that no great damage was done to buildings is ascribed to the movement being chiefly vertical. The horizontal direction is stated by an observer to be from south-west to north-east, and by another from north-east to south-west.

SCHOPENAUER'S treatise on the "Philosophy of vision and colours," which originally appeared upwards of fifty years ago, and which has hitherto been treated with unmerited neglect by the great writers on physiological optics, has just reached a third edition. An interleaved and annotated copy of the second edition prepared by the author himself in 1854 was found amongst his papers, and has formed the basis for the present "improved and augmented" reissue, which appears under the editorship of Julius Frauenstädt.

WE desire to call special attention to the singularly interesting address of the new Rector of the University of Vienna, Carl von Littrow, on a subject which does not at first sight appear to be of a very interesting character, viz., the backwardness of the ancients in the sciences. This backwardness he ascribes, firstly, to an actual want of the power of accurate observation; and, secondly, to a restless spirit of speculation. The illustrations of these positions are drawn from astronomy, the science to which in early times the greatest care was devoted. Of the instances adduced to show that the ancients, notwithstanding their fine feeling for form, evidenced in the remains of classic art, had not even the most primitive power of observation, we may mention the following. According to the elder Pliny, whose estimate is very much higher than those of Hipparchus and Ptolemy as recorded in the Almagest, the number of fixed stars is 1,600; whereas, in our own day, Argelander, working in such a comparatively unfavourable climate as Bonn, records on his maps no less than 3,256 stars visible to the naked eye. Again, Argelander gives nineteen as the number of nebulæ and star-clusters visible in our latitudes, while Hipparchus mentions only two, and Ptolemy but five; both of these observers entirely passing over such remarkable objects as the nebulæ in Orion and in Andromeda. The group of the Pleiades was considered of great importance for ancient navigation, and was constantly watched; and yet only seven of its stars were discovered. Indeed most of the early observers could only see six; the seventh was lost sight of for centuries; and ultimately, when the middle star in the tail of the Great Bear first attracted attention, the conclusion arrived at was that the latter was the missing seventh star of the Pleides. Nowadays cases are known of people who are not astronomers seeing from fourteen to sixteen stars in the Pleiades; and it is by no means uncommon for persons of good sight to see eleven. The star a in Capricornus was seen by man for thousands of years without its being noted that it is a double star, a fact that any child would discover now if its attention were directed to it. It would be interesting to know what is the capacity of individuals of savage races as regards discriminating celestial objects. Light might then be thrown upon the question, how far the observational defects of the early astronomers were due to mere carelessness, and how far we inherit a schooled eye from genetions of ancestors who gradually accustomed themselves to the accurate discrimination of external objects.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 9.—Dr. W. A. Miller, V.P., in the chair. The following papers were read:—

"Spectroscopic Observations of the Sun."—No. V. By J. Norman Lockyer, F.R.S.

The author first referred to several new facts of importance as follows:

"I. The extreme rates of movement in the chromosphere observed up to the present time are—

Vertical movement	40	miles a second
Horizontal or cyclonic movement.	120	,,

"II. I have carefully observed the chromosphere when spots have been near the limb. The spots have sometimes been accompanied by prominences, at other times they have not been so accompanied. Such observations show that we may have spots visible without prominences in the same region, and prominences without spots; but I do not say that a spot is not accompanied by a prominenee *at some stage of its life*, or that it does not result from some action which, in the majority of cases, is accompanied by a prominence.

"III. At times, when a prominence is seen bright on the sun itself, the bright F line varies considerably, both in thickness and brilliancy, within the thickness of the dark line. The appearances presented are exactly as if we were looking at the prominences through a grating.

"IV. Bright prominences, when seen above spots on the disk, if built up of other substances besides hydrogen, are indicated by the bright lines of those substances in addition to the lines of hydrogen. The bright lines are then seen very thin, situated centrally (or nearly so) on the broad absorption-bands caused by the underlying less-luminous vapours of the same substances.

"V. I have at last detected an absorption-line corresponding to the orange line in the chromosphere. Father Secchi states* that there is a line corresponding to it much brighter than the rest of the spectrum. My observation would seem to indicate that he has observed a bright line less refrangible than the one in question, which bright line is at times excessively brilliant. It requires absolutely perfect atmospheric conditions to see it in the ordinary solar spectrum. It is best seen in a spot-spectrum when the spot is partially covered by a bright prominence.

"VI. In the neighbourhood of spots the F bright line is sometimes observed considerably widened out in several places, as if the spectroscope were analysing injections of hydrogen at great pressure in very limited regions into the chromosphere.

"VII. The brilliancy of the bright lines visible in the ordinary solar spectrum is extremely variable. One of them, at 1871·5, and another, at 1529·5 of Kirchhoff's scale, I have detected in the chromosphere at the same time that they were brilliant in the ordinary solar spectrum.

"VIII. Alterations of wave-length have been detected in the sodium-, magnesium-, and iron-lines in a spot-spectrum. In the case of the last substance, the lines in which the alteration was detected were *not* those observed when iron (if we accept them to be due to iron alone) is injected into the chromosphere.

"IX. When the chromosphere is observed with a tangential slit, the F bright line close to the sun's limb shows traces of absorption, which gradually diminish as the higher strata of the chromosphere are brought on to the slit, until the absorption-line finally thins out and entirely disappears. The lines of other substances thus observed do not show this absorption.

"X. During the most recent observations, I have been able to detect traces of magnesium and iron in nearly all solar latitudes in the chromosphere. If this be not merely the result of the good definition lately, it would indicate an increased general photospheric disturbance as the maximum sunspot period is approached. Moreover, I suspect that the chromosphere has lost somewhat of its height."

The author appends a list of the bright lines, the position of which in the chromosphere have been determined absolutely, with the dates of discovery, remarking that in the case of C and F his observations were anticipated by M. Janssen:—

Hydrogen

C.	October 20, 1868.
F.	October 20, 1868.
near D.	October 20, 1868.*

[* *Hydrogen?*—G. G. S.]

near G.	December 22, 1868.
h.	March 14, 1869.

Sodium

D.	February 28, 1869.

Barium

1989·5†	March 14, 1869.
2031·2	July 5, 1869.

Magnesium and included line

b^1, b^2, b^3, b^4	February 21, 1869.

* *Comptes Rendus*, 1869, 1 sem. p. 358.

† This reference is to Kirchhoff's scale.

Other Lines.

Iron	1474.	June 6, 1869.
?	1515·5.	June 6, 1869.
Bright line	1529·5.	July 5, 1869.
?	1567·5.	March 6, 1869.
?	1613·8.	June 6.
Iron	1867·0.	June 26.
Bright line	1871·5.	,,
Iron	2001·5.	,,
?	2003·4.	,,
? band or line near black line, very delicate . . .	2054·0.	July 5.

Other lines besides these have been seen at different times; but their positions have not been determined absolutely.

The author points out that taking iron as an instance, and assuming that the iron-lines mapped by Ångström and Kirchhoff are due to iron only, he has only been able, up to the present time, to detect three lines out of the total number (460) in the spectrum of the lower regions of the chromosphere,—a fact full of promise as regards the possible results of future laboratory work. The same remark applies to magnesium and barium.

The paper then proceeded as follows :—

"Dr. Frankland and myself have determined that the widening out of the sodium-line in the spectrum of a spot which I pointed out in 1866, and then stated to be possibly an evidence of greater absorption, indicates a greater absorption due to greater pressure.

"The continuous widening out of the sodium-line in a spot must therefore be regarded as furnishing an additional argument (if one were now needed) in favour of the theory of the physical constitution of the sun first put forward by Dr. Frankland and myself—namely, that the chromosphere and the photosphere form the true atmosphere of the sun, and that under ordinary circumstances the absorption is continuous from the top of the chromosphere to the bottom of the photosphere, at whatever depth from the bottom of the spot that bottom may be assumed to be.

"This theory was based upon all our observations made from 1866 up to the time at which it was communicated to the Royal Society and the Paris Academy of Sciences, and has been strengthened by all our subsequent work; but several announcements made by Father Secchi to the Paris Academy of Sciences and other learned bodies are so opposed to it, and differ so much from my own observations, that it is necessary that I should refer to them, and give my reasons for still thinking that the theory above referred to is not in disaccord with facts.

"Father Secchi states that the chromosphere is often separated from the photosphere, and that between the chromosphere and the photosphere there exists a stratum giving a continuous spectrum, which he considers to be the base of the solar atmosphere, and in which he thinks that the inversion of the spectrum takes place.

"With regard to the first assertion, I may first state that all the observations I have made have led me to a contrary conclusion. Secondly, in an instrument of comparatively small dispersive power, such as that employed by Father Secchi, in which the widening out of the F line at the base of the chromosphere is not clearly indicated, it is almost impossible to determine, by means of the spectroscope, whether the chromosphere rests on the sun or not, as the chromosphere is an envelope and we are not dealing merely with a section. But an instrument of great dispersive power can at once settle the question; for since the F line widens out with pressure, and as the pressure increases as the sun is approached, the continuous curvature of the F line must indicate really the spectrum of a section; and if the chromosphere were suspended merely at a certain height above the photosphere, we should not get a widening due to pressure: but we always do get such a widening.

"With regard to the second assertion, I would remark that if such a continuous-spectrum-giving envelope existed, I entirely fail to see how it could be regarded as a region of selective absorption. Secondly, my observations have indicated no such stratum, although injections of sodium, magnesium, &c. into the chromosphere not exceeding the limit of the sun's limb by 2″ have been regularly observed for several months past. To-day I have even detected a low level of barium in the chromosphere not 1″ high. This indicates, I think, that my instrument is not lacking in delicacy; and as I have never seen anything approaching to a continuous spectrum when my instrument has been in perfect adjustment, I am inclined to attribute the observation to some instrumental error. Such a phenomenon might arise from a local injection of solid or liquid particles into the chromosphere, if such injection were possible. But I have never seen such an injection. If such an occurrence could be observed, it would at once settle that part of Dr. Frankland's and my own theory, which regards the chromosphere as the last layer of the solar atmosphere; and if it were possible to accept Father Secchi's observation, the point would be settled in our favour.

"The sodium experiments to which I have referred, however, and the widening out of the lines in the spot-spectra, clearly indicate, I think, that the base of the atmosphere is below the spot and not above it. I therefore cannot accept Father Secchi's statement as being final against another part of the theory to which I have referred—a conclusion which Father Secchi himself seems to accept in other communications.

"Father Secchi remarks also that the F line is produced by the absorption of other bodies besides hydrogen, because it never disappears. This conclusion is also negatived by my observations; for it has very often been observed to disappear altogether and to be replaced by a bright line. At times, as I pointed out to the Royal Society some months ago, when a violent storm is going on accompanied by rapid elevations and depressions of the prominences, there is a black line on the less-refrangible side of the bright one; but this is a phenomenon due to a change of wave-length caused by a rapid motion of the hydrogen.

"With regard to the observation of spot-spectra, I find that every increase of dispersive power renders the phenomenon much more clear, and at the same time more simple. The selective absorption I discovered in 1866 comes out in its most intense form, but without any of the more complicated accompaniments described by Father Secchi. I find, however, that by using three prisms this complexity vanishes to a great extent. We get portions of the spectrum here and there abnormally bright, which have given rise doubtless to some of the statements of the distinguished Roman observer; but the bright lines, properly so-called, are as variable as they are in any other part of the disk, but not much more so. I quite agree that the 'interpretation' of sun-spot phenomena to which Father Secchi has referred, which ascribes the appearances to anything but selective plus general absorption, is erroneous. But as I was not aware that it had ever been propounded, I can only refer to my own prior papers in support of my assertion which were communicated to the Royal Society some three years ago."

"Researches on Gaseous Spectra in relation to the Physical Constitution of the Sun, Stars, and Nebulæ."—Third Note. By E. Frankland, F.R.S., and J. Norman Lockyer, F.R.S.

The authors remark that it has been pointed out by Mr. Lockyer that the vapours of magnesium, iron, &c., are sometimes injected into the sun's chromosphere, and are then rendered sensible by their bright spectral lines. (Proc. Roy. Soc., vol. xvii. p. 351.)

2. It has also been shown (1) that these vapours, for the most part, attain only a very low elevation in the chromosphere, and (2) that on rare occasions the magnesium vapour is observed like a cloud separated from the photosphere.

3. It was further established on the 14th of March, 1869, and a drawing was sent to the Royal Society indicating, that when the magnesium vapour is thus injected, the spectral lines do not all attain the same height.

Thus, of the b lines, b^1 and b^2 are of nearly equal height, but b^4 is much shorter.

4. It has since been discovered that of the 450 iron lines observed by Ångstrom, only a very few are indicated in the spectrum of the chromosphere when iron vapour is injected into it.

5. The authors' experiments on hydrogen and nitrogen enabled them at once to connect these phenomena, always assuming that the great bulk of the absorption to which the Fraunhofer lines are due takes place in the photosphere itself.

It was only necessary, in fact, to assume that, as in the case of hydrogen and nitrogen, the spectrum became simpler where the density and temperature were less, to account at once for the reduction in the number of lines visible in those regions where, on the authors' theory, the pressure and temperature of the absorbing vapours of the sun are at their minimum.

6. It became important, therefore, to test the truth of this assumption by some laboratory experiments, the preliminary results of which are communicated in this note.

* *Comptes Rendus*, 1869, 1 sem. p. 764.

The spark was taken in air between two magnesium poles, so separated that the magnesium spectrum did not extend from pole to pole, but was visible only for a little distance, indicated by the atmosphere of magnesium vapour round each pole.

The disappearance of the *b* lines was then examined, and it was *found that they behaved exactly as they do on the sun.* Of the three lines, the most refrangible was the shortest; and shorter than this were other lines, *which Mr. Lockyer has not detected in the spectrum of the chromosphere.*

This preliminary experiment, therefore, quite justified the assumption, and must be regarded as strengthening the theory on which the assumption was based, namely, that the bulk of the absorption takes place in the photosphere, and that it and the chromosphere form the true atmosphere of the sun. In fact, had the experiment been made in hydrogen instead of in air, the phenomena indicated by the telescope would have been almost perfectly reproduced; for each increase in the temperature of the spark caused the magnesium vapour to extend further from the pole, and where the lines disappeared a band was observed surmounting them, which is possibly connected with one which at times is observed in the spectrum of the chromosphere itself when the magnesium lines are not visible.

Professor Williamson communicated a paper "On the successive Action of Sodium and Iodide of Ethyl on Acetic Ether," by J. Alfred Wanklyn, F.C.S. The author referred to a paper by Frankland and Duppa, describing the products obtained on treatment with iodide of ethyl of the yellow wax-like mass given by the action of sodium on acetic ether. Besides the description of the compounds, Frankland and Duppa gave four equations expressive of their view of the origin of the wax-like mass: each one of these four equations affirmed the evolution of an equivalent of hydrogen by every equivalent of sodium employed; but according to Mr. Wanklyn neither acetic ether nor any other ether ever evolves hydrogen by reaction with the alkali metals. All equations which assume evolution of hydrogen in these reactions are therefore inadmissible. In the present paper Mr. Wanklyn offers an explanation of Frankland and Duppa's products, which does not involve the assumption of evolution of hydrogen. On reference to Frankland and Duppa's paper just cited, it will be found that the products described by them as obtained from the "wax-like mass" and iodide of ethyl are the following:—

A. $C_8\ H_{14}\ O_3$, liquid boiling at 195° C.,
B. $C_{10}\ H_{18}\ O_3$, liquid boiling at 210° C. to 212° C.,

butyric ether, caproic ether, and also some unacted-upon acetic ether, and a considerable quantity of common ethylic ether. Mr. Wanklyn has already shown that the direct products of the action of sodium on acetic ether are ethylate of sodium and sodium-triacetyl. Nothing else seems to be produced directly. But the excess of acetic ether, which is necessarily taken, acts on some of the ethylate of sodium, producing alcohol and acetate of ethylene-sodium, the extent to which this secondary action takes place being determined by the exact circumstances of the experiment. We have, therefore, in the wax-like mass got by prolonging the action of sodium on acetic ether:—

Ethylate of sodium	$C_2\ H_5\ NaO$
Sodium-triacetyl	$C_6\ H_9\ O_3\ Na$
Acetate of ethylene-sodium . . .	$C_4\ H_7\ Na\ O_2$
Alcohol	$C_2\ H_6\ O$.

On the first three iodide of ethyl acts, giving iodide of sodium and organic liquids. From the ethylate of sodium comes the common ether. From the sodium-triacetyl comes ethyl-triacetyl, which is $A = C_8\ H_{14}\ O_3$, having been got by Geuther from the pure sodium-triacetyl. From isolated acetate of ethylene-sodium and iodide of ethylene Mr. Wanklyn has recently obtained liquid B, $C_{10}\ H_{18}\ O_3$. This liquid boiled at 212° C. and gave carbonate of baryta with baryta-water, and was identical with Frankland and Duppa's liquid B. By the action of liquid A upon ethylate of sodium Geuther has recently shown that butyric ether is produced together with acetate of ethylene-sodium, and Mr. Wanklyn predicts that liquid B will give caproic ether by a similar reaction.

Royal Geographical Society, December 13, Sir R. Murchison in the chair. The President made some comments on the recent letter from Dr. Livingstone, whose return would, he thought, very probably be delayed by the exploration of the waters, which might prove the head waters of the Congo. The paper of the evening was Mr. Hayward's account of his visit to Eastern Turkestan; a large map constructed by Captain George, from the maps and observations sent home by Mr. Hayward, and two views, enlarged from sketches taken by him on the spot, illustrated the paper. Dr. Leitner's collection of Yarkandi manufactures was also exhibited, and the presence of Niaz Muhammed, the native of Yarkand, excited much interest. Mr. Hayward has carefully fixed all the positions in the maps sent home by him, and also sent itineraries, list of names, and plans of towns. He mentioned the valuable pocket artificial horizon invented by Captain George, which enabled him to escape suspicion. Mr. Hayward left Leh Sept. 29, and proceeded by the Chang Chennoo Pass, 18,839 feet high, to Shadula, in lat. N. 36° 21′ 11″, long. E. 78° 18′, 360 miles from Leh, the frontier fort of Eastern Turkestan, 14,745 feet high, which is divided from the dominions of the Maharajah of Kashmir by the Karakorum range. Mr. Shaw had, unknown to Mr. Hayward, arrived a few days before. The travellers were detained while a messenger was sent forward to obtain permission for them to enter the country. The opportunity was taken to explore the sources of the Yarkand Daria, beyond the Khirgiz Pass, 17,095 feet high. From this a view of the Eastern Kuen Luen peaks was obtained, 90 miles away, the course of the river was traced and positions proved. A new pass, called the Yangi Pass, over the Kuen Luen, was observed, and described as practicable for horses, and easily made practicable for carriages, and even for guns. It is at present exposed to the depredations of robbers from Hunza Nagyr, which render it insecure and little used. Twenty days were spent in this exploration, and 300 miles of mountain districts explored. One peak rising to 28,278 feet, was observed from a spur of Kuen Luen Mountains. The source of the Yarkand River, in lat. 35° 37′ 34″ N., long. 77° 50′ E., was reached on December 8th. At a height of 16,654 feet above the sea, the cold experienced was intense. The thermometer the following morning showed the mercury to have sunk to a level with the bulb, or 18° below zero. Having returned to Shadula, he found that permission had come for his advance to Yarkand, and started on December 18th to reach that place by the Sanju Pass. Mr. Hayward described the Khirgizes, the Bedouins of Turkestan, from whom he experienced kindness and hospitality, as throughout the country seems to have been the case. From Shadula yaks were provided, on which the travellers crossed the Sanju Pass. The first village entered was Kibriz. The Turki villages present a comfortable appearance. The country is well cultivated, and the people well to do. The dress, &c., of the different classes was carefully described. Slaves are still owned by some; but the former slave trade at Yarkand has been suppressed by Yakoob Kushbegi. Between Sanju and Yarkand a sandy steppe was crossed, the commencement of a desert called Tahla Makân Desert, stretching to the east, towards the Gobi Desert. Strange legends of former cities, now buried in the sand, were related by the Panja Bashi. Yarkand was entered on December 27th. It is described as a parallelogram of 2 miles by 1½, containing 40,000 houses, 120 mosques, and 120,000 inhabitants. It is defended by mud walls 45 feet high, with bastions, and an outlying fort. The ruler of Yarkand, Muhammed Yakoob (Kushbegie), "Atalih Ghazee" of Eastern Turkestan, was at his camp near Kashkar. The governor of the city, "a well-informed, pleasant, well-read man," received Mr. Hayward with much courtesy. A house was assigned him, and plentiful supplies furnished him; but he was not allowed, except on visits to the governor, to leave the courtyard of his house during the two months he remained in Yarkand.

February 24th, Mr. Hayward proceeded to Kashkar, which is a strong town of 60,000 to 70,000 people, the central point of all the Central Asia roads. The next day he was received by the ruler, who by his bravery and military talents has raised himself to the chief authority over Eastern Turkestan. His character and abilities impressed Mr. Hayward so much, that he says, were Central Asia undisturbed by foreign pressure, he would be another Zenghis Khan. He received the traveller kindly, and spoke of his desire for visits from Englishmen, who had been hitherto prevented from visiting his country by the Bokhara tragedy. He also alluded to the death of Adolph Schlagintweit, but did not mention that he had himself killed Hullee Khan, the murderer of Schlagintweit, two years ago. Mr. Hayward remained a month in Kashkar, vainly hoping to get permission to proceed to the Pamir Steppe, but was obliged to abandon the attempt. The position of Kashkar was fixed by him at

City . . . . . 39° 19′ 37″ } N. lat.
Fort . . . . . 39° 23′ 9″ }

and 76° 10′ E. long., at an elevation of 4,165 feet. He concluded

by some account of the revolt against the Chinese dominion, which, after lasting a hundred years, was overthrown in 1863; after which the present ruler, with his Uzbeg troops, defeated the Tunganis, and successively made himself master of the different places, and is now master of the country. But his tenure is precarious, and his fear of assassination causes him to change his apartment every hour during the night.—In the ensuing discussion, the president stated that, so far from Russia regarding our commercial entrance into Eastern Turkestan with jealousy, the Czar and Prince Gortschakoff had both assured Mr. Forsyth that so long as the Atalih Ghazee confined himself to the country south of the Tian Shan, Russia would not interfere with Eastern Turkestan.—The president also pointed out that Mr. Hayward's discoveries had confirmed A. von Humboldt's theory as to the salient points of the mountain systems of Central Asia. Mr. Hayward was about starting to explore the Pamir Steppe, by way of Ghilghit.—Sir H. Rawlinson mentioned that he was enabled to state that the Indian Government were about to arrange with the Maharajah of Kashmir, to send officers to survey the routes to the frontier of Turkestan; and intended afterwards to enter into negotiations with the Atalih Ghazee for the same purpose, as to the routes in his dominions. It is understood that Russia has not recognised the Atalih Ghazee, regarding him as a rebel against the empire of China—an ally of Russia.

Royal Microscopical Society, December 8.—The Rev. J. B. Reade, M.A., F.R.S., president, in the chair. Prof. Rymer Jones, F.R.S., read a paper on Deep-sea Dredgings from China and Japan. Professor Jones stated that he had recently received from Lieut. Ross, R.N. (grandson of Sir J. Ross), certain specimens of deep-sea dredgings, obtained at a depth of 1,080 fathoms, from the bottom of the sea near Fly Island, in the neighbourhood of Sandal-wood Island. After alluding to the theories which had until a recent period prevailed with respect to the depth at which animal life existed in the ocean, and to the researches and discoveries of Prof. Forbes, Sir. J. Ross, and Dr. Wallich, Prof. Jones proceeded to give a description of the contents of a phial (a small portion of the dredgings sent by Lieut. Ross), from which about a grain and a half of solid matter had been obtained. The first result of the microscopic examination of this matter was the discovery of a considerable quantity of silex, so finely triturated, however, as to be scarcely visible. The next discovery was a large number of sponge *spiculæ*; many of the spicules being sculptured in forms of the greatest beauty. Of these spicules there were 12 genera. Some 800 or 900 specimens of *Foraminifera* were next found, exhibiting nearly every form of the animal hitherto found in the bed of the Atlantic. A still more interesting discovery was that of 600 or 700 *Polycystinæ*; which differed from those found in Barbadoes, in this respect, that whereas the latter were usually brought up fractured and imperfect, the former were perfectly intact in all parts, displaying the most exquisite structures, and hundreds being clothed in thin soft covering. From this fact it might be argued that they had been taken from their ocean home alive, notwithstanding the immense pressure to which they are said to be subjected. There were also many species present which had not as yet received names from naturalists. Besides these, Prof. Jones had found a large number of shields of various shapes, resembling the *Diatomaceæ*; and of these there were not less than 300. Lastly, he had found diatoms themselves, more sparsely distributed, but of larger size than those usually coming under the notice of microscopists; and of these there were over fifty specimens. What larger animals lived at the bottom of the deep sea he could not say, but as there appeared to be abundant food for them, and as both Sir J. Ross and Dr. Wallich had found star-fishes in the respective localities dredged by them, it might be reasonably inferred that they abounded in the ocean bed, and that a most extensive fauna existed there as yet entirely undiscovered. The following papers, for want of time, were taken as read, viz.: "On the Stylet Region of the Ominontoplean Broboscis," by Dr. McIntosh, and "Organisms in Mineral Infusions," by C. Staniland Wake, F.A.S.L. Four gentlemen were elected Fellows, and the Society adjourned to January 12, 1870.

Entomological Society, December 9.—Mr. H. W. Bates, president, in the chair. Seven new members were elected, namely, MM. d'Emerich, De Marseul, and Oberthur (foreign members), Captain Lang, R.E., and Messrs. W. Arnold Lewis, J. Cosmo Melvill, and Howard Vaughan. Exhibitions of *Hymenoptera* were made by Prof. Westwood and Mr. Frederick Smith; of *Lepidoptera*, by Mr. F. Smith and Mr. J. Jenner Weir; of *Coleoptera*, by Prof. Westwood and Mr. Albert Müller. Communications were read from Mr. Robert McLachlan on *Boreus hymenalis* and *B. Westwoodii*; from Mr. Edwin Brown, respecting the locust captured at Burton-on-Trent and exhibited at the previous meeting, which had been identified as *Acridium peregrinum*, a species distributed over a great part of Asia and the North of Africa, but not hitherto detected in Europe.

Ethnological Society, December 7.—Prof. Huxley, LL.D., F.R.S., president, in the chair. At the meeting of the International Congress for Prehistoric Archæology, held last year at Norwich, a committee was formed, under the presidency of Sir John Lubbock, Bart., for the purpose of inquiring into the present condition of the prehistoric remains in the British Isles. Subsequently, the functions of this committee were transferred to the Ethnological Society, and the first-fruits of its labours in this direction have just appeared in the shape of a valuable Report on the Prehistoric Monuments of the Channel Islands, prepared by Lieut. Oliver, R.A. These islands are remarkably rich in megalithic structures of noble proportions, but from their unprotected state they have been subject to the most ruthless destruction. Not only have they been demolished by the "navvy" and the mere treasure-seeker, but they have also suffered considerably from injudicious attempts at restoration. Nevertheless, they are still sufficiently numerous to form the subject of an elaborate Report. Lieut. Oliver pointed out the resemblance between some of these megalithic monuments and those in Madagascar erected at the present day by the hill-tribes of Hovas. The Report was copiously illustrated, and called forth a discussion, in which the chief speakers were the president, Mr. J. Lukis, Mr. J. W. Flower, Dr. Hyde Clarke, and Col. Lane-Fox.—At the same meeting, a note was read from Mr. Acheson on a supposed stone implement, found beneath the bed of a river worked for gold in Co. Wicklow.—A communication was also made, by Maj.-General Lefroy, on the Stature of the North-American Indians of the Chipewyan Tribe; and remarks were made upon it by Dr. Richard King.

Anthropological Society, December 7.—Dr. Beddoe, president, in the chair. Dr. Leitner gave some further details of his visit to Dardistan in 1866, especially referring to the Shina race. He briefly touched upon the main outlines of his journey, mentioning that his experience had modified his views as to the inconvenience resulting from the rarefaction of the air at high altitudes, inasmuch as he and his companions had surmounted passes of 18,000 feet without experiencing any of the usual effects. Although the Dards were at war with the Maharajah of Kashmir, and the towns apparently deserted, he was able to assemble, by sending round a drummer, 150 to a feast, and continued on most friendly terms with them during his abode in Ghilghit. The vocabularies and grammars of the hitherto unwritten Dardoo dialects which he has collected show a probably parental Aryan type. It is to be much regretted that the refusal of the India Office to grant an extension of leave to Dr. Leitner will compel his return to India within a fortnight, and almost deprive him of the opportunity of arranging and comparing these hitherto unknown languages. The Indian Government does not seem desirous of encouraging acquaintance with Central Asia. A traveller desirous of penetrating by Ghilghit to the Panin Steppe had recently been refused mules. Several interesting particulars of the customs among the Chilasis Ghilghites and other Dards were mentioned, which are alien to Mahommedan and Hindu ideas. The place and privileges accorded to women, who receive the visits of their husbands' friends without any suspicion—the custom of courtship, the use of wine, the fondness for dogs,—all seem to point to an independent origin of religion and manners. The value set upon dogs was illustrated by the fact that two men-slaves were given as the price of a good hound. The Sooni ruler of Chitral not merely sold his subjects, but his own mother, as a slave, and when asked how he could sell her whose breasts had suckled him, pointed to a cow, and said that she gave him milk constantly, yet he would sell her! and when a Moollah, who was to be sold, threatened him with vengeance for selling a minister of the Word of God, he replied that everybody sold the Koran—why therefore should he not sell the expounder of it. Dr. Leitner stated that the Kafirs were certainly fairer than the Kashmiris, but his experience hardly bore out the statement of their being exceptionally fair, with blue eyes and light hair. West of Balti the general type of face approximated more to the European. He could discover no religion or rites among them, save that once a year each deposited a stone on a cairn, situated on a high mountain. He found a species of caste division among the

Shinas, but the different castes intermarry and eat together. He narrated a curious Shina legend of a Shinari who fell in with a company of one-eyed demons, and was a witness of a demoniacal wedding. A very numerous and interested assembly listened with marked approval; and in reply to various questions, Dr. Leitner further stated that he had not remarked any megalithic or Druidic remains. The countries were traversed by him rather with a view to linguistic and philological discoveries. The houses were meanly constructed; the food evinced a rough skill in cookery; every Dard family seemed to possess a cavern, the secret of which was known only to them, and they thus had plentiful supplies of food, which they shared with him, while the Maharajah's sepoys were starving. Strong opinions were expressed as to the refusal of extension of leave to Dr. Leitner, and a resolution was unanimously passed calling upon the Government to take measures to aid and encourage travellers to visit these little-known regions of Central Asia. It is to be hoped that some means may be found to prolong the visit of Niar Mahommed, the Yarkandi, and both obtain from him information, and give him lasting impression of our resources and hospitality. We should not omit to mention that Dr. Leitner altogether denied the statement quoted from the *Invalide Russe*, that he had visited Herat or taken part in the battle of Samarcand.

Philological Society, December 3.—Mr. A. J. Ellis, F.R.S., in the chair. Mr. A. Melville Bell read a paper on Pronouncing all Languages. He showed how all the vowels could be produced: first, by placing the tongue in nine different positions, by means of which the extent and form of the neck which unites the front with the back cavity of the mouth was modified; secondly, by increasing or diminishing the whole of the cavities behind this neck; thirdly and fourthly, by altering the form of the cavities in front of the neck in the two former cases, by the action of the lips. The thirty-six vowels thus produced practically covered all known vowel sounds. He also showed how the consonants could be produced by three positions of the tongue and one of the lips, modified in six definite manners, allowing voice or breath to pass through a simple narrow orifice with central aperture, or a compound orifice of the same description, or a double simple or compound orifice, the central passage being stopped, and emission of voice taking place at the sides; or else by stopping breath or voice altogether, or allowing them to pass through the nose. He also explained how these forty-eight consonants could be varied, producing, with the glottal and nasal actions, all the possible varieties of articulation. He illustrated his paper by diagrams and models of his symbols, by which in each case he made the precise position of the organs of speech necessary for producing each sound visible on paper in a single definite and intelligible letter. He informed the Society that these letters had been most effective in teaching little children who had been born deaf and dumb to articulate and distinguish vowel sounds with accuracy; a statement which the chairman confirmed from personal knowledge of Miss Hull's school for deaf and dumb girls, 102, Warwick Gardens, Kensington. The meeting unanimously passed the following resolution: "That this meeting of the Philological Society desires to express its strong sense of the beauty and great value of Mr. A. M. Bell's system of Visible Speech, and its ready applicability to purposes of philological investigation."

Institution of Civil Engineers, December 7.—Mr. C. W. Gregory, president, in the chair. The first paper read was on the Public Works of the Province of Canterbury, New Zealand, by Mr. Edward Dobson, Assoc. Inst. C.E. In this communication a history was given of the Public Works Department of Canterbury, from its establishment, in 1854, to the completion of the railways, in 1868. During that period the survey of the province, commenced under the "Canterbury Association," had been completed by the officers of the Survey Department; the eastern portion of the province had been thrown open to settlement, by the construction of many hundred miles of metalled roads; the western goldfields had been connected with the capital, by a coach-road through the passes of the New Zealand Alps—a road remarkable both for the boldness of its design and the circumstances under which it was executed; and a complete system of railroad had been surveyed, the key to which (a tunnel 129 chains in length through the crater wall of Lyttleton Harbour) had been successfully completed. Extensive harbour works had been constructed, public buildings erected in the principal towns, and telegraph and postal services carried to a fair state of organisation. The total expenditure on public works and surveys during the period referred to had been, in round numbers, 1,800,000*l.*, out of a total Government expenditure of about 8,880,000*l.* The population in 1854 was about 6,000; in 1868 it amounted to 54,000, including the mining population of the county of Westland. The great bulk of the public works of Canterbury possessed but little professional interest—the country being level, and the bridges chiefly of timber of ordinary construction. Many of the rivers run on ridges above the general surface of the plains, and in dealing with them it was essential to leave abundant waterway, as there was little chance of any ordinary embankment standing against such torrents as they sometimes carried. Paradoxical as it might appear, the portions of the proposed railways which were to traverse the level plains would require heavy earthworks, while the lines through the ranges, being contoured on the hill-sides, would be carried for miles on surface gradients with light side-cutting through a mountainous and difficult country. The principal works executed by the Government were: first, the Summer Road from Lyttelton to Christchurch, which was scraped out of the cliffs for a continuous length of several miles; second, the West Coast Road, from Christchurch to Hokitika, which was constructed in nine months, through a hundred miles of rough and difficult country, totally uninhabited, and for the most part densely timbered; third, the Moorhouse Tunnel, on the line of the Lyttelton and Christchurch Railway, 2,861 yards in length, driven through the crater of an extinct volcano under a summit level 1,220 feet above the sea; and fourth, the wharf and jetties at the Lyttelton station, built upon a soft mud-bank which was, in places, 50 feet in depth. In laying out roads on hilly ground, the principle uniformly adopted was to follow the windings of the spurs, contouring the gradients with the spirit-level, so as to minimize both cutting and embankment, and to dispense with culverts as far as possible. In the case of side cuttings, the gradient was contoured with the spirit-level and lock-spitted. The back line of the floor of the cutting was thus ranged out, and the depth of the cutting measured at every half-chain. The width of the slope was then calculated and set off, and the back line of the slope lock-spitted. The work could then be let by contract at any future time when the funds might be voted by the council, no plans or sections being required, or any details, beyond the rate of slope, the total length of the cutting, and its cubic content. A serious difficulty in the conduct of the road works was the want of timber. The expedient adopted was to keep constantly in stock a quantity of planks, 16 feet 8 inches long, and 8 inches by 3 inches in section, and the bridges and culverts were built on standard patterns designed with reference to this unit of material. This plan effected a great saving of office labour, as no drawings were required in ordinary cases; and as three planks made up 100 feet (board measure), any labourer was competent to take an account of the timber used, all that was necessary being to count the number of planks. Amongst the road bridges there were few that presented special interest, with, however, two exceptions. These were: first, a drawbridge over the Waimakariri River, built on the telescope principle, from a simple design, and which worked satisfactorily; and, secondly, a bridge over the Taipo River, on the West Coast Road, presenting several peculiarities of construction. The Harbour Works possessed considerable interest, which was enhanced by their partial failure. It was found that the mud-bank was too soft to support the screws of the screw-pile jetty, and, accordingly, additional lengths of piles were cast, and a solid core of hard wood placed in the bottom of each pile, and driven down to the solid rock, on which the weight of the structure was made to rest; the flanges of the screws simply acting as supports to check lateral vibrations. The diagonal bracing was put in by divers without difficulty, the exact length of each brace being taken from a template applied by the diver to the work after the piles were screwed down to their proper depth. The sea-wall slipped forward in two places during the progress of the work, the total amount of forward movement in each case being between 5 feet and 6 feet. The author did not consider that any advantage would have been gained by carrying the piles down to the solid rock, as, in all probability, the outward movement of the embankment would in that case have overturned the work and destroyed it. He thought that the partial failure of the work might be attributed to two causes: first, that the stone embankment was deficient, both in bulk and weight, for the duty it had to perform; and, secondly, that the tipping of the clay embankment was commenced before the stone embankment had had time to take a solid bearing, so as to form an abutment to

resist the pressure of the backing. The work had since been completed, by driving an outer row of piles and putting in fresh capsills, jointing, and planking; and locomotives had been running for twelve months over the embankment without any further slipping, or more than the ordinary amount of settlement. It was worthy of notice, that no effect whatever was produced upon the sea-wall, or the jetties, by the great earthquake wave of August 16th, 1868, although the sea receded so as to lay dry a great portion of the harbour; and it might have been reasonably expected that the removal of the pressure upon the ground in front of the sea-wall would have been accompanied by the subsidence of the station ground. The breakwater was still in progress by prison labour.—The second paper, on Ocean Steam Navigation, with a view to its further Development, by Mr. John Grantham, Memb. Inst. C.E., was read in part, and it was announced that it would be resumed at the next meeting.

EDINBURGH

Naturalists' Field Club, November 30.—Annual Meeting. The retiring president, Mr. Brown, delivered an address on the Education and Ethics of a Naturalist.—The following officers were then elected for the ensuing session:—Mr. R. Scot-Skirving, president; Mr. A. Craig-Christie, vice-president; Mr. Andrew Taylor, Lecturer on Geology, hon. treasurer and secretary; Drs. Black, McBain, R.N., Richardson, and Cameron, and Messrs. Brown, Sadler, Jackson, Panton, C. W. Peach, Herbert (Trinity), Kannemyer, and Archer, council. The club recorded its thanks to Mr. Thomas Edmonston, the late secretary, for his services. Miss Phœbe Blyth, of Abbotsford Park, was admitted without a ballot, and on a ballot the following gentlemen were elected members:—Lieut.-Colonel Rankin (Trinity), Dr. H. W. Nachot, and Messrs. Leitch and Macfie. The annual dinner took place the same evening, the president in the chair.

DUBLIN

Royal Geological Society of Ireland, December 8.—On this date a joint meeting of the fellows of this society and of the fellows of the Royal Zoological Society was held in one of the lecture-rooms of Trinity College, Sir Dominic Corrigan, Bart., in the chair. The Rev. Prof. Haughton read a paper on the Comparative Mechanism of the Flexor Tendons of the Feet and Hands in Mammals, Birds, and Reptiles; Prof. Traquair read a paper on *Griffithides mucronatus*, McCoy.

Institution of Civil Engineers of Ireland, December 8.—Mr. J. Ball Greene, president, in the chair. Mr. J. Price read a paper by Mr. W. Anderson, one of the ex-presidents, entitled "Record of some Experiments on Heating Water and on Condensing Steam by tubular and double-cased vessels."

MANCHESTER.

Literary and Philosophical Society, November 16.—J. P. Joule, LL.D., F.R.S., president, in the chair. Professor Osborne Reynolds, B.A., of Owens College, was elected an ordinary member of the society. A communication by Mr. E. W. Binney, F.R.S., F.G.S., on the Permian Strata of East Cheshire, was read. The author questioned the correctness of the Government map of the district lying between Macclesfield and Stockport, as far as regards the so-called "red rock fault," by which the coal measures are supposed to be bounded on their dip. According to his observations there is no more evidence of a fault between Macclesfield and Stockport, where the trias and permian beds cover the coal measures, than is to be found on the eastern side of the *Pennine* chain between Sandyacre and Sunderland, where carboniferous strata disappear under permian.—Professor Roscoe, Ph.D., F.R.S., communicated a paper on the Combinations of Phosphate of Lime and Sulphurous Acid, by Dr. B. W. Gerland, of Macclesfield. Phosphate of lime, in whatever state it may be, readily dissolves in an aqueous solution of sulphurous acid. The solution can be obtained of great strength: thus, from freshly precipitated tribasic phosphate of lime a liquor was prepared of 1·3 specific gravity, and from bone ash one of 1·708 specific gravity. The former, on analysis, gave results which agree tolerably with the formula $3CaO, PO_5, 6SO_2$. The solution of bone ash in sulphurous acid of 1·1708 specific gravity was also found, on analysis, to contain the amount of phosphoric acid required by that formula. The solution of phosphate of lime in sulphurous acid possesses the taste and smell of the acid, but to a much smaller extent than an aqueous solution of the acid containing the same amount of sulphurous acid. Under the influence of boiling heat the phosphate solution is decomposed slowly, sulphurous acid escapes, and a heavy white crystalline precipitate is formed. Under the microscope this appears to be composed of crystals of the hexagonal system, like those of rock-crystal. Washed and dried over sulphuric acid, it gave, on analysis, results agreeing with the formula $3CaO, PO_5, SO_2, 2HO$. This sulphited phosphate of lime has no smell or taste, and is distinguished from all sulphites by its stability. Heated in an air bath for three hours to 130° C. it lost 0·64 per cent. of water, but the amount of sulphurous acid remained unchanged; neither had a humid atmosphere the slightest effect upon it. The water is held in intimate combination, and is only expelled at a higher temperature when it is accompanied by fumes of sulphuric and sulphurous acids. The residue contains, besides lime and phosphoric acid, sulphate and sulphide of calcium. The sulphite, which withstands the action of the atmosphere indefinitely, is rapidly oxidised when incorporated with soil. In the soil it acts as a soluble phosphate of lime. It has in fact for several seasons been used as manure, and has given great satisfaction. The new sulphite possesses remarkable antiseptic and disinfecting powers, and on this account will command a general interest. The efficacy of sulphurous acid as a disinfectant is well known; it would be more appreciated if it could be conveniently applied. The aqueous solution is expensive by transport, it is very changeable, and in many cases it is unavailable on account of its pungent smell: whilst for medical purposes it can only be used in exceptional cases, in consequence of its irritating action. The sulphites are still more changeable. Exposed to the air they are acted upon by carbonic acid and by oxygen, and when mixed with decaying organic matter for disinfecting purposes they very often increase the mischief, and sometimes cause an abundant escape of sulphuretted hydrogen. The compound of phosphate of lime with sulphurous acid has none of these disadvantages. Acids, as well as ammonia, are neutralised by it. From a sanitary point of view, ammonia is particularly objectionable; being a product of putridity it helps to accelerate it, and also serves as a vehicle for disseminating other products, which, without it, would not be volatile, or only so to a less degree. The sulphited phosphate, when applied to putrid matter, will probably do its first service by neutralising the ammonia present (including compound ammonias), and also prevent its further formation, as the test paper will show. The smell will soon cease, or at least be greatly diminished and altered, and the mass will be safe for a long time, so that it may be removed or dried without danger or inconvenience. Dr. Gerland remarked that large quantities of putrid matter in open spaces are more completely and speedily disinfected by small portions of the phosphate, than samples in glass bottles. The compound recommends itself as a disinfectant by its physical properties. It is a clean white powder, which stains and soils nothing, dusts off garments or carpets, leaving no mark; it is free from smell and taste, and harmless to animal life. The solution of phosphate of lime in sulphurous acid also possesses disinfecting powers, and acts in many cases even with greater energy than the powder. It might be used with advantage as being applicable to places which could not be reached by the other. The neutrality, regularity of composition, utter harmlessness, and freedom from smell and taste recommend the sulphited phosphate of lime for trial in therapeutics. It would be of interest to investigate it in relation to putrid puerperal fevers, pyæmia, &c.

Microscopical and Natural History Section, November 8.—Joseph Baxendell, F.R.A.S., vice-president of the Section, in the chair.—Mr. W. J. Rideout presented the Section with one of the "Diotamaceen Typenplatte" prepared by J. D. Möller, of Holstein.—Mr. J. B. Dancer sent for the inspection of the members a young cuckoo, which had been caught by a cat in his garden, Old Manor House, Tipping Street, on the 19th August.—The following note was read from Mr. Joseph Sidebotham:—"About fifteen years ago, I had a large cabinet made, of forty-five drawers, to contain shells and carpological specimens, the drawers being made of pencil cedar. Very soon I found that the resinous vapour from the wood became deposited on some of the fruits and shells, making them appear as if they had been dipped in varnish. Chloroform appeared to be the only solvent, and the specimens were obliged to be washed with it. This became so bad that I had the whole of the drawers removed, and replaced with drawers of baywood. Some time afterwards, Mr. Carter advised me to have the cedar drawers sized and papered inside, and a new cabinet made to contain them: accordingly he made

me one to contain thirty drawers. These drawers were exposed to the air for twelve months, and very well sized inside, and papered, but the resinous vapour is still deposited on the objects in the drawers as before, and so far is a warning to every one never to use pencil cedar for such a purpose. I should not, however, have thought this matter worthy of mention before the Section, had it not been for the very curious and capricious way in which some objects are coated with this resin, while others are left entirely free, and for which I am totally unable to account. In shells the genera *Conus* and *Oliva* are never touched by it, nor are *Cyprea* or *Mitrea*, whilst *Helix*, *Bulimus*, and *Pecten*, are coated over: this is the case when there are specimens of these and other genera in the same drawer. As this deposit is on the genera I have named, and never on the others, it would seem to indicate that the texture of some shells would attract the vapour and not others. But in the case of bird's eggs, the very strange manner in which some species are picked out as it were and others left, is most remarkable. In the owl's eggs, for substance, the barn owl is always free, while the tawny owl is covered with the varnish, although side by side. The song thrush is never attacked, and the missel thrush always." Trays exhibiting these peculiarities were passed round for inspection.—Mr. Sidebotham also sent a living Death's Head Moth, bred from a pupa, which he had obtained at Lytham, and exhibited that the members might hear its curious cry or squeak when touched.—Mr. H. A. Hurst deposited in the Library a copy of a rare botanical work by a Jesuit priest, the Rev. J. Barrelier, which contained upwards of thirteen hundred carefully engraved plates of plants, which he had collected in France, Spain, and Italy. The work was edited by Antonio de Jussieu, and published in Paris in 1714. Mr. Hurst also exhibited some dried plants, recently collected by Mr. Wanklyn in the Southern States of America. Mr. Coward exhibited species of Podostemaceæ, collected by Gardner, in India and Ceylon. The Podostemaceæ, a little-known order of Tropical Aquatics, closely resemble the Liverworts in habit and general appearance, but possess phanerogamous flowers and dicotyledonous seeds. The order was placed by Von Martius amongst Endogens, in the near neighbourhood of the Naiadaceæ, and by Lindley in his Rutal Alliance of Exogens. Gardner considers it to be nearly allied to the pitcher plants, Nepenthaceæ. The difficulties attending the position of the order were well illustrated in the specimens exhibited, which presented a singular resemblance in foliation to Jungermannia and Riccia, and in the first view of the pedicillated ribbed capsule to the fructification of a moss, but in essential characters the true place appeared to be amongst the aquatic Endogens, with the anomaly of possessing a dicotyledonous seed.

November 30.—The Rev. William Gaskell, M.A., vice-president, in the chair. Mr. J. B. Dancer, F.R.A.S., communicated a paper on the Microscopical Examination of Milk under certain conditions, giving the results of observations made with the view of checking those of M. V. Essling, who states that vegetable organisms, like those found in putrefying substances, make their appearance in milk, before the milk gets sour. On examining a sample of unadulterated milk, Mr. Dancer was unable to detect the appearances described by Essling. The smallest oil globules exhibited as usual great molecular activity, but there was no appearance of dotted matter, or any fungoid growth when the milk was examined by powers varying from 200 to 1,500. A bottle was filled with some of this milk and securely corked; other portions of the milk were placed in open cups: one cup was kept in a cabinet which was closed during the day; the milk of the second cup was placed in a closet, the atmosphere of which was known to be favourable to the growth of fungi, the *Mucor Mucedo* being the most abundant and of the same family as that mentioned as having been found in cream by M. V. Essling. The milk in the bottle and that in the cups was examined daily, precautions being taken to close the bottle speedily after a portion was removed. On the third day the milk in the open cups was sour to the smell, but no change appeared visible under the microscrope; the upper portion of the milk in the bottle had become very rich in oil globules by the formation of cream. On the fourth day the casein had coagulated in the milk in the open cups, and the flaky precipitate was visible under the microscope; the pellicle surrounding the oil globules now appeared to be very easily ruptured, and with the slightest pressure some of the globules could be joined together—sometimes a number of globules which had been ranged in line by a current would coalesce by a slight movement of the fluid, and form an elongated mass. Fifth day, no appreciable alteration. Sixth day, the milk which had been placed in the closet had patches of mould visible on its surface: a microscopical examination of this mould showed it to be the *Mucor Mucedo*, such as had been frequently found on fruit which had been left in this closet. The fungus appeared on the surface only, no trace of it could be found in the milk taken from various depths. The milk in the cup kept in the cabinet exhibited no appearance of the *Mucor Mucedo* or any other vegetable or animal organism; it had become thickened into a pasty mass with an intensely sour odour. These observations were continued for eleven days, and the only difference observable was in the oil globules—they began to lose their spherical form, as if the investing pellicle had been weakened in parts and had become expanded. These experiments were repeated with a second supply of milk, and the results were alike in both cases. The range of temperature during the experiments was from 45° to 63° Fahr. These experiments led Mr. Dancer to believe that vegetable organisms do not as a rule make their appearance in pure unadulterated milk unless it is exposed for some time to atmospheric influences; most probably the spores are supplied by the atmosphere. He, however, considered M. V. Essling's suggestion to bottle the milk very good, and thought that cream pans with covers would be a very great improvement on the open ones as at present employed, at the same time having due regard to the cleanliness of the apartment and vessels in which the milk is kept.

Brighton

Brighton and Sussex Natural History Society, December 9.—The president, Mr. T. H. Hennah, in the chair. A paper was read by Mr. C. P. Smith on the Gemmæ of Mosses. Besides the ordinary mode of generation from a spore, which gives rise to a *prothullus*, from which the perfect plant is developed, mosses have another mode of generation, by means of gemmæ or sprouts, which have been defined as loose granular bodies, capable of becoming plants. As yet, none of the *Pleurocarpi* or side-fruiting mosses have, in Britain, been found producing gemmæ, whose situation on the plant varies in different species. Thus, in *Tortula papillus*, which grows on trees in Sussex and elsewhere, and has a thick spongy nerve, the gemmæ are found in the upper parts of the inside of the leaf—the fruit of this moss is unknown except in Australia; *Didymodon gemmascens*, having the nerve excurrent, has the tip crowded with gemmæ; in *Tetraphis pellucida* they are in pedicellate clusters at the ends of separate stems; in *Bryum atropurpureum* they form tubercles or bulbs in the axils of the leaves. On the leaves of *Orthotrichum Lyellii* grow little strings of cells, which, presenting a confervoid appearance, were named *Conferva castanea:* they have, however, been demonstrated to develop into young plants of mosses. *Oncophorus glaucus* has a great number of cells forming a dense mass at the tip of the leaf: these in the damp season give rise to young plants, so that this moss is common in counties where it never fruits. The subject of the growth of gemmæ has not yet been thoroughly worked out: he purposed investigating the phenomena, when he hoped to have some new facts to lay before the society. The paper was illustrated by drawings and microscopical specimens prepared by Mr. Smith, and exhibited by the following gentlemen, the most striking of which were—by Mr. Hennah, *Mnium cuspidatum*, *M. Hornum*, *Polytrichum commune*, and *Neckera oligocarpa*, showing flowers; Mr. Smith, *Ceratodon purpurcum* and *Cinclidium stygium*, showing peristomes, and *Ephemerum serratum*, with prothullus and young buds; Mr. Sewell, section of leaf of *Pottia cavifolia* and *Orthotrichum Lyellii*, with confervoid gemmæ on the leaves, the *Conferva castanea* of the early botanists; Mr. Wonfor, *Aulocomnion androgyum*, *Ullota phyllantha*, and *Tetraphis pellucida*, exhibiting gemmæ.

Paris

Academy of Sciences, December 6.—M. Andral communicated a memoir on the relation of the variations of the temperature of the human body to variations in the quantities of some constituent principles of the blood and urine. In this paper the author discussed the proportion to be observed between the temperature of the body taken under the axilla and the amount of fibrin, albumen, and globules contained in the blood, and that of urea eliminated by the kidneys. He treated of the comparative phenomena presented in various diseases.—MM. Bouillard and Becquerel remarked upon this communication. M. Faye communicated extracts from letters from MM. B. A. Gould and L. Respighi upon the solar atmosphere and promi-

nences, with some remarks upon them by himself. Mr. Gould's letter related to the luminous protuberances observed during the last eclipse. He referred them to the chromosphere, which he regarded as the general atmosphere of the sun, and he accepted the notion that they indicate a predominance of hydrogen in that region, but he inclined to ascribe to this a greater elevation than is generally given to it, especially as the Coast Survey Expedition had obtained photographs which show traces of it at an elevation of 7 minutes. Mr. Gould also remarked upon the evidence furnished by the perihelion distance of the comet of 1843.—M. Respighi's note referred to the relation between the protuberances and solar spots, and he stated that in the neighbourhood of the poles of the sun the protuberances are almost constantly wanting, that they are in close relation with the faculæ and spots, and that the faint shadows which appear upon the photosphere are due to the interposition of the materials of eruptions, which may persist for many days together.—M. C. Marignac presented a paper on the influence of water upon saline double decompositions, and upon the thermic effects which accompany them. He described the mode in which he experimented, and gave the following results:—The dilution of a solution causes a variation of temperature in either direction, which usually diminishes with the degree of dilution, but with sulphuric acid the increase of temperature is augmented by dilution. The mixture of solutions of two salts which do not decompose each other, generally gives rise to an evolution of heat less than that produced by the simple dilution of the solutions. When they can form a double salt, there is usually absorption of heat. The mixture of alkaline sulphates with sulphuric acid causes a considerable absorption of heat. With solutions of the alkaline bisulphates, the addition of water produces a considerable and increasing evolution of heat. The mixture of two saline solutions, or of a salt and an acid capable of decomposition without producing an insoluble compound, gives rise to considerable thermic effects, which, in some cases, at least, are increased by dilution. With mixtures, the result appears to be different according as the dilution is effected before or after the mixture of the solutions.—A note by M. H. Resal, on the relative movements of the water in the curved floats of Poncelet's water-wheel was read; as also a note by M. Bosscha in answer to observations made by M. Regnault upon a previous letter of the author's on the measurement of temperatures.—M. Lecoq de Boisbandeau presented a memoir on some points of spectrum-analysis, in which he confirmed Secchi's observations on the spectra of different parts of Geissler's tubes, and communicated his own remarks on the spectra of the aureola of the positive pole, of the blue light of the negative pole, and of the spark itself. He also remarked upon differences caused by alterations in the conditions under which the spark is produced.—M. J. L. Soret communicated a note on the illumination of transparent bodies, in which he maintained, in opposition to M. Lallemand, that this is to be ascribed to suspended particles, especially in water. He described some experiments made by him. M. Chevreul in remarking upon this communication, noticed the decomposition of glass by water even at a temperature of 98° C. (= 208, 4° F.), and referred to the action of other bodies upon glass.—M. J. Maumené presented a reply to M. Dubrunfaut's note on inverted sugar, and M. Dubrunfaut a notice of his investigations of the catalytic phenomena presented by the action of acids upon crystallised sugar by the examination of the rotatory properties of its products.—M. A. Petit communicated a note on the sugar normally contained in wine, in which he stated that he had found in all wines a quantity of sugar varying from 0·50—5 grammes per litre. Sugar also occurs in vinegar.—M. Sanson, in a note on the caballine species of the genus *Equus*, endeavoured to show that our domestic horses belong to eight distinct species.—A memoir on the chemical composition of fossil bones by M. Scheurer-Kestner was presented by M. Milne-Edwards. The author remarked upon the conversion, in fossil bones, of a portion of the ordinary osseine into soluble osseine, and showed by analysis that the per centage of the latter is, *cæteris paribus*, equal in bones of the same date, so that its amount may furnish an almost infallible proof of the contemporaneity or otherwise of bones found together in the same cave or deposit. M. Elie de Beaumont made some remarks on this communication.—Notes were communicated by M. Ruffner on the preservation of meat by sulphurous acid, and on various questions of hygiene, and by M. Coffin on the "metaphysics of the differential calculus;" of these the titles only are given.

DIARY

THURSDAY, DECEMBER 16

ROYAL SOCIETY, at 8.30—Researches into the Constitution of the Opium Bases. Part III. On the Action of Hydrochloric Acid on Codeia: A. Matthiessen, F.R.S., and C. Wright.—On the Thermodynamic Theory of Waves of Finite Longitudinal Disturbance: Prof. Rankine, F.R.S.—On Approach caused by Vibration: Prof. Guthrie.
SOCIETY OF ANTIQUARIES, at 8.30.—On the Descent and Arms of the House of Compton: Mr. Evelyn Philip Shirley, F.S.A.
LINNEAN SOCIETY, at 8.—On a species of *Ipomœa* yielding Tampico Jalap: Daniel Hanbury, F.R.S.
CHEMICAL SOCIETY, at 8.
ZOOLOGICAL SOCIETY, at 4.
NUMISMATIC SOCIETY, at 7.
PHILOSOPHICAL CLUB, at 6.
LONDON INSTITUTION, at 7.30.—Architecture: Prof. R. Kerr
EDINBURGH GEOLOGICAL SOCIETY, at 8.

FRIDAY, DECEMBER 17.

PHILOLOGICAL SOCIETY, at 8.15.
QUEKETT MICROSCOPICAL CLUB, at 8.

MONDAY, DECEMBER 20.

MEDICAL SOCIETY, at 8.
ROYAL ASIATIC SOCIETY, at 8.
LONDON INSTITUTION, at 4.—Elementary Physics: Prof. Guthrie.
INSTITUTE OF ACTUARIES, at 7.
SOCIETY OF ARTS, at 8.—The Spectroscope and its Applications: Mr. J. Norman Lockyer, F.R.S.

TUESDAY, DECEMBER 21.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Anniversary Meeting.
STATISTICAL SOCIETY, at 8.
PATHOLOGICAL SOCIETY, at 8.
ETHNOLOGICAL SOCIETY, at 8.—On an Ancient Calvaria, assigned to Confucius: Prof. Busk, F.R.S.—On the Koords and Armenians: Major Millingen, F.R.G.S.—On the Kitai and Kara-kitai: Dr. Gustav Oppert

WEDNESDAY, DECEMBER 22.

SOCIETY OF ARTS, at 1.—On Wines—their Origin, Nature, Analyis, and Uses; with special reference to a new Alcoholic Drink made from Tea: Dr. J. L. W. Thudichum.
GEOLOGICAL SOCIETY, at 8.—On the Iron-ores associated with the Basalts of the North-east of Ireland: Mr. Ralph Tate, F.G.S., and Dr. J. S. Holden, F.G.S.—Note on the Skull of the Large Kimmeridge Crocodilian, *Dakosaurus maximus*, Buenstedt, *Steneosaurus*, Geoffr. St. Hilaire: Mr. J. W. Hulke, F.R.S.—Note on a fragment of a Jaw with peculiar Teeth from Kimmeridge Bay: Mr. J. W. Hulke, F.R.S.—Notes on the Structure of *Sigillaria*: Principal Dawson, F.R.S. of Montreal.—Notes on some new Animal Remains from the Carboniferous and Devonian of Canada: Principal Dawson, F.R.S.

THURSDAY, DECEMBER 23.

SOCIETY OF ANTIQUARIES, at 8.30.

BOOKS RECEIVED

ENGLISH.—Home Life of Sir David Brewster: By his daughter, Mrs. Gordon (Edinburgh: Edmonston and Douglas):

FOREIGN.—Histoire de la Création: par H. Burmeister; traduite de l'allemand: E. Maupas.—Monographie des Ligumineuses Cæsalpinées: H. Baillon.—Die Nordamerikanische Zuckerfabrikation aus Sorgo und Imphy: Dr. Karl Löffler und Peter von Papi-Balogh.—Untersuchungen über Bau und Entwicklung der Arthropoden: Dr. Anton Dohrn.—Ueber die Bauweise des Feldspaths: Dr. Fredrich Scharff.—Japanisches Meeres-Conchylien: Dr. C. E. Lischke.—Die Pflanzenstoffe: Dr. Aug. Husemann und Dr. Theod. Husemann.—Die Lagerstätten der Nutzbauren Mineralien: Johann Grimm.—Archiv fur Mikroskopische Anatomie: Max Schultze.

CONTENTS

ERRATUM.—Line 26, col. 2, p. 166, should read as follows: "total number about 200. I have identified at least 60"