or in beds of shale interstratified with the sandstone, cutting off communication with the open air in this direction. Fissures traversing a dry sandstone in such a situation constitute an air-chamber which may clearly be of great capacity. On cutting one of a system of connected fissures, the first effect is frequently to liberate a quantity of pent-up air or choke-damp, as at Solberge; subsequently the opening becomes the sole channel by which equilibrium is preserved between the enclosed air and the atmosphere. It would however seem as probable that the opening should occur below the water-level as above it. In such a case the first effect of an expansion of the pent-up gases would be to force out water, and raise the level of the water in the well. The agitation of the water noticed in the well at Chester is probably due to the openings being partly above and partly just below the surface of the water. That they not infrequently are wholly below appears probable from observations on springs and wells, for it has been noticed that in certain chalk-springs there is an increase in the amount of water flowing when there is a rapid fall in the barometer, though no rain may have fallen, and that under the same circumstances water recommences to flow from land-drains and percolation gauges. The gaugings of deep wells in the chalk have confirmed these observations and show that there is a rise in the water-level under a decrease of atmospheric pressure. These movements have been attributed to the expansion of the dissolved gases.[1] It is probable that the gases when given off by the water, rise into and occupy cavities from which there is no escape upwards.

It is noticeable however that five certainly, and two probably, of the blowing wells described above derive their properties from fissures in the New Red Sandstone; no case is known in either chalk or limestone, though these are soluble rocks peculiarly liable to contain caverns or widened joints. It is not improbable that the fissures are too numerous in these rocks, so that wherever large hollows occur, there are also communications upwards with the open air. In sandstone on the other hand large hollows are of extremely rare occurrence, and in view of this difficulty it has been suggested that the Magnesian Limestone which underlies it about Northallerton, at a depth of about 400 feet, and is known to be extremely cavernous, may have given way in places, and led to the formation of hollows in the sandstone. This explanation however is not applicable to the wells at Tamworth or Chester, where the sandstone is not underlain by limestone. It seems more probable that the strength of the air-currents should be taken in connection with the copiousness of the water-supply as indicative of the great extent of small ramifying fissures in some of the triassic sandstones. That the united capacity of such fissures must be very great to account for the phenomena is undeniable. The volume of air contained in the cavities at the Solberge well was estimated at about 10,000,000 cubic feet, or as much as would fill a chamber measuring 217 feet each way, length, width, and height.[2] In making this estimate no allowance was made for aqueous vapour, or for air held in solution in the water, both of which would come off in increased quantities with a decreasing pressure. The former was known by the state of the meter to have been present in large quantities. But making every allowance for these causes of error, it is impossible to escape the conclusion that the fissures, small as they are individually, must in the aggregate form a reservoir of immense capacity.

In concluding these remarks we may refer to the practical application of the knowledge of these properties in fissures. It has been noticed that the drains of large works begin to smell on the approach of rain, and there can be little doubt that this is partly due to the setting up of an outward current corresponding to a fall in the barometer. In fact every network of covered drains, and every covered cess-pool, where special provision for ventilation is not made, must constitute a natural blowing well. It is not our intention to discuss here the engineering details of drainage. It is sufficient to point out that by a faulty system of ventilation, or by the derangement of a system originally good, sewer-gas might be forced into a house with every fall of the barometer.

Lastly we would allude to the effect of the barometer on the escape of fire-damp from coal-seams. Coal is a rock subject to jointing; seams are not only broken through and displaced by faults, but for some distance from the main fracture are traversed by joints and smaller shifts resulting from the general strain. A brief visit to a fiery portion of a mine is sufficient to show the part played by these small clefts. On every side is heard the monotonous hissing or bubbling of the escaping gas, often accompanied by the deeper note of a "blower," or one of those larger channels often observed in connection with faults. The gas is continously given off as a result of a slow decomposition taking place in the coal, and the amount that comes off indicates a great extent of connected fissuring. For though cavities charged with gas under pressure and liable to exhaustion are found, yet large "blowers" commonly continue active for years, and must therefore drain a large area of the seam. While the movement of the gas in the blower differs from that of the air in sandstone fissures, in being always in one direction, namely outwards, it is at the same time evident that the same cause which induces an outward current in the well would cause an increase in the outward current from the coal. The increase would be proportional to the capacity of the fissures; a fall in the barometer from thirty to twenty-nine inches for example would cause $\frac{1}{30}$th of the body of gas stored in the fissures to be added to the ordinary outflow. The liability to explosion with a falling glass has long been a subject of observation. When it is considered that a wide margin is usually allowed in the ventilation to ensure the sufficient dilution and removal of fire-damp, and that a number of other contingencies may bring about an explosion, it becomes evident that a powerful cause must be operating to make the influence of the barometric changes perceptible.

A. STRAHAN

[1] Baldwin Latham, Report of the British Association for 1881, p. 614.
[2] *Proc.* York Geol. and Polyt. Soc., *op. cit.*

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 25.—"Internal Reflections in the Eye," by H. Frank Newall, B.A.

The author in this paper describes the appearance and investigates the cause of a faint light seen under certain circumstances now to be related:—Stand opposite a uniformly dark wall in a darkened room. Direct the eye to any point in front, and keeping the eye fixed, and being ready to perceive any appearance out of the line of direct vision without moving the eyes towards it, hold up a candle at arm's length, and move it to and fro over about two inches on a level with the point fixed, and a little to the right or left of it. The faint light may be seen moving with a motion opposite to that of the candle on the other side of the point of direct vision.

Near inspection of the light shows it to be an inverted image of the candle, about equal in size, very faint.

Reasons related in the paper lead the author to offer the following explanation: the physical cause of the faint light or "ghost," is light which, proceeding outwards from the image of the candle, formed on the retina by the lens, is reflected back on to the retina by the anterior surface of the lens. This second image is "referred" outwards, and seems as if produced by a faint source of light outside the eye.

The effects of alterations of the state of accommodation on the appearance of the ghost are described; the question as to whether the retina is to be regarded as a screen or as a *regular* reflector is discussed; and the results of calculations based on numbers given by Helmholtz for his schematic eye are noted as forming a difficulty in the explanation.

If the candle be replaced by sunlight, further observations are to be made: (1) signs of the faulty centering of eye-surfaces, as shown by the fact that the sun and its ghost do not arrive at the centre of the field of vision together; (2) signs of oblique reflection at a concave mirror, as shown by the fact that the ghost is circular in only one state of accommodation, whilst in other states it is extended either in a horizontal direction for near focus, or in a vertical direction for distant focus.

To about four out of fifteen persons the author has failed to show the ghost; but no relation is as yet observed between the visibility of the ghost and the kind of sight of the observer, as defined by the ordinary terms, long- and short-sightedness.

A second "ghost," probably due to reflections entirely within the lens, is referred to in the paper: but this, on account of its indistinctness, has not been investigated, except to establish the fact that its motion is the same in direction as that of the candle in the circumstances above related.

February 1.—On the Electrical Resistance of Carbon Contacts, by Shelford Bidwell, M.A., LL.B.

The experiments described in the paper were undertaken with the object of investigating the changes of resistance occurring in carbon contacts under various conditions.

A short movable carbon rod was placed across and at right angles to a similar rod which was fixed in a horizontal position, and arrangements were made for varying and accurately measuring the pressure of the one upon the other, for varying and measuring the current passing through them, and for measuring the resistance at the points of contact. The following are the most important results arrived at:—

1. *Carbon Contacts.*—Changes of pressure produce proportionately greater changes of resistance with small pressures than with great pressures. Thus, when the pressure was increased from ·25 to ·5 grms., the resistance fell from 16·1 to 11·0 ohms., the difference being 5·1 ohms; whereas, when the pressure was increased from 25 to 50 grms., the resistance fell from 2·1 to 1·8 ohms., the difference being only ·3 ohms.

Changes of pressure produce proportionately greater changes of resistance with weak currents than with strong currents. Thus when the pressure was increased from ·25 to ·5 grm., the resistance fell from 9·27 to 8·45 ohms with a current of ·1 ampere; and from 25·50 to 17·75 ohms with a current of ·001 ampere.

Changes of current, the pressure remaining constant, produce greater changes of resistance with small currents than with large currents, and with light pressures than with heavy pressures.

When the resistance of a carbon contact has been reduced by an increase of pressure, it will, on the removal of the added pressure, rise to approximately its original value.

The passage of a current whose strength does not exceed a certain limit, depending upon the pressure, causes a permanent diminution in the resistance (so long, of course, as the contacts are undisturbed), and the stronger the current, the greater will be such diminution.

When the strength of the current exceeds a certain limit, the resistance is greatly and permanently increased (generally becoming infinite). The greater the pressure, the higher will be such limit.

Unless special means are adopted for maintaining a constant current, the fall in the resistance which attends increased pressure is greater than that which is due to increased pressure alone being partly due also to the increased current.

It is not proved that the diminished resistance which follows an increase of current is an effect of temperature.

2. *Metallic Contacts.*—For the sake of comparison, a few experiments were made with metals. The metal principally used was bismuth, which was selected on account of its high specific resistance, but experiments were also made with copper and platinum.

In the case of bismuth, and probably of other metals:—With a given pressure, the weaker the current the higher will be the resistance. This effect is most marked when the current is small. Thus, with a pressure of ·1 grm. the resistance, with a current of ·1 ampere, was 2 ohms; with ·01 ampere it was 16·92 ohms; and with a current of ·001 ampere it was 143·3 ohms. With a pressure of ·5 grm., the resistance with the same currents as before was 1·45, 1·47, and 3·8 ohms.

The passage of a current, even when very small, causes a permanent adhesion between metallic contacts. This effect had been previously observed by Mr. Stroh.

Increase in the current is accompanied by a fall of resistance, and if the current be again reduced to its original strength, the resulting change in the resistance will be small, and it will in no case return to its original value.

Diminution in the strength of the current is followed by a small fall in the resistance if the metal is clean, and by a small rise in the resistance if the metal is not clean.

Increased pressure produces a greater fall in the resistance with small pressures than with great pressures, and with weak currents than with strong currents.

The resistance, after having been reduced by increased pressure, does not return to its original value when the added pressure is removed.

3. *Reasons for the Superiority of Carbon over Metal in the Microphone.*—The above observations may perhaps furnish an answer to the question, Why does carbon give far better results than any metal when used in the microphone? The mere fact that a current causes delicately-adjusted metal contacts to adhere to each other seems sufficient to account for the superior efficiency of carbon. In addition to this phenomenon of adhesion, and probably connected with it, are the facts that metallic contacts, unlike those of carbon, do not even approximately recover their original resistance when once it has been reduced by increased pressure or increased current, unless indeed complete separation occurs; and even the initial effect of pressure upon resistance is in general much more marked with carbon than with metals.

Lastly, it is to be noticed that in the case of carbon, pressure and current act in consonance with each other: pressure diminishes the resistance, and in so doing, increases the strength of the current; and the current thus strengthened effects a further diminution in the resistance. In the case of metals, on the other hand (or at least in the case of clean bismuth) pressure and current tend to produce opposite effects. The resistance is diminished by pressure, and the current consequently strengthened; but by reason of the increased strength of current, the resistance is *higher* than it would have been if the current had remained unchanged. The effect of this antagonism is not very great, but it seems sufficient to give a material advantage to carbon.[1]

The paper contains fifteen tables, four curves, and three diagrams, illustrative of the apparatus used.

February 8.—"Note on Terrestrial Radiation." By John Tyndall, F.R.S.

On Hind Head, a fine moorland plateau about three miles from Haslemere, with an elevation of 900 feet above the sea, I have recently erected a small iron hut, which forms, not only a place of rest, but an extremely suitable station for meteorological observations. Here, since the beginning of last November, I have continued to record from time to time the temperature of the earth's surface as compared with that of the air above the surface. My object was to apply, if possible, the results which my experiments had established regarding the action of aqueous vapour upon radiant heat.

Two stout poles about 6 feet high were firmly fixed in the earth 8 feet asunder. From one pole to the other was stretched a string, from the centre of which the air thermometer was suspended. Its bulb was 4 feet above the earth. The surface thermometer was placed upon a layer of cotton wool, on a spot cleared of heather, which thickly covered the rest of the ground. The outlook from the thermometers was free and extensive; with the exception of the iron hut just referred to, there was no house near, the hut being about 50 yards distant from the thermometers.

On November 11, at 5.45 p.m., these were placed in position, and observed from time to time afterwards. Here are the results:—

6	p.m.	...	Air 36° Fahr.	...	Wool 26° Fahr.
8.10	,,	...	,, 36	...	,, 25
9.15	,,	...	,, 36	...	,, 25

air almost dead calm, sky clear, and stars shining.

November 12, the wind had veered to the east, and was rather strong. The thermometers, exposed at 5 p.m., yielded the following results:—

5.15	p.m.	...	Air 38°	...	Wool 33°
5.45	,,	...	,, 38	...	,, 34
6.45	,,	...	,, 38	...	,, 35
9	,,	...	,, 39	...	,, 36

During the first and last of these observations the sky was entirely overcast, during the other two a few stars were dimly visible.

On November 13, 25, and 26, observations were also made, but they presented nothing remarkable.

It was otherwise, however, on December 10. On the morning of that day the temperature was very low, snow a foot deep covered the heather, while there was a very light movement of the air from the north-east. Assuming aqueous vapour to play the part that I have ascribed to it, the conditions were exactly such as would entitle us on *a priori* grounds to expect a considerable waste of the earth's heat. At 8.5 a.m. the thermometers were placed in position, having left the hut at a common temperature of 35°. The cotton wool on which the surface thermometer was laid was of the same temperature. A single minute's exposure sufficed to establish a difference of 5° between the two thermometers. The following observations were then made:—

8.10 a.m.	...	Air 29°	...	Wool 16°
8.15 ,,	...	,, 29	...	,, 12

Thus, in ten minutes, a difference of no less than 17° had established itself between the two thermometers.

Up to this time the sun was invisible: a dense dark cloud,

[1] In April, 1882, the author communicated this observation to Mr. Preece, who referred to it in a paper read at the Southampton meeting of the Brit. Assoc., on "Recent Progress in Telephony."

resting on the opposite ridge of Blackdown, virtually retarded his rising.

8.20 a.m.	Air 27°	Wool 12°
8.30 ,,	,, 26	,, 11
8.40 ,,	,, 26	,, 10
8.45 ,,	,, 27	,, 11
8.50 ,,	,, 29	,, 11

During the last two observations, the newly-risen sun shone upon the air thermometer. As the day advanced, the difference between air and wool became gradually less. From 18° at 8.50 a.m., it had sunk at 9.25 to 15°, at 9.50 to 13°, while at 10.25, the sun being unclouded at the time, the difference was 11°; the air at that hour being 31° and the wool 20°.

In the celebrated experiments of Patrick Wilson, the greatest difference observed between a surface of snow and the air 2 feet above the snow, was 16°; while the greatest difference noticed by Wells during his long-continued observations fell short of this amount. Had Wilson employed swansdown or cotton wool, and had he placed his thermometer 4 feet instead of 2 feet above the surface, his difference would probably have surpassed mine, for his temperatures were much lower than those observed by me. There is, however, considerable similarity in the conditions under which we operated. Snow in both cases was on the ground, and with him there was a light movement of the air from the east, while with me the motion was from the north-east. The great differences of temperature between earth and air, which both his observations and mine reveal, are due to a common cause, namely, the withdrawal of the check to terrestrial radiation which is imposed by the presence of aqueous vapour.

Let us now compare these results with others obtained at a time of extreme atmospheric serenity, when the air was almost a dead calm, and the sky without a cloud. At 3.30 p.m., January 16, the thermometers were placed in position, and observed afterwards with the following results:—

3.40 p.m.	Air 43°	Wool 37°
3.50 ,,	,, 42	,, 35
4 ,,	,, 41	,, 35
4.15 ,,	,, 40	,, 34
4.30 ,,	,, 38	,, 32
5 ,,	,, 37	,, 28
5.30 ,,	,, 37	,, 30
6 ,,	,, 36	,, 32

These observations, and especially the last of them, merit our attention. There was no visible impediment to terrestrial radiation. The sky was extremely clear, the moon was shining; Orion, the Pleiades, Charles's Wain, including the small companion star at the bend of the shaft, the north star, and many others, were clearly visible. On no previous occasion during these observations had I seen the firmament purer; and still, under these favourable conditions, the difference between air and wool at 6 p.m. was only 4°, or less than one-fourth of that observed on the morning of December 10.

We have here, I submit, a very striking illustration of the action of that invisible constituent of the atmosphere, to the influence of which I drew attention more than twenty-two years ago. On December 10 the wind was light from the north-east, with a low temperature. On January 16 it was very light from the south-west, with a higher temperature. The one was a dry air, the other was a humid air; the latter, therefore, though of great optical transparency, proved competent to arrest the invisible heat of the earth.

The variations in the temperatures of the wool recorded in the last column of figures are, moreover, not without a cause. The advance of temperature from 28° at 5 p.m. to 32° at 6 p.m., is not to be accounted for by any visible change in the atmosphere, or by any alteration in the motion of the air. The advance was due to the intrusion at 6 p.m. of an invisible screen between the earth and firmament.

As the night advanced the serenity of the air became, if possible, more perfect, and the observations were continued with the following results:—

6.30 p.m.	Air 36°	Wool 31°
7 ,,	,, 36	,, 28
7.30 ,,	,, 35½	,, 28
8 ,,	,, 35	,, 26
8.30 ,,	,, 34	,, 25
9 ,,	,, 35	,, 27
10 ,,	,, 35	,, 28
10.30 ,,	,, 35	,, 29

After this last observation, my notes contain the remark, "Atmosphere exquisitely clear. From zenith to horizon cloudless all round."

Here, again, the difference of 4° between the temperature of the wool at 8.30 p.m., and its temperature at 10.30 p.m., is not to be referred to any sensible change in the condition of the atmosphere.

The observations were continued on January 17, 23, 24, 25, and 30; but I will confine myself to the results obtained on the evening of the day last-mentioned. The thermometers were exposed at 6.45 p.m., and by aid of a lamp read off from time to time afterwards.

7.15 p.m.	Air 32°	Wool 26°
8 ,,	,, 31	,, 26
9.30 ,,	,, 31	,, 27

During these observations the atmosphere was very serene. There was no moon, but the firmament was powdered with stars. The serenity, however, had been preceded by heavy rain, which doubtless had left the atmosphere charged with aqueous vapour. The movement of the air was from the south-west and light. Here again, with an atmosphere at least as clear as that on December 10, the difference between air and wool did not amount to one-fourth of that observed on the latter occasion.

The results obtained on February 3 were corroborative. The thermometers were exposed at 6.15 p.m.

7.15 p.m.	Air 34°	Wool 28°
8.25 ,,	,, 34	,, 30

Here again, the difference between air and wool is only 4°, although the sky was cloudless, and the stars were bright. The movement of the air was from the south-west and light.

On the forenoon of this day there had been a heavy and persistent rain storm. Heavy rain and high wind also occurred on the night following. The serene interval during which the observations were made lay, therefore, between the two storms. Doubtless the gap was well filled with pure aqueous vapour.

Further observations were made in considerable numbers, but they need not here be dwelt upon, my object being to illustrate a principle rather than to add to the multitudinous records of meteorology. It will be sufficient to say that, with atmospheric conditions sensibly alike, the waste of heat from the earth varies from day to day; a result due to the action of a body which escapes the sense of vi-ion. It is hardly necessary for me to repeat here my references to the observations of Leslie, Hennessey, and others, which revealed variations in the earth's emission for which the observers could not account. A close inspection of the observations of the late Principal Forbes on the Faulhorn proves, I think, that the action of aqueous vapour came there into play, and his detection of this action, while unacquainted with its cause, is in my opinion a cogent proof of the accuracy of his work as a meteorologist.

Postscript.—In the *Philosophical Transactions* for 1882, Part I. p. 348, I refer to certain experiments executed by Prof. Soret of Geneva. My friend has recently drawn my attention to a communication made by him to the French Association for the Advancement of Science in 1872. It gives me great pleasure to cite here the conclusions at which he has arrived.

"The influence of humidity is shown by the whole of the observations; and it may be stated generally that, other circumstances being equal, the greater the tension of aqueous vapour the less intense is the radiation.

"In winter, when the air is drier, the radiation is much more intense than in summer, for the same height of the sun above the horizon.

"On several occasions a more intense radiation has been observed in dry than in humid weather, although the atmosphere was incontestably purer and more transparent in the second case than in the first.

"The maximum intensity of radiation, particularly in the summer, corresponds habitually to days exceptionally cold and dry."

Such are the results of experiments, executed by a most excellent observer, on the radiation of the sun. They apply word for word to terrestrial radiation. They are, moreover, in complete harmony with the results published by General Strachey in the *Philosophical Magazine* for 1866. Meteorologists will not, I trust, be offended with me if I say that from such outsiders, fresh to the work and equipped with the necessary physical knowledge, they may expect efficient aid towards introducing order and causality among their valuable observations.

Mathematical Society, February 8.—Prof. Henrici, F.R.S., president, in the chair.—Capt. P. A. MacMahon, R.A., was admitted into the Society.—The following communications were made:—On the Sylvester-Kempe quadruplane, by Mr. H. Hart.—On curves obtained by an extension of Maclaurin's method of constructing conics, by Mr. S. Roberts, F.R.S.—A generalisation of the "nine-point" properties of a triangle, by Capt. P. A. MacMahon.—On the use of certain differential operators in the theory of equations, by Mr. J. Hammond.—A method for reducing the differential expression $dt/\sqrt{\{t-\alpha, t-\beta, t-\gamma, t-\delta\}}$ to the standard form, by Mr. J. Griffiths. The "nine-point" property was the following:—If through the centre of the circle *A B C*, and the ortho-centre of the triangle *A B C*, lines be drawn making angles α and $\pi - \alpha$ with the sides of the triangle, twelve points will be obtained on the sides, and these lie six and six on two circles of radius $\frac{1}{2} R$ cosec α. Each circle also passes through six other points, and they are inscribed circles of the two three-cusped hypocycloids, which are the envelopes of the two tangents, equally inclined to the axis (at angles α), to a parabola inscribed in the triangle *A B C*. Of course, when $\alpha = \frac{\pi}{2}$, the circles become the ordinary nine-point circle of *A B C*.

Linnean Society, February 1.—Sir John Lubbock, Bart., F.R.S., president, in the chair.—Messrs. F. W. Burbidge and Joseph Johnson were elected Fellows of the Society.—Dr. W. C. Ondaatje called attention to examples of red coral from Ceylon.—Mr. W. T. Thiselton Dyer exhibited a model of the fruit of the Double Cocoa-nut (*Lodoicea Seychellarum*, Lab.), of an unusual form, obtained from Major-General C. G. Gordon, R.E.—A series of microscopic sections of coal-plants were shown on behalf of Mr. J. Norman.—The following paper was then read:—On the structure, development, and life-history of a tropical epiphyllous lichen, by H. Marshall Ward. The author's observations lead him to believe that the epiphyllous cryptogam in question supports the view that a lichen is a compound organism composed of an alga on which an ascomycetous fungus has become more or less intimately affixed and dependent. It is developed on the leaves of many plants, but it has been more closely watched on *Michelia furcata*. The lichen presents four types, orange-red stellate patches, greyish-green blotches, clear grey spots, and white shining circles, but these pass imperceptibly into one another, and vary in size from a speck to a quarter of an inch in diameter. The reddish spots of the earlier stages is an alga of which the radiating filaments are in part reproductive organs, and in part barren hairs. It subsequently passes into the grey and green stages, and by a modification of growth the invasion of a fungus mycelium succeeds. The white matrix of the complete lichen consists of the same algal thallus invested by dense masses of the fungus hyphæ, which produce shining black dots, viz. the fruit bodies. The author describes in detail the peculiarities of growth and reproduction of the alga and fungus, and formation of the lichen. He alludes to and criticises Dr. Cunningham's account of *Mycoidea parasitica*, which latter is evidently closely related to that described by himself. Assuming that Mycoidea and Ward's Alga are generically the same, either Cunningham discovered a female organ of reproduction which becomes fertilised and produces zoospores, or he confounded these with certain fertile hair organs described by Ward. As regards the systematic position of the alga, a comparison with *Coleochæta* suggests that there is very little in common beyond mode of growth of the disc-like thallus, and the production of zoospores from certain cells. The genus *Chroolepus*, moreover, presents features which agree in several important points, viz., orange-red oily-cell contents, habitat, production of zoospores in ovoid cells developed terminally and laterally. The structure of the thallus, and relative positions of the main masses of fungal and algal portions, agree with what occurs in heteromerous crustaceous lichens, as Graphidea; but the perithecia indicate an angiocarpous alliance, bringing this form nearer such families as Pertusaria and Verrucaria, to the latter of which it may ultimately be referred.—A paper was read by F. Maule Campbell, on the pairing of *Tegenaria Guyonii*, and description of certain organs in the male abdominal sexual region. Two cases are related in which during confinement the males killed the females after union, and an instance is also given of an attempt to impregnate an immature female which was also destroyed by the male. In neither case could hunger have been the cause of the attack. The writer explains the occurrences, and also the accounts of females destroying males after union, on the ground "that those instincts which are habitually practised throughout the far greater portion of the life of the species, and on which it is dependent, would scarcely be suspended for a longer period than necessary for the sexual union." Some of the habits of spiders, and especially of this species, are mentioned as bearing on these sexual conflicts, and the specific benefits which would arise from them are referred to. The paper concluded by a note on some glands (probably for spinning) situated on the convexity of the abdominal sexual region. The ducts are considerably convoluted, and open through transparent tubular spines which are arranged transversely to the axis of the body of the spider. Two papilla-like processes below the opening of the genital sinus are described.

Zoological Society, February 6.—Prof. W. H. Flower, LL.D., F.R.S., president, in the chair.—A letter was read from Mr. F. C. Selous, dated from the Matabele Country, on the possibility of obtaining a White Rhinoceros.—Extracts were read from a letter received from the Rev. G. H. R. Fisk, C.M.Z.S., of Cape Town, giving an account of the habits of some reptiles which he had had in captivity.—A communication was read from Messrs. Salvin and Godman, containing the description of a new species of Pigeon of the genus *Otidiphaps* from Ferguson Island, one of the D'Entrecasteaux group, which they proposed to call *O. insularis*.—Mr. Sclater read some further notes on *Tragelaphus gratus*, and exhibited drawings of both sexes of this antelope, taken from specimens living in the Menagerie of the Jardin des Plantes, Paris.—A communication was read from Mr. E. W. White, F.Z.S., containing some supplementary notes to a former paper on the birds of the Argentine Republic.—A communication was read from the Rev. G. A. Shaw, containing some notes on the habits of an Aye-Aye which he had had in confinement for several months, and other information respecting this animal.—Mr G. A. Boulenger, F.Z.S., read a paper containing the description of a new species of Lizard of the genus *Enyalius* from Peru, which he proposed to name *E. palpebralis*.

BERLIN

Physiological Society, January 12.—Prof. du Bois Reymond, in the chair.—Dr. Falk read a contribution upon the phenomenon lately demonstrated by experiments on animals, that great oedema of the lungs can be produced in a very short time, even in a quarter of an hour, by compressing or otherwise interrupting the function of the left side of the heart; whereas a similar action on the right side does not produce such an effect. Dr. Falk has had an opportunity in two post-mortems of proving the correctness of these observations in respect to man. In one of these cases, a strong, healthy man died in consequence of a discharge of shot, and the post-mortem showed that the cause of death was the penetration of a shot into the wall of the left ventricle. The lung of this previously healthy man exhibited a high degree of oedema. In the second case, a healthy railway-workman was killed by a blow of a buffer upon the chest. The post-mortem showed a rupture of the right ventricle to have been the cause of death; the lungs which were carefully examined, did not show a trace of oedema.—Dr. W. Wolff described the structure of the tactile corpuscles, according to his researches, they contain no nerve-branchings, but consist of a rugose sheath, granular contents, and the free ends of the entering nerve-fibres. In opposition to other histologists he further found the epithelium-cells which he studied in the corneæ of small mammals to be devoid of nerves; and in agreement with this he has always found gland-cells to be without nerve. The sympathic nerve-fibres which enter into the glands according to Dr. Wolff always end in unstriped muscles.—Prof. Kronecker reported on experiments of Dr. Meiss, upon the irritability of the heart under abnormal conditions of nutrition. During experiments, undertaken to study the comparative effects of concentrated and diluted blood upon the frog's heart, and which established the occurrence of a more energetic activity by nutrition with concentrated blood, certain remarkable deviations occasionally occurred from the general law that frog's hearts (always) respond to every stimulation with maximal contractions. These deviations consisted in the occurrence of smaller sub-maximal beats between the maximal beats. Further investigation of this appearance led to the conclusion that this was a result of abnormal conditions of nutrition which was not easily or certainly to be produced. These sub-maximal contractions and the irregular pulse, were chiefly observed when passing a current of asphyxiated blood through the heart, but they always disappeared on supplying the heart with fresh blood.

Physical Society, January 19.—Prof. Roeber in the chair.—Prof. Schwalbe supplemented his former communications to the Society on ice-caves, wtth additional facts he had recently come to know through literature. He noted, as a most interesting phenomenon, that the occurrence of ice-caves was not confined to limestones, basalts, and lavas, but that they have also been observed in gypsum-hills. Thus, in the gypsum-hill Illetzkaja Satscha, in the Southern Ural, is an ice-cave which Murchison visited in August; situated in the street, it was closed with a simple wooden door, and it was utilised by the inhabitants of the district as a store-room. Its temperature was so low that the drinks kept in it only a short distance from the mouth were frozen. And as with all other caves distinguished by their low temperature and ice-formation, it was stated of this one, that in winter the air in it was very warm, so that people slept in it at night without requiring their sheep-skin furs. Murchison had applied to Sir John Herschel for an explanation of the phenomenon, and Herschel had offered the hypothesis, that it was a case of cold and heat waves, which, penetrating inwards from the surface of the earth, were retarded, and so caused the low temperature in summer and the warmth in winter. Prof. Schwalbe, however, has convinced himself that this explanation is inadequate; for the summers in which ice-caves have been visited and found filled with ice, have been preceded by very mild winters, *e.g.* the winter 1881-2 was very mild, yet the ice-cave in Bohemia, which he had himself visited, was covered with ice; besides, the retardation of cold several months is very improbable. Before a sufficient explanation of these peculiar conditions of temperature can be reached, continuous scientific observations must be made, for a long time, of the course of the temperature throughout the year. As to the warmth of air in the caves in winter, and the melting of the ice in winter, there are only observations by lay-persons, which, however, strikingly agree, even in the assertion that the ice-formation regularly takes place on a large scale in the month of May. With regard to the immediate cause of the ice formation no one (according to the author) can be in doubt, who has visited an ice-cave, and seen how the dropping water from the roof solidifies directly on falling. Water that has trickled through is over-cooled, and solidifies just as after falling to the ground, even when it meets a different solid body; the ice, further, is only met with where water drops. The strong cooling of the water and of the rock through which it has trickled, is, perhaps, connected with the process of filtration through the earth-strata. On this point experimental research must decide, following up the investigation made by Jungk in 1865, who observed a lowering of temperature in filtration of water through porous partitions. Such laboratory experiments, exact long-continued temperature-observations in accessible ice-caves, and topographical examinations of as many as possible of these caves (which are not rare), will surely bring about a solution of this still obscure natural problem.

Paris

Academy of Sciences, February 5.—M. Blanchard in the chair.—The following papers were read:—On the physical and mechanical constitution of the sun (third and last part), by M. Faye. He deals with the depth of spots, the movements of hydrogen and their effects, the height of protuberances and an illusion attending them, the clouds of the photosphere, &c.—M. Hirn presented an analysis of a *brochure* by himself and M. Hollauer. "Refutations of a second critique of M. G. Zeuner." It relates to the theory of steam-engines.—On the spherical representation of surfaces, by M. Darboux.—On the functions satisfying the equation $\Delta F = 0$, by M. Appell.—On the displacement of the sodium lines, observed in the spectrum of the great comet of 1882, by MM. Thollon and Guy. From the displacement observed with a single-prism spectroscope, he had estimated the rate of recession of the comet at from 61 to 76 km. per second. This is confirmed by M. Bigourdan, who, from a determination of the trajectory of the comet, estimates the velocity at the time in question (3 p.m. on September 18) at 73 km. The spectroscope is thus shown to be reliable for the purpose referred to.—Magnetic action of the sun and the planets; it does not produce secular variation in the great axes of orbits: note by M. Quet.—The distribution of energy in the solar spectrum and chlorophyll, by M. Timiriazeff. Prof. Langley finds, with his bolometer, the maximum of radiant energy in the orange, precisely that part of the spectrum which corresponds to the characteristic band of chlorophyll. M. Timiriazeff is studying the quantitative relation between solar energy absorbed by the chlorophyll of a leaf and that stored up through chemical work produced. It appears that the leaf can transform into useful work as much as 40 per cent. of the energy absorbed.—On some combinations of sulphite of magnesia with alkaline sulphites, by M. Gorgeu.—On hydraulic silica; reply to M. Le Châtelier, by M. Landrin.—On the mutual displacements of bases in neutral salts, the systems remaining homogeneous, by M. Menschutkine.—The microbes of marine fishes, by MM. Olivier and Richet. In all the fishes they examined (about 150) there were, in the peritoneal liquid, the lymph, the blood, and consequently in the tissues, microbes more or less numerous, having all the characters of terrestrial microbes, and reproducing similarly. Besides direct observation, the authors had recourse to experiments (1) of cultivation, (2) of occlusion. (In the latter case the fishes, or parts of them, were put into melted paraffine, which, after solidifying, was coated with several layers of collodion and Canada balsam, to protect from atmospheric germs. In a few weeks microbes were always abundantly developed.) The organisms were mostly *Bacillus*.—On the reaction-time of olfactory sensations, by M. Beaunis. He gives numerical results for this quantity (which is the time between sense-excitation and the moment when the person indicates by a signal that he has experienced the sensation) in the case of ten substances: ammonia, acetic acid, camphor, &c. They range from 37 to to 67 hundredths of a second. The time is longer than that for tactile, visual, and auditory sensations (in the author's case shorter than for tactile sensations).—On the respiration of aquatic plants or submerged aquatic-aërial plants, by M. Barthélemy. He considers the phenomena brought forward as proof and measure of the chlorophyllian function merely exceptional, and produced by the mode of experimentation. Under normal conditions, the special respiration of green organs cannot have the universal importance attributed to it.—Note on the morphological nature of the aërial branches of adult *Psilotum*, by M. Bertrand.—Influence of temperature on the production of wheat, by M. Duchaussoy. He gives in a table the yield of wheat in the department of Cher, and the mean temperature of spring and summer, from 1872 to 1881. The descending scale of the yield is nearly that of the mean temperature of summer. The years 1873 and 1876 are exceptions, and their small yield is explained by the dryness of the summer.

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