, F.G.S., vice-presidents.—Professor Young, the retiring president, delivered an address on "Rock Formations in relation to Geological Time." He concluded by expressing the pleasure he felt in resigning the chair to one so eminent in the walks of science as Sir William Thomson, whose contributions to theoretical geology had been of the utmost importance.—The President, in taking the chair, briefly thanked the members for the honour they had conferred upon him, and hoped he might be of some service to them in the prosecution of geological inquiry.

### Dublin

Natural History Society, March 6.—Professor E. Perceval Wright, president, in the chair.—The President delivered his inaugural address. He gave an interesting account of the history of the society from its commencement in 1838, when their meetings were held in Suffolk Street, and the opening address delivered by Mr. O'B. Bellingham. "There were then 104 members, and in 1840 the number had increased to 150. In 1844 the museum so increased that Mr. M'Coy was appointed curator, and he in 1845 laid a catalogue of the Irish animals in the museum before the society. This catalogue was printed and appended to the report for 1845-46. During these years many records of species new to Ireland were made. Very many valuable and interesting papers on zoological subjects were read. Many of these are to be found in full in the *Annals and Magazine of Natural History*. It is strange in looking over some of these to be reminded how great has been the development of some branches of natural science since they were written. Friends of many of us here—friends still living—many of them by no means yet full of days, yet wrote before the developmental stages of the crustacea were known, and could write of Spongilla as undoubtedly allied to the Diatomaceæ. About 1851 a few students in college, including myself, determined to form the University Natural Science Association, which is now amalgamated with the present society. Ere ceasing to speak of the College Society, let me pay a passing tribute to the memory of those who were our strong support, and who freely and generously held out to us that helping hand, and who have now left us for ever—Robert Ball, W. H. Harvey, A. H. Haliday, and A. Furlong; nor would it be seemly to forget all the encouragement and assistance given to us by the authorities of the College and the Regius Professor of Physic, or the loss we sustained when Allman, our Professor, counsellor, and friend was, by a hard fate, moved to succeed Forbes in Edinburgh."

## PAMPHLETS RECEIVED.

English.—The Dolmen Mounds and Amorpholithic Monuments of Brittany: S. P. Oliver, R.N.—Remarks on the successive Mining Schools of Cornwall: J. H. Collins.—The Unity of Man's Being: A. Diesterweg.—Modern Examples of Road and Railway Bridges, Part I.: Maw and Dredge—Transactions of the Institution of Engineers and Shipbuilders in Scotland—Quarterly Weather Report of the Meteorological Office, July-Sept., 1870.—Annual Report of the Geologists' Association, 1871.—Modern Science and the Bible; their Positive and Direct Antagonism.—The Study of Economic Botany: Jas. Collins.—Lord Derby on the United Kingdom Alliance.—Statistics of the Liquor Traffic: Rev. D. Burns.—19th Report of the Executive Committee of the United Kingdom Alliance.—The Deviation of the Compass in Iron Ships: W. H. Rosser.—Proceedings of the Geologists' Association.—Report of the Committee on Ships of War.—Report of the Case of H.M.S. *Megæra*.—Journal of the Iron and Steel Institute, February.—Catalogue of Microscopical Preparations of the Quekett Microscopical Club.—On the Mechanical Impossibility of the Descent of Glaciers by their Weight only: Canon Moseley.—French Farmers' Seed Fund Reports.—Eastbourne Natural History Society Report.—Journal of the Royal Dublin Society, No. 40.—Quarterly Journal of the Meteorological Society.

American & Colonial.—Hinrichs' School Laboratory of Physical Science, Nos. 3 and 4.—Experimental Steam Boiler Explosions: Prof Thurston.—Observations on Encke's Comet: Prof. C. A Young.—The Phœnix, for January, 1872.—Smithsonian Contributions to Knowledge; Converging series expressing the ratio between the diamater and circumference of a circle: W. Ferrel.—7th Annual Catalogue of the Massachusetts Institute of Technology.—The Lens, No. 1.—Proceedings of the American Philosophical Society, July-Dec., 1871.—Lecture on Water: C. F. Chandler.—Inaugural Lecture of the Department of Practical Science in M'Gill University: G. F. Armstrong.—Lectures delivered at the Industrial and Technical Museum at Melbourne during the Autumn Session of 1871.

Foreign.—Bericht der Kaiserliche Akademie der Wissenschaften zu Wien.—Bulletin de l'Académie Impériale des Sciences de St. Petersbourg.—Karte der Alpen in 8 kolorirten Blättern: Mayr u Berghaus.—Die Centralen Ortler-Alpen; nebst einem Anhange zu der Adamello-Presanella-Alpen: J. Payer.

## DIARY

*THURSDAY*, April 4.

Linnean Society, at 8.—On the Geographical Distribution of Compositæ: G. Bentham, President (concluded).
Chemical Society, at 8.

*FRIDAY*, April 5.

Geologists' Association, at 8.—On the Excavations on the Site of the Law Courts: Wilfrid H. Hudleston, and F. G. H. Price.—On Columnar Basalts: John Curry.
Archæological Institute, at 4.

*MONDAY*, April 8.

Royal United Service Institution, at 8.30.—H.M.S. *Agincourt* off, and off, the Pearl Rock: Commander R. H. Boyle, R.N.
Anthropological Institute, at 8.—Notes on the Hair of Oceanic Races: Dr. B. Davis.—Note on the Hair of a Hindostanee: Dr. H. Blanc.—On the Descent of the Esquimaux: Dr. Rink.

*TUESDAY*, April 9

Royal Institution, at 3.—Statistics and Social Science: Dr. Guy.
Photographic Society, at 8.—M. Merget's Mercury Process.

*WEDNESDAY*, April 10

Geological Society, at 8.—Notice of some of the Secondary Effects of the Earthquake of 10th January, 1869, in Cachar: Dr. Oldham, Calcutta, and Robert Mallet, F.R.S.—Notes on Atolls or Lagoon Islands: S. J. Whitnell. On the Glacial Phenomena of the Yorkshire Uplands: J. R. Dakyn.—Modern Glacial Action in Canada: Rev. W. Bleasdell, M.A.
Society of Arts, at 8.

*THURSDAY*, April 11.

Royal Society, at 8 30.
Society of Antiquaries, at 8.30.
Royal Institution, at 3.—Heat and Light: Dr. Tyndall.
Mathematical Society, at 8.—On the Mechanical Description of certain Sextic Curves: Prof. Cayley, V.P., F.R.S.

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