times the centre, for co-ordinated movements usually supposed to be the cerebellum, or, as it is often expressed, "one man gets drunk in his head, another in his legs." When the head is affected judgment becomes impaired, though memory and imagination may still be more active than usual. These faculties next fail, and the emotions become hilarious, pugnacious, or lachrymose. The spinal cord is generally unaffected even when the cerebellum is paralysed, and a man who is utterly unable to walk can still ride, the mere pressure of the saddle upon his thighs being sufficient to cause reflex contraction of his adductor muscles and fix him firmly on his seat, although the upper part of his body may be swaying about like a sack of wheat. The cord itself next becomes paralysed, and lastly the medulla oblongata, which regulates the respiratory movements.

After relating an anecdote illustrative of the effects of alcohol in hastening death during exposure to cold, Dr. Brunton remarked that, notwithstanding all these apparently injurious actions, alcohol was of great service when properly used. Many men came home from their offices completely exhausted, and the stomach, sharing the general exhaustion, is unable to digest the food which lies heavily in it, and incommoding instead of strengthening the individual.

A glass of sherry taken with the food will stimulate the stomach to increased action, and by the time the effect of the stimulus has passed away the food has digested and absorbed, and sustains the effect which the alcohol temporarily produced. When taken in considerable quantities for a long time, alcohol is apt to produce deposit of fat and fatty degeneration of organs, rendering a person not only less capable of work, but liable to uccumb to disease.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Dec. 11.—"Researches in Spectrum-Analysis in connection with the Spectrum of the Sun."—Part III., by J. Norman Lockyer, F.R.S.

The paper commences with an introduction, in which the general line of work since the last paper is indicated. Roughly speaking, this has been to ascertain the capabilities of the new method in a quantitative direction. It is stated that while qualitative spectrum-analysis depends upon the *positions* of the lines, quantitative spectrum-analysis on the other hand depends not on position but on the *length*, *brightness* and *thickness* of the lines.

The necessity of maps carefully executed and showing the individuality of each line is shown; and it is stated that the execution of these maps required the use of the electric arc to render the vapours of the metals incandescent. A battery of 30 Grove's cells of one pint capacity was accordingly employed in the researches about to be described.

The difficulties of eye-observations of the characters of the lines compelled the application of photography, another reason for the use of which existed in the facility it afforded for confronting spectra with each other, and so eliminating coincident lines, since the lines, if due to impurities, would be longest and thickest in the spectrum to which they really belonged.

The portion of the spectrum at present worked upon is that from H to F.

Another branch of the research has been the construction of a Table of all the named Fraunhofer lines, showing the lengths and thicknesses of the metallic lines to the absorption of which they were due; this Table enabled the author to allocate upwards of 50 lines in the solar spectrum, presumably overlooked by Angström and Thalén. The table was intended as a preliminary to a new photographic map of the spectrum from H to F, on a larger scale than Angström's, which was intended to clear away all the difficulties touching coincidences, and to have below it complete maps of all the solar elements with their long and short lines. This map is incomplete at present, but is making rapid progress

A preliminary search for elements supposed not to be in the sun has also been commenced.

Of the above-named researches the subsequent parts of the paper refer to:—

I. The experiments made on a possible quantitative spectrum-analysis.

II. The method of photographing spectra adopted.

III. The coincidences of spectrum lines.

IV. The preliminary inquiry into the existence in the sun of elements not previously traced.

I. *The Experiments made on a possible quantitative Spectrum-Analysis*

After the two former papers were sent in to the Royal Society, an investigation of the general changes undergone by spectra given by alloys was commenced.

A micrometer eye-piece was mounted on the observing-telescope of the spectroscope. With this the following phemonena were observed:—

I. The lines which remained varied their length as the percentage of the elements to which they were due varied.

II. Some of the lines appreciably varied their thickness or brightness, or both in the same way.

III. In cases where the brightness of a line was estimated through a considerable range of percentage composition by comparison with an air-line, the air-line was observed to grow faint and then disappear as the lightness of the metallic lines increased.

IV. In cases where the brightness or thickness of the line of one element was estimated by comparison with the line adjacent of the other constituent of the alloy, the point of equal brightness was observed to ascend or descend; this method was used to avoid the uncertainty of micrometric measurements of the tips of the lines in consequence of their variation in length due to the unequal action of the spark.

V. In some cases where the percentage of a constituent was so small that none of its lines were visible, there yet seemed to be an effect produced on the vapour of the opposite pole.

As these conclusions were derived from coarse alloys, and it was desirable to observe the effect of very fine gradation, Mr. C. Freemantle, the Deputy Master of the Mint, was begged to allow observations to be made on the gold-copper and silver-copper coinage alloys, and he immediately responded most cordially to the request.

Examples of the behaviour of some coarse alloys of silver and lead are given; they were irregular in their action, but it was observed that silver lines remained in the alloy as long as from ·05 to ·02 per cent. of silver was present. The alloys, however, were very unequal. Experiments on cadmium and tin alloys are described, the cadmium forming 10, 5, 1·0, 0·15 per cent. In the last but one cadmium line was permanent; in the first at least five were seen. In an alloy of 0·099 per cent. of cadmium with a mixture of lead, tin, and zinc constituting the rest of the alloy, the behaviour of the cadmium lines was sensibly the same as in a mixture of 0·1 per cent. of cadmium and 99·9 of tin.

In the Mint-specimens the same phenomena were observed *en petit*, as the coarser alloys showed *en grand*. In a gold-copper alloy $\frac{1}{1000}$ increase in the gold made the lines shorter, and a similar increase in the copper made them longer.

In the silver-copper alloy an increase of $\frac{1}{1000}$ in the silver lengthened the lines, a similar increase in the copper shortened them.

These phenomena can be explained by assuming such alloys to be different physical things, and that the spark acts upon the alloy as a whole as well as upon each vapour separately.

Thus in these Mint alloys, copper is common to both, and their melting-points are:—

Gold . . . 1200° (Pouillet).
Copper . . 1200° to 1000°, the precise point not determined.
Silver . . 1000° (Pouillet).

The intermediate position of copper explains the different action on its lines of gold and silver.

II. *The Method of photographing Spectra adopted*

A camera carrying a 5 × 5-inch plate and a 3-inch lens of 23 in. focus, replaced the observing-telescope of the spectroscope. The lens focused from 3900 to 4500 very fairly upon the plate. The beam passing through collimator and prisms was, as in Mr. Rutherford's researches, very small. As the electric arc in its usual vertical position gave all the lines from pole to pole, the lamp was placed on its side, and the arc used in a horizontal position, the slit being vertical. The dense core of the arc then gave all the short lines in the centre of the field, the longer ones extending beyond them on either side. In order to obtain a scale, it was resolved to photograph the solar spectrum immediately adjacent to the metallic spectrum under examination.

To effect this a portion of the slit was covered up while the solar spectrum passed through the free part, and then the part used for the solar spectrum was covered, while the formerly covered part was opened for the metallic spectrum. This was effected by a shutter, with an opening sliding in front of the slit; a diagram of its action and form is given.

The arrangement of the spectroscope, heliostat, &c., for obtaining the sun's light is described. The image of the sun was brought to a focus between the poles of the lamp by an extra lens interposed between the lamp and the heliostat.

The use of the shutter enables us to compare either two or more spectra upon a single plate, or the solar spectrum may be compared with two metallic spectra, being made to occupy the position between the two.

III. *On the Lines coincident in different Spectra*

The bearing of the former papers on the lengths of the lines of the elements is briefly recapitulated.

The examination of the various spectra of metals and alloys indicated the great impurity of most of the metals used, and suggested the possibility of the coincidences observed by Thalén and others being explained in the light of former work.

It is observed that coincidences are particularly numerous in the spectra of iron titanium, and calcium, and that nearly every other solar metallic spectrum has one or more lines coincident with lines of the last element. These coincident lines are, as a rule, very variable in length and intensity in various specimens of the metals in which they occur, and are sometimes altogether absent.

One of the longest calcium lines, that at wave-length 4226·3, is also seen in the strontium spectrum as a line of medium length, and 4607·5, a very long line in strontium, appears in calcium as a short line. Another very long strontium line, 4215·3, is asserted by Thalén to be seen in calcium; but the author has never seen it till lately, and *then only in a specimen of calcium known to contain strontium.*

We have here, then, a case of coincident lines, in which the one that is long and bright in one spectrum is short and faint in the other, and a case of a line said to be coincident in two spectra being, though always visible in one, sometimes absent in the other of them, and only appearing in it when the two substances were mixed. The hypothesis of impurity at once explains the whole case, even without the third line, which renders the fact of mixture certain.

The longest lines of calcium occur in iron, cobalt, nickel, barium, strontium, &c., and the longest lines of iron occur in calcium, strontium, barium, and other metals.

Other cases are adduced, and the following general statements are hazarded, with a premise that further inquiry may modify them.

1. If the coincident lines of the metals be considered, those cases are rare in which the lines are of the first order of length in all the spectra to which they are common: those cases are much more frequent in which they are long in one spectrum and shorter in the others.

2. As a rule, in the instances of those lines of iron, cobalt, nickel, chromium, and manganese which are coincident with lines of calcium, the calcium lines are long, while the lines as they appear in the spectra of the other metals are shorter than the longest lines of those metals. Hence we are justified in assuming that short lines of iron, cobalt, nickel, chromium, and manganese, coincident with long and strong lines of calcium, are really due to traces of the latter metal occurring in the former as an impurity.

3. In cases of coincidences of lines found between various spectra the line may be fairly assumed to belong to that one in which it is longest and brightest.

A description of some photographs of spectra is then given, a photograph of the coincident lines of calcium and strontium being amongst them, and proving that strontium occurs in the sun; and the section concludes with a brief description of the method employed in making the new map, showing lengths and thicknesses, and enumerating coincident lines. This is done thus: papers are pasted on to photographs of the solar spectrum on glass; the lengths of the lines of the metallic spectrum under examination (*e.g.* that of iron) are marked on this paper in prolongation of the solar lines to which they correspond. They are then copied upon a map, and another piece of paper being fixed down, another spectrum is proceeded with in the same way.

IV. *The Preliminary Inquiry into the Existence of Elements in the Sun not previously traced*

The previous researches having shown that the former test for the presence or absence of a metal in the sun, namely, the presence or absence of its brightest or strongest lines in the average solar spectrum, was not conclusive, a preliminary search for other metals was determined on; and as a guide, Mr. R. J. Friswell was requested to prepare two lists, showing broadly the chief chemical characteristics of the elements traced and not traced in the sun.

The tables showed that in the main those metals which had been traced formed stable compounds with oxygen.

The author therefore determined to search for the metals which formed strong oxides, but which had not yet been traced.

The result up to the present time has been that *strontium, cadmium, lead, cerium,* and *uranium* would seem with considerable probability to exist in the solar reversing layer. Should the presence of *cerium* and *uranium* be subsequently confirmed, the whole of the iron group of metals will thus have been found in the sun.

Certain metals forming unstable oxides, such as gold, silver, mercury, &c., were sought for and not found. The same was the case when chlorine, bromine, iodine, &c., were sought by means of their lines produced in tubes by the jar-spark. These elements are distinguishable as a group by forming compounds with hydrogen.

It is observed that certain elementary and compound gases effect their principal absorption in the most refrangible part of the spectrum when they are rare, and that as they become dense the absorption approaches the less refrangible end; that the spectra of compounds are banded or columnar, the bands or columns lying at the red end of the spectrum; that the absorption spectra of chlorine, iodine, bromine, &c., are columnar, and that these are broken up by the spark just as the band spectra of compounds are broken up: and that it is probable that no compounds exist in the sun. The following facts, gathered from the work already accomplished by Rutherford and Secchi are stated:—

There are three classes of stars:—

1. Those like Sirius, the brightest (and therefore hottest?) star in the northern sky, their spectra showing only hydrogen lines very thick, and metallic lines exceedingly thin.

2. A class of stars with a spectrum differing only in degree from those of the class of Sirius, and to this our sun belongs.

3. A class of stars with columnar or banded spectra indicating the formation of compounds.

The question is asked whether all the above facts cannot be grouped together in a working hypothesis, which assumes that in the reversing layers of the sun and stars various degrees of "celestial dissociation" are at work which prevents the coming together of the atoms which, at the temperature of the earth, and at all artificial temperatures yet attained here, form the metals, the metalloids, and compounds.

In other words, the metalloids are regarded as *quasi* compound bodies when in the state in which we know them; and it is supposed that in the sun the temperature is too great to permit them to exist in that state in the reversing layer, though they may be found at the outer portions of the chromosphere or in the corona.

It is suggested that if this hypothesis should gain strength from subsequent work, stony meteorites will represent the third class of metalloidal or compound stars, and iron meteorites the other, or metallic stars.

The paper concludes as follows:—

"An interesting physical speculation connected with this working hypothesis is the effect on the period of duration of a star's heat which would be brought about by assuming that the original atoms of which a star is composed are possessed of the increased potential energy of combination which this hypothesis endows them with. From the earliest phase of a star's life the dissipation of energy would, as it were, bring into play a new supply of heat, and so prolong the star's life.

"May it not also be, if chemists take up this question, which has arisen from the spectroscopic evidence of what I have before termed the plasticity of the molecules of the metalloids taken as a whole, that much of the power of variation which is at present accorded to metals may be traced home to the metalloids? I need only refer to the fact that, so far as I can learn, all so called changes of atomicity take place when metalloids are involved, and not when the metals alone are in question.

"As instances of these, I may refer to the triatomic combinations formed with chlorine, oxygen, sulphur, &c. in the case of tetrad or hexad metals. May not this be explained by the plasticity of the metalloids in question?

"May we not from these ideas be justified in defining a metal, provisionally, as a substance the absorption spectrum of which is generally the same as the radiation spectrum, while the metalloids are substances the absorption spectrum of which, generally, is not the same?

"In other words, in passing from a hot to a comparatively cold state, the plasticity of these latter comes into play, and we get a new molecular arrangement. Hence are we not justified in asking whether the change from oxygen to ozone is but a type of what takes place in all metalloids?"

Abstract of paper "On the Quantitative Analysis of certain Alloys by means of the Spectroscope," by J. Norman Lockyer, F.R.S., and William Chandler Roberts, Chemist of the Mint.

The authors, after referring to experiments which showed clearly that the spectroscope might be employed to detect minute differences in the composition of certain alloys, proceed to give an account of the researches which they had instituted with a view to ascertain the degree of accuracy of which the method is capable.

The image of an electric-spark passing between the unknown alloy and a fixed electrode being thrown by means of a lens on the slit of the spectroscope, the phenomena observed were found to vary with the composition of the alloys; and further, by arranging them together with known check-pieces on a suitable stand, and bringing them in turn under the fixed electrode, the composition of the unknown alloys was determined by comparison with the known check-pieces.

The shape of the electrode ultimately adopted was stated; the pieces were held in their places by suitable metallic clips. Special attention was then directed to the adjustment of the length of the spark, which was found to materially influence the phenomena. The method adopted consisted in placing the variable electrode in the field of a fixed microscope having a 3- or 4-inch objective, and adjusting the summit of this electrode to coincide with the spider lines of the eye-piece.

After a series of experiments on alloys of zinc and cadmium of various compositions, the results of which were shown on a curve, more extended trials were made with the gold-copper alloy employed in coinage, which was peculiarly suited to these researches in consequence of the known method of assay having been brought to so high a state of perfection (the composition being determined with accuracy to the $\frac{1}{10000}$ part of the original assay-piece of about 7 grains), and from the fact that reliance can be placed on its homogeneity. The paper is accompanied by a series of four curves, which show the results of experiments, and in which the coördinates are given by the ordinary method of assay, and by the spectroscopic readings.

The chief practical advantage which appeared to flow from this inquiry was that, if it were possible to replace the parting assay by the spectroscopical method, a great saving of time in ascertaining the value of gold bullion would be effected.

Institution of Civil Engineers, Dec. 9.—T. Hawksley, president, in the chair.—"On the Geological Conditions affecting the Constructing of a Tunnel between England and France," by Mr. Joseph Prestwich, F.R.S. The author reviewed the geological conditions of all the strata between Harwich and Hastings on one side of the Channel, and between Ostend and St. Valery on the other side, with a view to serve as data for any future projects of tunnelling, and to show in what directions inquiries should be made. The points considered were the lithological characters, dimensions, range and probable depth of the several formations. The London clay, at the mouth of the Thames, was from 200 feet to 400 feet thick, while under Calais it was only 10 feet, at Dunkirk it exceeded 264 feet, and at Ostend it was 448 feet thick. He considered that a trough of London clay from 300 feet to 400 feet, or more, in thickness extended from the coast of Essex to the coast of France, and, judging from the experience gained in the Tower Subway, and the known impermeability and homogeneity of this formation, he saw no difficulty, from a merely geological point of view, in the construction of a tunnel, but for the extreme distance —the nearest suitable points being 80 miles apart. The lower Tertiary strata were too unimportant and too permeable for tunnel work. The chalk in this area was from 400 feet to 1,000 feet thick; the upper beds were soft and permeable, but the lower beds were so argillaceous and compact as to be comparatively impermeable. In fact, in the Hainaut coal fields they effectually shut out the water of the water-bearing tertiary strata from the underlying coal measures. Still, the author did not consider even the lower chalk suited for tunnel work, owing to its liabilty to fissures, imperfect impermeability, and exposure in the Channel. The gault was homogeneous and impermeable, but near Folkstone it was only 130 ft. thick reduced to 40 ft. at Wissant, so that a tunnel would hardly be feasible. The Lower Greensands, 260 ft thick at Sandgate, thinned off to 50 ft. or 60 ft. at Wissant, and were all far too permeable for any tunnel work. Again, the Wealden strata, 1,200 ft. thick in Kent, were reduced to a few unimportant rubbly beds in the Boulonnais. To the Portland beds the same objections existed as to the Lower Greensands, both were water-bearing strata. The Kimmeridge clay was 360 ft. thick near Boulogne, and no doubt passed under the Channel, but in Kent it was covered by so great a thickness of Wealden strata as to be almost inaccessible; at the same time it contained subordinate water-bearing beds. Still, the author was of opinion that, in case of the not improbable denudation of the Portland beds, it might be questionable to carry a tunnel in by the Kimmeridge clay on the French coast, and out by the Wealden beds on the English coast. The oolitic series presented conditions still less favourable, and the lower beds had been found to be water-bearing in a deep artesian well recently sunk near Boulogne. The experimental deep-boring now in progress near Battle would throw much light on this part of the question. The author then passed on to the consideration of the Palæozoic series, to which his attention was more particularly directed while making investigations, as a member of the Royal Coal Commission, on the probable range of the coal measures under the south-east of England. He showed that these rocks, which consisted of hard Silurian slates, Devonian and carboniferous limestone and coal measures, together 12,000 ft. to 15,000 ft. thick, passed under the chalk in the North of France, outcropped in the Boulonnais, were again lost under newer formations near to the coast, and did not reappear until the neighbourhood of Frome and Wells was reached. But, although not exposed on the surface, they had been encountered at a depth of 1,032 ft. at Calais, 985 ft. at Ostend, 1,026 ft. at Harwich, and 1,114 ft. in London. They thus seemed to form a subterranean table land of old rocks, covered immediately by the chalk and Tertiary strata. It was only as the southern flank of this old ridge that the Jurassic and Wealden series set in, and beneath these the Palæozoic rocks rapidly descended to great depths. Near Boulogne these strata were already 1,000 ft. thick; and at Hythe the author estimated their thickness might be that or more. Supposing the strike of the coal measures and the other Palæozoic rocks to be prolonged from their exposed area in the Boulonnais across the Channel, they would pass under the Cretaceous strata somewhere in the neighbourhood of Folkestone, at a depth estimated by the author at about 300 ft., and near Dover at about 600 ft., or nearly at the depth at which they had been found under the chalk at Guines, near Calais, where they were 665 ft. deep. These Palæozoic strata were tilted at high angles, and on the original elevated area they were covered by horizontal Cretaceous strata, the basement beds of which had filled up the interstices of the older rocks as though with a liquid grouting. The overlying mass of gault and lower chalk also formed a barrier to the passage of water so effectual, that the coal measures were worked without difficulty under the very permeable Tertiary and upper chalk of the North of France; and in the neighbourhood of Mons, notwithstanding a thickness of from 500 ft. to 900 ft. of strata charged with water, the lower chalk shut the water out so effectually that the coal measures were worked in perfect safety, and were found to be perfectly dry under 1,200 ft. of these strata combined. No part of the Straits exceeded 186 ft. in depth. The author, therefore, considered that it would be perfectly practicable, so far as safety from the influx of the sea water was concerned, to drive a tunnel through the Palæozoic rocks under the Channel between Blanc Nez and Dover, and he stated that galleries had actually been carried in coal, under less favourable circumstances, for two miles under the sea near Whitehaven. But while in the case of the London clay the distance seemed almost an insurmountable bar, here again the depth offered a formidable difficulty. As a collateral object to be attained, the author pointed to the great problem of the range of the coal measures from the neighbourhood of Calais in the direction of East Kent, which a tunnel in the Palæozoic strata would help to solve. These were, according to the author, the main conditions which bore on the construction of a submarine tunnel between England and France. He was satisfied that on geological grounds alone, it was in one case perfectly practicable, and in one or two others it was possibly so; but there were other considerations besides those of a geological nature, and whether or not they admitted of so favourable a solution was questionable. In any case, the author would suggest that, the one favourable solution admitted, it might be desirable, in a question involving so many and such great interests, not to accept an adverse verdict without giving all those considerations the attention and deliberation which the importance of the subject deserved. Granting the possibility of the work in a geological point of view, there were great and formidable engineering difficulties; but the vast progress made in engineering science during the last half century, led the author to imagine that they would not prove insurmountable, if the necessity for such a work were to arise, and the cost were not a bar.

Royal Astronomical Society, Dec. 14.—Prof. Cayley, president, in the chair.—Prof. Pritchard gave a verbal account of the Physical Observatory about to be established at Oxford. He said that the University authorities had been induced to grant a site for a physical observatory in the noble park of sixty acres, which they had recently thrown open to the public. He had been anxious that such a site should not be disgraced by an unsightly building such as observatories usually were. He found himself fortunately situated in having amongst his old pupils Mr. Barry, the well-known architect, who had furnished them with a design which he showed to the meeting, and had devised, amongst other things, a dome with a fine broad shutter, which he trusted would be really ornamental as well as useful. There would be a central tower of three rooms, one above the other; the basement room would be used for storage; above would be the professor's room; and in the floor above that would be mounted the noble reflector which had been presented to the University by Dr. De La Rue. In a side wing there would be a transit instrument to be used for educational purposes, and another telescope which he hoped would be well worked by members of the University. Mr. Barry informed the society that their new rooms at Burlington House would probably be ready by the middle of April.—Capt. Noble mentioned to the society that in the new volume of the *Nautical Almanac* for 1877 tables of Uranus were given, but it was no credit to England that we should have been kept waiting for them until they were presented to us from across the Atlantic by the labour of Prof. Simon Newcomb.

Entomological Society, Dec. 1.—H. T. Stainton, F.L.S., vice-president, in the chair.—Mr. Bond exhibited a hybrid specimen between *Clostera curtula* and *C. reclusa* partaking of the characters of both parents.—Mr. Jenner Weir exhibited specimens of a minute Hymenopterous insect (a species of *Psen*), which he had observed in large numbers (probably 150) in June last on a pear leaf at Lewes. They had congregated together on the surface of the leaf like a swarm of bees, though it was not apparent what motive brought them together.—Mr. Dunning read extracts from a letter from New Zealand stating that the red clover had been introduced into that colony, but that they had no humble bees to fertilise the plant. Also that certain Lepidopterous insects had been accidentally imported into the islands, but that the corresponding Ichneumon flies were wanted to keep down their numbers. It was suggested that the nests of humble bees might be imported, when the bees were in a dormant condition, keeping them in that state (by means of ice) during the voyage.—Mr. Baly communicated a paper on the Phytophagous Coleoptera of Japan, being a continuation of a former paper on the same subject.—Mr. Bates communicated a supplementary paper on the Longicorn Beetles recently brought from Chontales, Nicaragua, by Mr. Thomas Belt.—Mr. W. H. Miskin, of Queensland, communicated criticisms on Mr. Masters' Catalogue of the described species of Diurnal Lepidoptera of Australia.—A fourth portion of the catalogue of British Insects, now being published by the society, was on the table. It contained the Hymenoptera (*Oxyura*), by Rev. T. A. Marshall, M.A.

PARIS

Academy of Sciences, Dec. 8.—M. de Quatrefages, president, in the chair.—The president announced the death of M. Cl. Gay, member of the Botanical Section; and the Perpetual Secretary also announced the death of the well-known mineralogist, C. F. Naumann, Corresponding Member of the Mineralogical Section.—The following papers were read:—An answer to M. Pasteur's paper on the origin of beer yeast, by M. A. Trécul. The author contradicted M. Pasteur's statement that the development of *Pencillium glaucum* from *putrid* yeast was an admitted fact. On the contrary, it had been observed to develop itself from perfectly healthy yeast.—On the vitreous substances found included in Santorin lava, by M. F. Fouqué.—On the determination of the ratio of two specific heats by the compression of a limited volume of gas, by M. E. H. Amgat.—On the distribution of the neolithic populations in the department of the Oise, by M. R. Guérin.—On the habits of the *Phylloxera* (continued), by M. Max. Cornu.—A further notice on the connection of storms and sunspots as observed at Paris and Fécamp was received from M. Poëy.—Preliminary note on the elements existing in the sun, by Mr. Norman Lockyer. M. Berthelot then criticised the paper. He held that the phenomena of specific heat, &c., indicated that the elements, so-called, were on a very different basis from the compounds, and that the phenomena they presented in this respect could not be explained if they were not regarded as actually simple bodies. M. Dumas thought that, as he had himself maintained before the Academy, elements ought only to be regarded as elements in relation to human experience and not as absolute elements, a fact which he considered Lavoisier to have established. He considered that modern experiments tended to confirm this opinion.—Note on the identity of Cauchy's formulæ for the determination of the conditions of convergence of Lagrange's series with those given by Lagrange himself, by M. L. F. Ménabréa.—On the November meteors, by M. Wolf.—Note on Faye's periodic comet and on the discovery and observations of twenty nebulæ made at the Marseilles observatory, by M. E. Stephan.—On the movement of an elastic wire one end of which has a vibratory motion, by M. E. Mercadier.—Observations on the action of certain poisons on sea fish, by MM. A. Rabuteau and F. Papillon.—On the embryo cell of the egg of osseous fish, by M. Balbiani.—On the age of the dental follicle in the *mammiferæ*, by MM. E. Magitot and Ch. Legros.—On the use of electrical cauterisation in surgical operations, by MM. Ch. Legros and Onimus.—On the Ostrœacious marl of Fresnes-lès-Rungis (Seine), by M. Stan. Meunier.—Note on a meteor observed at Versailles on Dec. 3, by M. Martin de Brettes.—New analysis of the water of St. Thiébaut's fountain at Nancy, by M. P. Guyot.—Studies on certain combustibles from the basin of Donetz and Toula, Russia, by MM. Scheurer-Kestner and Meunier-Dollfus.

BOOKS RECEIVED

ENGLISH.—Guide to Latin Prose: R. M. Millington (Relfe).—Wild Animals: Wolf (Macmillan & Co.).—Problems of Life and Mind: George Henry Lewes (Trübner & Co.).—Theory of Attraction. 2 vols.: Todhunter (Macmillan & Co.).—The Borderland of Science: R. A. Proctor (Smith, Elder & Co.).—Memoir of Mary Somerville: Martha Somerville (John Murray).—Manual of Comparative Anatomy and Physiology: J. M. Bradley (Simpkin and Marshall).—The River Amazon: H. W. Bates (John Murray).—The Chase: Somerville (W. Tegg).—Virgil's Eclogues. Translated: Millington (Longmans).—Quantitative Chemical Analysis. 6th edition: Fresenius (Churchill).—Nautical Almanac, 1877 (John Murray).—The Simplicity of Life: Dr. Ralph Richardson (H. K. Lewis).—Introduction to Quaternions: Kelland and Tait (Macmillan).—Free-thinking and Plain Speaking: Leslie Stephens (Longmans).—United States Geological Survey. 6th Annual Report: F. W. Haydyn (Trübner & Co.).—Harvest of the Sea: Bertram (John Murray).—Mountain, Meadow, and Mere: G. C. Davies (H. S. King & Co.).—Legal Handbook for Architects: Jenkins and Raymond (H. S. King & Co.).—The Conservation of Energy: Balfour Stewart (H. S. King & Co.).—Telegraphic Journal, vol. i. (Gillman).—Primer of Geology: A. Geikie (Macmillan & Co.).—Darwinism and Design: G. St Claire (Hodder & Stoughton).—From January to December (Longmans).—Pheasants for Coverts and Aviaries: W. B. Tegetmeier (Horace Cox).

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