established by recent researches on gaseous conveyance of electricity and vacuum-tube phenomena. This, however, is a large subject, and cannot yet be regarded as by any means satisfactorily understood; though everything points to the fact that gases transmit currents by atomic convection, *i.e.* electrolytically.

(2) When copper touches zinc, the previous state of equilibrium is disturbed, and a fresh equilibrium is set up, into which dielectric strain in the surrounding insulator enters as a prominent component. Attack of the zinc, and continuous progression of electricity, are precisely what then tend to occur, being only prevented by the insulating character of the medium. Permit it to conduct, and the whole at once becomes a Voltaic cell on closed circuit.

(3) If the potential of a metal is defined as Sir W. Thomson defines it, *viz.* as the potential energy of a unit charge in the air close to the metal, the statement quoted from p. 111 must of course be modified; but if, as I believe, true. An intrinsic step of potential exists between each metal and the air in contact with it, which step is constant for each metal and calculable from thermo-chemical data; if therefore by metallic contact two metals be forced to the same potential, it at once follows that a slope of potential is set up in the air from one to the other. This is the very thing observed in all static Volta experiments, and has been cursorily stated as if it were a difference of potential between the metals themselves.

I think Mr. Burbury will find this quite clear if he does me the honour to read the complete argument; but if he still perceives a difficulty, I shall be much interested in hearing from him further.

OLIVER J. LODGE.

Attractive Characters in Fungi.

It is to be hoped that the interesting discussion on the colours and attractive characters of fungi may induce someone, with the requisite time and patience, to undertake a study in this rich field of investigation, which has scarcely been entered. In a paper published in the *Annals of Botany* (vol. iii., No. 10, May 1889) it is shown that among the Phalloidei the coloration, odour, and contrivances for the attraction of insects for the dispersion of the spores are as remarkable as those possessed by many Phanerogams for cross-fertilization. Among 1288 species of fungi, other than Phalloids, tabulated from Bulliard's "Champignons de la France," Tulasne's "Fungi Hypogæi," and Cooke's "Agarici," the proportion of those with inconspicuous colours is about 73 per cent., while among the Phalloids the proportion is under 2 per cent.; 90 per cent. of the latter being either red or white. According to Köhler and Schubler, as quoted by Balfour, the proportion of inconspicuously coloured flowers, among 4197 species tabulated, is about 4 per cent., the proportion of red and white being slightly over 50 per cent. Seventy-six per cent. of Phalloids have functionally attractive odour, and only 9.9 per cent. of flowers; and 18.6 per cent. of these fungi have rayed or stellate forms, so common among flowers—a shape which I have shown by measurement and experiment to be that which gives the maximum conspicuousness at moderate distances (*i.e.* within the range of insects' vision) with the minimum expenditure of material. In *Coprinus*, where the spores become immersed in black and frequently very fetid fluid, some species appear to resemble certain composite flowers which are visited by large numbers of flies, and Dr. Haas has found glucose in the hymenial fluid. There are reasons to suppose that the fætor developed by *Phallus* may be due to the secondary action of putrefactive bacteria.

From analogy it is probable that the colours and many of the characters in other groups are not adventitious, but have been selected to aid in the preservation of the species; *e.g.* the *Perizæ* are even more brilliantly coloured than the Phalloidei, and have the hymenial surface and spores freely exposed, and many small forms (*Amanita*, *Mycena*) are beautifully coloured, and grow in places where insects abound. In other cases the colours are no doubt protective by inducing resemblance, or by conspicuousness, as in many brightly-coloured poisonous forms (procrystic and aposematic colours of Poulton). I would suggest that in some cases the glutinous character referred to by Mr. Worthington Smith and Dr. Cooke may be protective against the attacks of animals, as insects and slugs. Of hundreds of specimens of *Phallus impudicus* which I have examined, I never

found the gelatinous layer eaten through by slugs, although the spongy stem after emergence from the volva is frequently so eaten, and numbers of Agarici and other forms not so protected are attacked by insects and slugs. It is known that the mucoid secretion of slugs tends to protect them from the attacks of birds and ants, and other enemies.

T. WEMYSS FULTON.

20 Royal Crescent, Edinburgh, January 10.

The Morphology of the Sternum.

MY friend Prof. T. J. Parker has in these pages (Dec. 11, 1890, p. 142) lately recorded the existence of a sternum in the shark *Notidanus indicus*. The anterior of the two cartilages which he figures has been already described by Haswell (Proc. Linn. Soc. N.S.W., vol. ix., part 1); and, in view of Parker's conclusions, it is interesting to note that he speaks of it (p. 23) as "temptingly like the presternal," but that "the presence of such an element in the skeleton of any group nearer than the Amphibia seems to preclude this explanation." That the Amphibian sternum is for the most part, if not wholly, a derivative of the shoulder-girdle, there can no longer be a question; and, although the researches of Goette leave us in doubt concerning the hypo (post-omo) sternum, they show that that can be no derivative of the costal apparatus. Working anatomists will realize in Parker's application of Albrecht's terminology the expression of a fundamental difference between the sternal skeleton of the Ichthyopsida and Amniota. The researches of Goette, Hoffmann, Ruge, and others, show the sternum of the higher Amniota to consist of a greater costal portion and of lesser ones, chief among the latter being the episternum or interclavicle. They suggest (especially if Hoffmann's assertion that the precoracoid or clavicular bar is, in Mammals, primarily continuous with the spine of the scapula) that the interclavicle may be, throughout, the vanishing vestige of the coracoidal sternum of the Ichthyopsida. The latter would appear, therefore, to have been replaced in time by the more familiar costal sternum, derivative of the hæmal arches (ribs); and, this being so, might we not boldly, and with advantage, go a step further than Parker has done, and distinguish between a coracoidal *archisternum* of the Ichthyopsida, and a hæmoeoracoidal *neosternum* of the Amniota? If this be conceded, the characters referred to must be incorporated in our diagnoses of the two great types named.

G. B. HOWES.

South Kensington, January 12.

Stereoscopic Astronomy.

THE following exquisite test of the delicacy to which astronomical photography has attained may be interesting. In Admiral Mouchez's "Photographie Astronomique" (1887)—a small book, and cheap—are eight photographs of Jupiter, by the M.M. Henry, taken on April 21, 1886. Several are at intervals of only three minutes in time. What with the large red spots, the irregularities of the two belts, and white spots on the upper belt, there are quite details enough to enable the eye to perceive the solidity of the planet, in a stereoscope, if the earlier picture is submitted to the right, and the later to the left eye. Reversing the order of the pictures gives a puzzling effect, which, with a little practice, is seen to be hollowness instead of solidity. But the mind resents this true result, and so gets puzzled.

To satisfy myself that I was not, on the other hand, misled by the wish to see solid, I put the matter to the proof by asking a friend to shuffle the photographs, and submit any two to me in the stereoscope without either of us knowing which they were, or in which order they were placed. After recording my judgment, "solid" or "hollow," on each pair, the times and order of place were ascertained and recorded. I found that I was able, after twenty trials, not only to say whether two images taken three minutes apart were rightly or wrongly placed in the stereoscope, but I could guess in any case with some accuracy what the interval was before either of us knew it. This, of course, was only possible by familiarity with these particular images.

W. J. H.

Lawn-Upton, Littlemore, January 17.

Mock Sun.

LAST evening, about five minutes after five o'clock, I observed that a cloud in the south-west was strongly illuminated from below. As the sun had set more than half an hour, and considerably more to the south, I was surprised by the degree of

illumination. Observing more closely, I saw about 5° above the horizon, and about 12° – 15° north of Hartland Point, the appearance of the sun in a fog, but only about one-third the apparent diameter when in the same place. I watched it for about five minutes, when it was gradually obscured by the rising mist.

T. MANN JONES.

Northam, Devon, January 17.

Our Latest Glacial Period.

I AM informed that near the Wash, and I suppose at other parts of the coast, the sea at low water is frozen into masses which with the rising tide become floes, and are urged backwards and forwards on the beach. This is, I believe, not a frequent occurrence on our shores, and it would be interesting if any observers could note whether the shingle or the stones embedded beneath the floes, when such are found, have become polished or scratched as by glacial action.

W. ATKINSON.

17 Trafalgar Square, Chelsea, S.W., January 5.

P.S.—My anticipation has proved correct as far as the small bergs in the Thames are concerned, for after a little search I have found in Chelsea Reach chalk blocks with grooves and striations that would be no discredit to a boulder clay specimen. I should be glad to hear of any similar markings on flint, chert, or other hard rocks, or even on limestone or sandstone, and also to learn whether there are, as I think there must be, other recorded instances of the formation of glaciated rocks in the British Isles or the coasts of Europe since Pleistocene times.

January 17.

THE GREAT FROST OF THE WINTER OF 1890-91.

TO find a parallel to this frost for intensity and endurance, we must go back, as regards London and the south of England generally, to the severe winter of 1814, when the great fair was held on the Thames, which for long presented from bank to bank a uniform stretch of hummocky ice and snow. In that year the severity of the winter was more equably felt over the whole of Great Britain than during the present winter. Thus in 1814, the mean temperature of Gordon Castle, near the Moray Firth, for January was 27° , whereas during last December it was 36° ; and, so far as records go, all parts of the United Kingdom suffered nearly alike during that memorable winter.

But during this winter of 1890-91, the contrasts of temperature in the different parts of the country from Shetland to the Channel are altogether unprecedented. In Shetland and Orkney, the mean temperature of December was about half a degree above the mean of the month for the past thirty-five years. In Caithness it was about the average, but on advancing southward the cold was the more intense, till its maximum intensity was unquestionably at Oxford, where the mean of the month was 11° below the mean of the past 35 years. The following short scheme shows generally the geographical distribution of this great frost, the first column giving the depression below the mean at places on the west coast; the second, at places in the interior of the island; and the third, at places on the east coast:—

West Coast.	Inland.	East Coast.
Barrahead ... $-0^{\circ}9$	Inverness ... $-1^{\circ}4$	Fraserburgh ... $-0^{\circ}3$
Skye ... $-1^{\circ}2$	Braemar ... $-1^{\circ}8$	Aberdeen ... $-0^{\circ}6$
Islay ... $-2^{\circ}0$	Glasgow ... $-3^{\circ}8$	St. Abbs ... $-2^{\circ}8$
Douglas ... $-4^{\circ}4$	York ... $-5^{\circ}6$	Spurn Head ... $-4^{\circ}7$
(Isle of Man) ... $-4^{\circ}4$	Loughboro' ... $-8^{\circ}8$	Yarmouth ... $-5^{\circ}9$
Holyhead ... $-6^{\circ}0$	Oxford ... $-11^{\circ}0$	—
Pembroke ... $-6^{\circ}7$	Southampton ... $-8^{\circ}8$	Dungeness ... $-8^{\circ}1$
Scilly ... $-4^{\circ}4$		

As occurs in all low winter temperatures, the intensity of the cold is most pronounced in situations farthest

removed from the ocean. Thus, from Oxford, the intensity of the frost was in all directions less felt. In Ireland, the intensity was pretty evenly distributed, ranging below the average from $-2^{\circ}5$ at Dublin to $4^{\circ}6$ at Foynes and Killarney.

A very cursory examination of the weather maps of the Meteorological Office shows at once the cause of this singular difference in the degree to which different parts of Great Britain have been subjected to this frost. During the whole of this period atmospheric pressure to the east and north-east of the British Islands, notably over Russia and Scandinavia, has been unusually and persistently high, rising on occasions above 31'000 inches; thus, so to speak, stopping the way to the usual easterly course of the cyclones from the Atlantic over North Western Europe. Thus, in the extreme north of the British Islands, pressure has been lowered below what prevailed to the south, and consequently the preponderance of south-westerly winds has been greater. On the other hand, farther south, barometers have been almost constantly higher than they have been away still farther to southward; and be it particularly noted, low-pressure areas, or cyclones, have been almost constantly present over the Mediterranean, or even on occasions farther south, either formed over this region or drafted in from the Atlantic, with the inevitable result that the whole of Western Europe has been overspread with polar winds from north, north-east, and east, bringing with them a degree of cold which the newspaper press has been chronicling for us at our breakfast-tables day by day.

INDIAN ETHNOGRAPHY.

OUR Indian dependencies form a vast field for ethnological inquiry which we have not as yet sufficiently cultivated; in fact, its importance is realized by but very few. What is really required is a systematic study of the various races of India, carried out according to a definite plan. Independent observers may do, and many have done, much; but by co-ordination more and better work can be accomplished. The Bureau of Ethnology in Washington has for its especial object the investigation and recording of all that relates to the North American Indians, and the splendid series of Reports issued by that Bureau form an invaluable mine of information on American anthropology. Is it too much to ask from our Government that we should have an analogous Bureau of Indian Ethnography? It would not suffice merely to have a department for researches on Indian ethnology, and for the publication of the results; something more than this is wanted. It would be necessary to have a library of works relating to Southern Asia, and to have an elaborately classified catalogue of books, memoirs, articles, and so forth, on every branch of Indian anthropology. Were this done, anyone who wished for information about a particular district would be able to find references to all that was known about the people, their customs, arts, and crafts. The catalogue should be a systematic bibliography, irrespective of the actual contents of the library of the institution, though every endeavour should be made to make this as complete as possible.

Such a Bureau, if properly directed, would serve as a great stimulus to those who are interested in the native races of India, but who require encouragement and direction. There can be little doubt that an immense number of isolated observations are lost for the lack of a suitable depository, the recorders of such observations being fully aware that these are too casual to be of much value; when accumulated, however, the case is very different. Were it known that a record of any obscure or rarely observed custom would be duly filed and so classified as to be readily available to anyone who was studying Indian folk-lore, the probability is that many memoranda would find their way to the Bureau which otherwise would be lost.