THURSDAY, JANUARY 31, 1884

THE INDIANS OF GUIANA

Among the Indians of Guiana: being Sketches chiefly Anthropologic from the Interior of British Guiana. By Everard F. Im Thurn, M.A. Oxon. (London: Kegan Paul, Trench, and Co., 1883.)

GENERALLY speaking, the books of travel on which anthropologists have to depend for information as to the less cultured tribes of mankind are descriptions of a country and its exploration, with a chapter or two on the natives. Here the plan is reversed, the main book being a treatise on Caribs and Arawaks, to which is prefaced a short but lively description of the forests and savannahs of Guiana, with their plants and animals, forming as it were a frame in which to set the human picture. When Mr. Im Thurn first went to Guiana in 1877, he spent much of his two years' stay in wanderings among the Indians, and before the end of 1881 went back to the colony, where he is now Resident Magistrate of the Pomeroon District. Such appointments are much to be commended, on the one hand as putting the indigenous tribes under the control and protection of an official thoroughly conversant with native character and custom, on the other hand as placing a scientific man in intimate relations with the fast disappearing culture of the lower races.

The question to what races these native tribes of Guiana belong has occupied Mr. Im Thurn, with results which are not only interesting in themselves but have a bearing on larger problems of anthropology. We too readily take it for granted that the lower barbarians have no history beyond two or three generations of old men's memory. In the present district, however, something far beyond this seems to be made out. The native tribes of Guiana fall into two divisions. One group is made up of the Arawaks, Warraus, and Wapianas; and these, though unintelligible and hostile to one another, are united by a common feeling of aversion to the Caribs, who, native tradition says, came from the West India Islands. These Caribs, who form the other group of tribes of Guiana, are in appearance, language, and customs similar to those of the West Indies, so that we have here a case of native tradition asserting that certain tribes of a country were invaders from another region, though the Carib immigration thus remembered took place perhaps three to five hundred years ago. The present author is so convinced of the reality of this event that he calls the Caribs in Guiana "stranger" tribes to distinguish them from the "native" tribes. Long ago as the invasion happened, Mr. Im Thurn points out that the industrial arts of the two races have not yet become blended. The Arawaks and other native tribes continue to make their hammocks of palm fibre, not taking to the use of cotton thread for hammock-weaving, although the Caribs brought this art so long ago with them from their islands, and have practised it in Guiana ever since. What is still more curious is that the rude method of making thread by rolling palm or grass fibre into a twist with the palm of the hand on the thigh, may be commonly seen in Guiana, although the use of the spindle for spinning cotton is also usual. The explanation of this coexistence of a savage and a more civilised art is no doubt that the old native tribes were "thigh-twisters," but the new stranger tribes were spinners, and the descendants of both have more or less kept up their hereditary methods (pp. 171, 287).

Among matters bearing on the history of civilisation which struck Mr. Im Thurn was the custom of building houses on piles. This may be seen in its primary form among the Warraus (p. 202); although quiet times and security from enemies make it no longer worth their while to build actually out in the waters, they still build many pile-huts in the swamps. These miserable huts have been described as standing on a platform of interlaced stems of the manicole palm, supported on tree trunks five or six feet high, with a notched trunk serving as a ladder, to which, when the waters were high, the canoe was made fast. The motive of building in such a situation is intelligible enough as a means of safety from enemies, but next we come to an extension of the practice requiring explanation:—

"A most remarkable fact is that houses on piles are not unfrequently built, for no apparent reason, on the savannah; and this is done not by any special tribe, but occasionally by Arecunas, Macusis, and by other Carib tribes. They stand not in swamps but on dry ground, sometimes on top of a hill. Except that they are much larger, they are exactly like the Warrau houses already described; and it is a noteworthy fact that the platform on which the house stands is, as in the case of the Warrau houses, made of the stems of manicole palms (*Euterpe oleracea*), though this moisture-loving palm is very locally distributed in the savannah region, and the Indians fetch it from long distances, although other apparently equally suitable material is at hand. It is probable that these savannah pile-builders revert to a form of house which they saw—and perhaps used—on the coast land, when they first reached the mainland from the islands."

This explanation of pile-houses on land as due to survival of the once purposeful habit of building them in the water is the more interesting from its correspondence with a theory based on similar facts on the other side of the globe. Prof. Moseley, describing New Guinea ("Notes by a Naturalist on the *Challenger*," p. 396) points out that the pile-dwellings must have been first built in the water for protection and afterwards were continued on land. Pushing the argument further, he suggests that the pile-house on dry ground was converted into a two-story dwelling by filling in the spaces between the poles with leaves or mats, so that the lower part might serve as a storehouse or cowhouse. In this way Prof. Moseley accounts for the Swiss peasant's châlet as derived from the watery home of the ancient lake-dweller, the present balcony representing the old platform to which the lake-men climbed up from their canoes. When the present remarks find their way into Mr. Im Thurn's hands, it is to be hoped that he will test this ingenious view by the evidence within his reach.

Mr. Im Thurn's researches into the religious ideas of the Guiana tribes disclose a remarkable theological condition. To so acute a student of the theory of religion it must have been an exciting occupation to live in daily mental contact with Animistic conceptions at once so primitive and so vivid. In any future discussion of

Animism, the results obtained by him must take a prominent place.[1] Few, if any, Europeans have had such perfect opportunity of seeing the idea of soul originate in the evidence of the senses in dreams, as interpreted by childlike, savage philosophy. Dreams are, to these rude people, events of real life, in which the spirits or phantoms of other men come to them in sleep, or are seen when the sleeper, in like manner, leaves his own body lying and goes forth into the dream-world. Both these conceptions are illustrated in the following stories of what occurred to our traveller :—

"It becomes important, therefore fully to recognise the complete belief of the Indian in the reality of his dream-life, and in the unbroken continuity of this with his working life. It is easy to show this belief by many incidents which came under my notice. For instance, one morning when it was important to me to get away from a camp on the Essequibo River, at which I had been detained for some days by the illness of some of my Indian companions, I found that one of the invalids, a young Macusi, though better in health, was so enraged against me that he refused to stir, for he declared that, with great want of consideration for his weak health, I had taken him out during the night and had made him haul the canoe up a series of difficult cataracts. Nothing could persuade him that this was but a dream, and it was some time before he was so far pacified as to throw himself sulkily into the bottom of the canoe. At that time we were all suffering from a great scarcity of food, and hunger having its usual effect in producing vivid dreams, similar effects frequently occurred. More than once the men declared in the morning that some absent men, whom they named, had come during the night and had beaten or otherwise maltreated them; and they insisted upon much rubbing of the bruised parts of their bodies. Another instance was amusing. In the middle of one night I was awakened by an Arawak named Sam, the captain or head man of the Indians who were with me, only to be told the bewildering words, 'George speak me very bad, boss; you cut his bits!' It was some time before I could collect my senses sufficiently to remember that 'bits' or fourpenny-pieces are the units in which, among Creoles and semi-civilised Indians, calculation of money, and consequently of wages, is made; that to cut bits means to reduce the number of bits or wages given; and to understand that Captain Sam, having dreamed that his subordinate George had spoken insolently to him, the former, with a fine sense of the dignity of his office, now insisted that the culprit should be punished in real life" (p. 344).

Not less clear is the train of native argument by which the notion of soul extends itself from man to the other animals, which in the view of the rude Indian are beings differing indeed from man in bodily form and strength, but comparable with him in ways and cunning, creatures talking among themselves in their own languages, not more unintelligible to him than are the languages of surrounding tribes of men. Indeed the peai-man or magician of his own tribe, carrying into fraudulent effect this real belief, holds converse in his hearing with birds and beasts. What rude men think of the intelligence of animals is well illustrated by a custom which came under Mr. Im Thurn's own notice. "Before leaving a temporary camp in the forest, where they have killed a tapir and dried the meat on a babracot (stage of green sticks for smoking meat over a fire), Indians invariably destroy this babracot, saying that should a tapir passing that way find traces of the slaughter of one of his kind, he would come by night on the next occasion when Indians slept at that place, and taking a man, would babracot him in revenge."

Not to discuss here the spirits of rocks, waterfalls, and objects generally, which animate the Indian's world, mention may be made of those particular phases of Animism which underlie the proceedings of the native magicians, as to which Mr. Im Thurn has brought some picturesque and instructive facts into view. To understand these ideas, it has to be borne in mind that by the native law of vengeance, when an injury has been done (or believed to have been done) to a man, his nearest relative, as his avenger (*kenaima*), sets himself to follow and slay the wrongdoer, or, if he cannot be found, one of his relatives. Thus every Indian lives in constant dread that a kenaima may be following him like a shadow through the forest till he can catch him sleeping or helpless, strike him down, and rub deadly poison into his flesh, or dislocate his limbs. All this really happens, but the Indian extends the idea into his spirit-world, and, with a rude but sufficient philosophy, finds a cause of all sickness and death in attacks by the spirits sent by the imaginary kenaimas, which enter into the bodies of beasts of prey to attack their victims, or poison them, or, embodied in worms or insects, or any other small objects, pass into their bodies, and cause aches and pains. Against these spirit-foes the Indian has a protector, the magician or *peai*-man. This personage's craft is based on the same Animistic theory as that of his dupes, as is plain from the training for the profession which he undergoes, fasting, wandering in the forest, and drinking large draughts of tobacco-water, till he can work himself up into morbid passions of excitement, in which his intercourse with the spirits is carried on, partly no doubt in knavish imposture, but partly also in genuine belief. The methods by which this practitioner drives out disease-spirits from his patients were actually experienced by Mr. Im Thurn, who had the luck of getting a peai-man to operate on him for a slight headache and fever. A company of some thirty people, mostly attracted by the prospect of so novel a performance as peai-ing a white man, were assembled in the house of the doctor, the entrance was closed, the fires put out, and all lay in their hammocks, our traveller being especially warned not to set foot on the ground, for the kenaimas would be on the floor, and would do dreadful things to him if they caught him. Much like his analogue the professional medium at a modern *séance*, the peai-man made the patient promise not to stir out of his hammock, nor look, nor lay hands on anything that might touch him. For a while all was still, till suddenly the silence was broken by a burst of indescribable and really terrible yells and shouts, which filled the house, shaking walls and roof, sometimes rising rhythmically to a roar, which never ceased for six hours. Questions seemed to be thundered out and answers shouted back, with no pause in the sound. A little Macusi boy, who had slung his hammock close to Mr. Im Thurn's, whispered to him that it was the peai-man roaring his questions and commands to the kenaimas, who were yelling and growling and shouting

[1] A paper by Mr. Im Thurn, embodying much of this research, will be found in the *Journal of the Anthropological Institute*, vol. xi., and remarks of mine on it in a lecture on anthropology printed in NATURE, May 3 and 17, 1883.—E. B. T.

their answers. Every now and then, through the mad din, there was a sound, at first low and indistinct, and then gathering in volume, as if some big winged thing came from far toward the house, passed through the roof and then settled heavily on the floor: and again, after an interval, as if the same winged thing rose and passed away as it had come. As each of these mysterious beings came and went, the air, as if displaced by wings, was driven over the patient's face. They were the kenaimas coming and going. As each came, his yells were first indistinctly heard from far off, but grew louder and louder until, as he alighted on the floor of the house, they reached their height. The first thing each did was to lap up some of the tobacco-water, with an ostentatious noise, from the calabash on the floor. But while he lapped the peai-man kept up the shouts, until the kenaima was ready to answer. When each kenaima had given an account of itself, and had promised not to trouble the sick man, it flew rustling away. They came in the form of tigers, deer, monkeys, birds, turtles, snakes, and of Ackawoi and Arecuna Indians. Their voices were slightly different in tone, and they all shouted in voices which were supposed to be appropriate to their forms, but, oddly enough, all hoarsely. It was a clever piece of ventriloquism and acting. The whole long terrific noise came from the throat of the peai-man, or perhaps a little of it from his wife. The only marvel was that the man could sustain so tremendous a strain upon his voice and throat for six long hours. The rustling of the wings of the kenaimas, and the thud which was heard as each alighted on the floor, were produced by the magician skilfully shaking the leafy boughs brought in for the purpose, and then dashing them suddenly against the ground. This Mr. Im Thurn discovered by the boughs accidentally touching his face, when he seized some of the leaves with his teeth. At the crisis he seemed to feel a hand laid on his face. The effect of all this upon him was very strange. Before long he passed into a kind of fitful sleep or stupor, probably akin to mesmeric trance. Incapable of voluntary motion, he seemed to be suspended somewhere in a ceaselessly surging din. Now and then when the noise all but died away, and the peai-man was supposed to have passed out through the roof and to be heard from a great distance, he awoke to half-consciousness, but as the magician came back and the noise grew again he fell back into stupor. At last towards morning, when the noise ended, he awoke thoroughly, and finding the entrance unbarred, rushed out to find relief in the rain and storm. His head was indeed anything but cured of its ache, but the peai-man insisted that he must be cured, and asked for payment, producing a caterpillar, which he declared was the kenaima which had caused the pain, and which he had extracted when he touched the patient's face. Accordingly he received a fourpenny looking-glass as his fee, and was satisfied.

These extracts will give an idea of the goodness of the material contributed by Mr. Im Thurn to the study of the lower phases of human thought. In conclusion, a few words may be said as to his suggestions on the interesting problem how an explorer may reach the plateau-top of the precipice-walled Roraima, and settle the question what ancient and modern animals and plants have survived and developed there, and whether there may be any truth in fancies of strange human tribes dwelling there, cut off for ages from their fellow-men. In the far west of Guiana or over the Brazilian boundary, where the savannah itself rises 5000 feet above the sea, Roraima springs from it in perpendicular sandstone cliffs 2000 feet high, topped by a flat tableland apparently forest-covered, and whence waterfalls pour down. Round the whole circumference the cliff-wall is said to be perpendicular, but this is mere conjecture, for no traveller has ever been round it. The summit may prove accessible from the other side, and at any rate enough is known of the fauna and flora of the district to make it certain that a naturalist who should accomplish the circuit would be well rewarded by discoveries, even if he failed to reach the top. There is a way as yet untried, which Mr. Im Thurn is convinced will prove more practicable than those by which Roraima has been hitherto approached. He recommends going up the Potaro as far as possible by boats, and thence striking across the savannah on foot. The journey is one of difficulty and privation, which Mr. Im Thurn warns any explorer against undertaking without fully weighing the difficulty and cost. Perhaps we may hear some day of himself, as the leader of a well-equipped expedition, making the attempt. E. B. TYLOR

THE COLLECTION OF DEERS' HORNS AT THE ROYAL CASTLE OF MORITZBURG

Die Hirschgeweih-sammlung im Königlichen Schlosse zu Moritzburg bei Dresden, mit allerhöchster Genehmigung und Unterstützung Seiner Magestät des Königs Albert von Sachsen. Herausgegeben von Dr. Adolf Bernhard Meyer, K.S. Hofrath und Director des K. Zoologischen Museums zu Dresden. (Dresden: Wilhelm Hoffmann, 1883.)

THE King of Saxony's Hunting Lodge of Moritzburg lies some three hours' journey north from Dresden; it is built on an island in a little lake embowered amid the Friedewald. It was built between the years 1542 and 1589, under the Electors Moritz (1541-1553), August (1553-1586), and Christian I. (1586-1591), after the plans of the first of these Electors, apparently by the architect Hans von Dehn-Rothfelser, and it has been enlarged and renovated from time to time chiefly under the Electors John George I. (1611-1656), and John George IV. (1691-1694), and August II. King of Poland (1694-1763). It contains some two hundred rooms and seven halls, in which latter are arranged the series of pictures relating to hunting, and a collection of horns of all sorts. For this latter the Castle may thank the celebrity which it has among all sporting characters and zoologists. The walls of the large Banqueting Hall, which is 20·25 m. long, 10·50 m. wide, and 11·60 m. in height, are adorned with a collection of seventy-one noble horns of deer, of which none are under four-and-twenty points; while in the Audience Hall is preserved a collection of forty-two more or less extraordinary or monstrous horns, amongst which is the celebrated pair with sixty-six points.

It was a happy thought of Dr. A. B. Meyer, the indefatigable Director of the Royal Zoological Museum at Dresden, to publish an illustrated catalogue of this collection, which, with the gracious approval and assistance of the present King Albert of Saxony, has assumed the form

of a splendid folio volume, with 30 plates, in which from 1 to 26 contain figures of all the remarkable horns from the Banqueting Hall, and from 27 to 29 represent some of the more interesting of the monstrous horns, while on Plate 30 we have a most extraordinary instance of a pair of horns—one of ten, the other of twelve, points—which had during life got inextricably interlocked with one another. The finest and most characteristic pairs of horns were selected for these photographs, which are by a new process most excellently reproduced on the plates. As a frontispiece to the text we have a photograph of a quaint sketch of the Castle.

About 1861, Dr. Meyer informs us, acting under the direction of Grand Marshall H. von Freisen, a catalogue of the seventy-one horns in the Banqueting Hall, with measurements in inches, was compiled, but unfortunately some of the identifications cannot be regarded as certain. It is strange that, in spite of the great care with which this collection of horns has been kept, there seems to be no record of when and whence the very ancient ones came to Moritzburg. Even the *Archives* of the place are nearly silent about them. Dr. Meyer has in this quite luxurious catalogue done what he could to rescue all that is known about the collection from oblivion, and he promises at some future time to give the history of the remaining two-thirds as a continuation of this work.

OUR BOOK SHELF

Guide to Methods of Insect Life, and Prevention and Remedy of Insect Ravage. By Eleanor A. Ormerod. Pp. 1–167, 8vo. (London: Simpkin, Marshall, and Co., 1884.)

THE text contains the substance of ten lectures delivered for the Institute of Agriculture. At p. 7 there is an italicised remark to the effect that "*insects always begin life by being produced by a female.*" This may be regarded as an indication of the presumably ultra-ignorant class for whose benefit the lectures were prepared. But we prefer to think that far too low an estimate of the knowledge possessed by our agriculturists has been made, and doubt not that, by a majority of them, the remark will be taken as the reverse of complimentary. The book is exceedingly well got up, and in a very attractive style, and will no doubt become popular (on account of the multitude of illustrations. For the agriculturist purely, it seems to us that it goes either not far enough or too far; it is too "showy" for practical purposes, and often, unwittingly, too abstruse. The copious illustrations are mostly excellent, and many of them are original (among the very few very indifferent figures, that of the "Bee-parasite" may be cited). But the necessity for many of the figures in a book apparently intended for the agricultural class may be doubted, and some have evidently been introduced for effect. That American bogey (or "fraud") the "Colorado Beetle," is honoured by the reproduction of his portrait, and the *Phylloxera* is dismissed with only dishonourable mention. The general information is sound, but occasionally vague, as in the definitions of the terms "larva" and "pupa," and in the apparent assumption that respiration is exclusively effected by the external air being conveyed to the tracheæ by means of *spiracles*. The "Glossary" will no doubt be found very useful to the majority of the readers of the book, but some terms (e.g. "*Telum*") appear wonderfully abstruse, as used in a work in which it was necessary to explain that "*insects always begin life by being produced by a female.*"

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Remarkable Sunsets

ON Friday, the 11th inst., the weather was very remarkable; it recalled to our minds, though on a smaller scale, the storm of December 12, 1883. In the afternoon, about three o'clock, the wind arose with violence, and great squalls alternated with relative calms. The movements of the clouds were also very curious. Layers of air of different elevation floated in various directions, and the lower very low-hanging clouds which moved at the same level had, at different points of the sky, an unequal and changing rapidity. The wind beneath was, at 6 p.m., west-south-west; the lower clouds came from the west, the more elevated, on the contrary, from the north-north-west, so there is no doubt that whirlwinds blew that day in the upper air. The sun had set with a very fine after-glow, and in the ensuing night and morning there fell, now and then, showers of rain occasionally accompanied by snow and hail. Besides, the night before a magnificent halo had been observed around the moon, so

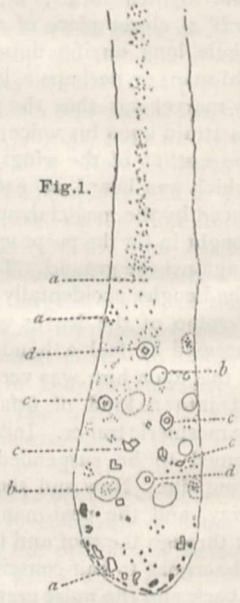


FIG. 1.—Sediment and residue of an evaporated drop of rain, fallen January 12, 1884, on a window-pane. *a a a*, particles of the ash; *b b*, drops of hygroscopic matter; *c c c*, crystals of common salt and andesitous mineral; *d d*, drops with salt crystals.

that the presence of ice-crystals on January 11, in the higher regions of the atmosphere, is certain. In consequence of the low temperature, the air in those regions must have had a great density, and so, apparently, there must have been a great chance that the whirlwinds on Friday had moved the heavy, cold air from above downwards.

That this was really the case seems to proceed from the fact that during the night of January 11 and 12 the rain had brought down on my windows the same sediment as that of December 12, though in smaller quantity. The identity of this sediment with the ashes of Krakatoa will now be beyond doubt to any one who has read the numerous communications in NATURE on the remarkable sunsets. Why I wish to refer to this affair once more is that at the microscopic examination of the dust of January 12 I found in it a relatively great quantity of complete individual crystals, partly soluble, partly insoluble, in water, which had remained unobserved by me in December.

After having scraped the dust off the window-panes and put it on the slide in a drop of oil, I made a drawing of the crystals

by means of the camera lucida, magnifying them 400 times, as represented in Fig. 2.

The crystals, as seen in Fig. 2 *a*, evidently exist in common salt; this follows from their solubility in water, their crystalline form, and their reaction in the flame. They are found in so great a number in the residuum of every drop of rain that we come to the conclusion that these little crystals must be found as such in those regions of the atmosphere where the dust is floating, the air containing there hardly anything else but ice, and surely little liquid water.

In Fig. 2 *b* we see the crystals insoluble in water. They are uncoloured and perfectly transparent, and may be considered to be the crystalline form of the andesitous mineral of which the ashes consist for the greater part.

The residuum of the evaporated rain-drop of January 12 showed itself about in the manner seen in Fig. 1. If the window-pane is used as a slide and the dust examined directly with the microscope, one will find there a great number of little drops (*b b*, Fig. 1), in most of which a very fine sediment is seen of the constituents of the ashes; in a few drops, however, there are to be found crystals of common salt (*d d*); further, many loose crystals spread over the whole space (*c c*). Probably

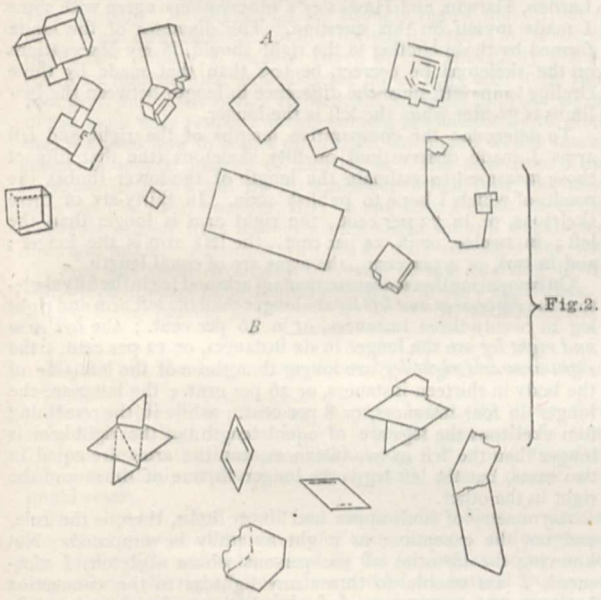


Fig. 2.

Fig. 2 (× 400).—Crystalline matter in the residue of Fig. 1. *A*, crystals of common salt; *B*, crystals of the andesitous mineral, insoluble in water.

the little drops are due to the presence of some hygroscopic matter such as $MgCl_2$ or $CaCl_2$ around some salt crystals. Especially at the lower end of the whole drop assemble the larger, glassy, black and brown particles of the ashes.

The above proves that during the last few weeks crystals of a particular nature were floating in the air, and will perhaps explain the appearance of mock suns described by some of the observers of the after-glow.

In a sample of original ashes from Krakatoa, when examined in oil, I only found very few salt crystals, and the completely outgrown andesitous crystals not at all. I am, however, convinced that with longer research I should have found the latter, and others seem to have discovered them indeed, but they are without doubt very rare. So it seems to me that it may be taken for granted that in the atmospheric dust the proportionate number of completely formed crystals is larger than in the natural ashes, and the presence of so much common salt in the upper air during these days is surely a remarkable fact.

Wageningen, January 14 M. W. BEYERINCK

THE atmospheric appearances frequently seen during the last few months, principally at sunrise and sunset, from the similarity of some of the manifestations to auroral appearance, have led some persons to suspect connection of the phenomena with magnetism.

Hitherto auroral exhibitions have, at Greenwich, been invariably accompanied by considerable magnetic disturbance, and the absence of such disturbance on days on which the recent remarkable atmospheric phenomena have been seen at Greenwich seems conclusive as to the question of direct connection with magnetism. The Astronomer-Royal has therefore thought that a brief statement of the circumstances in this respect might be of interest to your readers. It appears that, either at sunrise or sunset, unusual atmospheric appearances were seen at Greenwich on November 8, 9, 13, 25, 26, 27, 28, 29, December 1, 2, 4, 5, 6, 7, 11, 17, and January 12 last. Of these days, on November 13 and January 12 the magnets were quiet, and on November 8, 9, 25, 26, 29, December 4, 5, 6, 7, and 17 very quiet; on November 27, 28, December 1, 2, and 11, there was a little motion. The whole period was quiet generally as regards magnetic activity; only at one time during the period from November 8 to January 12 was there any noteworthy disturbance, which occurred on the days from November 19 to 22, and in no case was it in any degree remarkable. WILLIAM ELLIS

Royal Observatory, Greenwich, January 26

ON p. 157 of your current volume you ask your "readers in all parts of the world" to communicate facts relative to the singular sunsets which have been seen.

Until seeing your request I had made no note of dates, but as far as I can trust my memory the "after-glow" was noticed here early in September, 1883. On one night it lasted about two hours after sunset. The phenomenon of "Contrast-Farben" mentioned by von Helmholtz in NATURE, December 6, 1883, p. 130, I have noticed most markedly on two occasions—once in October, and again on December 28 or 29, 1883. During this year the sunsets on January 5, 9, 12, and 13, have been accompanied by the "after-glow."

About 12 o'clock on the 13th I saw a peculiar colour in the neighbourhood of the sun, which on closer inspection was seen to be in the form of an ellipse, the major axis being in the plane of the meridian. The length of this axis was about 50°. The sun was situated nearer the upper extremity of this axis, in breadth about 20°. The colour of this ellipse was a pale reddish-violet ashen (if you can imagine such a combination). The sky at the time was a deep blue, except in the ellipse. I suppose the violet tinge was due to a combination of the red of what at evening forms the "after-glow" and the blue sky. There were a few clouds slowly moving from the west, and as one of these approached the sun, when within about 6 diameters of the sun, the edge nearer the sun became coloured a faint yellow; then followed pale pink, dark pink, green, then again dark pink in bands; as the cloud floated over the sun's disk one saw the bands of colour continuous, forming a halo. The clouds were of a fleecy texture; I believe they were "cirro-stratus," not, however, as open as what we call a "mackerel sky," and so tenuous that they did not appreciably diminish the sun's brilliancy. The sunset on this day (January 13) was followed by a most intense "after-glow," but of only short duration. The pink colour was at first in three broad rays, extending about 50° from the point at which the sun disappeared, the central ray almost vertical, one of the others on each side between the central ray and the horizon. After a short time the intermediate spaces became coloured red and then the colour ceased.

The colour itself when most marked I can best describe as that of burning cyanogen gas, a deep peach blossom. I have noticed that the brilliant after-glows here have been preceded by a dazzling glow, elliptical in shape, in the immediate neighbourhood of the sun, the outer edge of this ellipse being comparatively dull and marked, and not having the same colour as the sky a little further removed. The eastern horizon I have also seen tinged pinkish before the colours make their appearance in the west, and so marked has this been that I have regarded it as a sign of the coming after-glow.

I may add that for the last ten days the ground has been covered with snow, and the temperature during the early part of last week quite low, from 15°-20° F. during the day. During the end of the week the temperature was about 32° F.

I have written thus at length, hoping that there may be something of interest to you. Should you find anything it will give me pleasure; should you not, this will at least show you that some of your distant readers would like to aid you in paths which are not their own. W. G. BROWN

University of Virginia, U.S.A., January 15

THE brilliant morning and evening glows have not yet left us. In connection with a letter of one of your correspondents of December 20, 1883, it may be interesting to add that the year 1783, which was characterised by a fearful eruption of Skaptar Jokul in Iceland, and by remarkable sky-colour phenomena similar to those we have lately had, was also the year in which the last *great* eruption of Asama Yama in Japan took place (see *Transactions of the Asiatic Society of Japan*, vol. vi. part ii. p. 327). Asama Yama is the greatest *active* volcano in Japan. In connection also with the unusual quantity of aqueous vapour with which the atmosphere has been charged, as proved by the spectroscopic observations of Prof. Michie Smith and others, and the facility that dust particles give for the formation of clouds, and therefore also of snow, it may be interesting to note that the beginning of the present year has been characterised by the greatest fall of snow that the oldest inhabitants here have known for thirty years. The minimum temperature reached this winter (– 28° C. on the morning of December 23 in the neighbourhood of the college) is also the lowest for Kingston during the same period. Prof. Goodwin is now engaged in analysing the snow in order to find out whether similar impurities to those found in Europe and in Java are present.

D. H. MARSHALL

Queen's University, Kingston, Canada, January 13

Circular Rainbow seen from a Hill-top

IN the *Philosophical Magazine* for January, 1884, p. 61, is an interesting article by Prof. Tyndall describing experiments made to produce circular rainbows by artificial light and artificial mist, his attention having been attracted to the subject by an observation made in the Alps on one occasion when the shadow of his body was projected at night time on to mist by a lamp behind him, and was seen to be surrounded by a luminous circle, or halo of light. I was so fortunate as to see lately identically the same effect produced with remarkable beauty and completeness in broad daylight from the summit of a Welsh hill. Staying last week for a couple of days at Pen-y-Gwryd, near Snowdon, in company with a friend, we walked one morning up the Glydr-Vach. The rain was steadily descending as we left the little inn, and the thick mist swathed the hill-sides in obliterating folds. Just as we reached the summit at noon a slight breeze thinned away the mist in front of the sun, and a burst of sunshine illuminated the hill-tops. Clambering on to the natural cairn which crowns the summit, we looked down into the valley, in which lies the small lake Llyn Idwal. Along the valley the wind drove masses of thin mist and scud, and on this we saw to our surprise the shadow of the summit with our own sharply-marked shadows projected on it. We waved our arms, and the mystic figures replied by waving theirs. Surrounding these immense shadowy figures we could see two concentric rainbows completely circular, the centre being the shadow of our heads. The colours of the inner rainbow were in the order of the primary bow, and the outer was a secondary and more faintly-tinted rainbow. During all this time the sun was shining brightly on our backs; when the wind cleared away the mist completely in the valley, the shadows and the rainbows vanished, but reappeared when fresh masses of vapour were blown into the line of our shadows. A very rough attempt at determining the angle subtended by the diameter of the primary bow seemed to show that it was much less than 90°, in fact not probably above 20°. This interesting appearance lasted only for a few minutes, as the wind drove up fresh mist in front of the sun, and the rainbow-circled phantoms disappeared. It would be interesting to know if any of your readers have ever observed a similar phenomenon. It has, I believe, been seen by balloonists when the altitude of the sun is great and a layer of mist and cloud lies beneath. Shadows thrown on mist are common; but this rainbow addition was new, not only to me, but to my friend, and his mountaineering experience has been very considerable.

J. A. FLEMING

Unconscious Bias in Walking

MR. LARDEN'S letter in your issue of the 17th inst. (p. 262) regarding "circling to the left in a mist," and the replies of Messrs. G. H. Darwin and Hawksley, have opened an interesting question, and one which seems to be but imperfectly understood. The true explanation of this vexed question has for some years appeared to me to be that to which it is attributed by Mr. Hawksley, namely, inequality in the length of the legs. A few years ago I made some investigations on the length of the lower limbs in man, the results of which were published in the *Journal of Anatomy and Physiology*, vol. xiii. p. 502 (1879). I found that of seventy well-authenticated skeletons which I examined, the lower limbs were equal in length in only seven instances, or in 10 per cent.; in twenty-five instances, or 35·8 per cent., the *right* limb was longer than the left, while in thirty-eight instances, or 54·3 per cent., the *left* limb was longer than the right. The left leg I found not only to be more frequently longer than the right, but the difference in length between the two limbs is greater on an average when the left is the longer. Inequality in length is not confined to any particular age, sex, or race, but seems to be universal in all respects. My observations corroborated those of several American surgeons made on the living subject. The result of one limb being longer than the other will naturally be that a person will unconsciously take a longer step with the longer limb, and consequently will circle to the right or to the left according as the left or right leg is the longer, unless the tendency to deviation is corrected by the eye. The left leg being more frequently the longer, circling should, if this theory of its being due to inequality of the limbs be correct, take place more frequently to the right than to the left. This is precisely what we find to obtain, and in this respect Messrs. Larden, Darwin, and Hawksley's observations agree with some I made myself on this question. The diameter of the circle formed by those circling to the right should, if my observations on the skeletons be correct, be less than that made by those circling to the left, since the difference in length between the two limbs is greater when the left is the longer.

To determine the comparative lengths of the right and left arms I made observations on fifty skeletons (the first fifty of those measured to estimate the length of the lower limbs), the results of which I hope to publish soon. In thirty-six of these skeletons, or in 72 per cent., the right arm is longer than the left; in twelve, or in 24 per cent., the left arm is the longer; and in two, or 4 per cent., the arms are of equal length.

On comparing these measurements of arm and leg in the fifty skeletons the *right arm and left leg* are longer than the left arm and right leg in twenty-three instances, or in 46 per cent.; the *left arm and right leg* are the longer in six instances, or 12 per cent.; the *right arm and right leg* are longer than those of the left side of the body in thirteen instances, or 26 per cent.; the latter are the longer in four instances, or 8 per cent.; while in the remaining four skeletons the legs are of equal length but the right arm is longer than the left in two instances, and the arms are equal in two cases, but the left leg is the longer in one of those and the right in the other.

Asymmetry of both upper and lower limbs, then, is the rule, and not the exception, as might naturally be supposed. Not knowing the histories of the persons whose skeletons I measured, I am unable to throw any light as to the connection between the proportions of the limbs and right- and left-handedness.

The particular causes of inequality in the length of the bones of the right and left sides of the body will probably always be more or less a matter of theory. The general cause is, as Mr. Hawksley states, owing to more rapid growth of the one limb than the other. I do not think in the majority of instances it can be attributed to "illnesses to which we are subject in early life," as he surmises. Asymmetry is almost invariably found throughout the whole skeleton, for example it is extremely rare to find a skull the two sides of which are absolutely symmetrical. In the limbs it is perhaps more easily attributable to the blood-supply being greater to one bone than to another. The nervous system may also have to be taken into account as a cause.

J. G. GARSON

Royal College of Surgeons, London, January 26

I AM left-handed and left-footed; that is, if there is anything to do that requires strength or skill, the left hand is always used; in football-playing, or anything requiring the use of the foot, the left foot gets the work to do.

I remember being once lost in the woods in America whilst trying to make a short cut home, and, after walking a good many miles, came upon my own snow-shoe track on its left side; thus my bias had been from right to left.

In a bitter cold day with thick snowdrift and a gale of wind on our "left front," as a soldier would say, some men were on a sledge journey on the Arctic coast in 1847. It was important

to reach a certain point, and each of the party in turn (including an Esquimaux) took the lead, but all failed to keep the correct course beyond a minute or two, so that the constant stoppages necessary to consult the compass were trying to the hands; in fact one of the native dogs, protected by a thick fur, fairly succumbed to the cold, and the poor thing had to be abandoned to its fate.

We at last thought of placing an Esquimaux boy of about fourteen as leader, and he managed to keep a straight course with wonderful accuracy, although he walked crab-fashion, sideways, so as to protect his face from the bitter blast.

Is Mr. Larden's theory correct, namely, "that those in whom the left leg is strongest would circle to the right?" I think not, because according to my idea it is the leg *from* which one steps, and not the leg that *takes the step* or that is placed in advance that imparts the impetus; so that a strong left leg would cause the step with the right foot to be longest, and the person would circle to the left. JOHN RAE

4, Addison Gardens, January 26

WITH reference to the letters by Messrs. Darwin and Hawksley in the current number of NATURE (p. 286), I may say that I am very strongly "left-legged" (also strongly right-handed), but so far as I am aware there is not the slightest difference in the *lengths* of the two limbs. I became aware of the peculiarity when a child, by noticing that on a slide the other boys used to go right foot first, and I left foot. Subsequent attempts to break myself of the habit only resulted in my coming ignominiously to grief, and if I tried now to leap a ditch right foot first I would tumble headlong into it instead of clearing it. The next time I find occasion to *kick* I will *try* to remember which foot was used. It is right to state, however, that in my case I think there has probably existed from infancy a very slight natural weakness of the right ankle. Attempts with me to walk a straight line with the eyes shut seem invariably to result in my swerving to the *left*, which appears to be contrary to Mr. Darwin's experience.

Lewisham, January 25 R. MCLACHLAN

MIGHT not the longer step taken by one leg be explained as follows:—

Most people when standing at ease habitually throw their weight on one leg; but, whichever it be, its movement is more likely to disturb the balance of the body. It would therefore be more quickly replaced on the ground, and a shorter step would result.

The unequal steps would not necessarily effect a circular course, as may be easily shown by experiment. A divergence, say, to the right would be caused by the left leg swinging in its step towards the right, and such would be its natural movement if the body inclined to the right. Now a person who constantly stands more on the right leg than the left would have that inclination in his walk, in spite of the alternate removal of the burden from each leg. This tendency to lean towards the right would be still further encouraged by the ancestral or individual use of the walking-stick in the right hand.

The suggestion of Mr. G. H. Darwin (January 24, p. 286) that the mounting a horse on the left side may be accounted for by the sword is strengthened by the freedom of the sword-arm requiring that the left hand be used to grasp the reins, which is the first act in mounting. There would be a momentary want of control over the horse if, under these circumstances, it were mounted from the right side. F. M. CAMPBELL

Rose Hill, Hoddesdon, January 28

IN a letter to you about another subject Mr. G. H. Darwin suggested last week that the British rule of the road for riding was justified by the advantage of having your sword hand towards a stranger, but why then should the rule of the road in walking be, what I understand it to be, the reverse of the rule in riding?

I would suggest that perhaps the rule in riding is adopted from the rule in driving, and that the latter results from the fact that a driver may be assumed to carry his whip in his right hand and therefore to sit to the right if there be two on the driving seat, and that when he is so seated he can see better how he is passing another vehicle if our rule is adopted.

This, like Mr. Darwin's suggestion, would leave us without xplanation why most nations have adopted a rule the reverse f ours.

It would perhaps be hardly scientific to say it is because Englishmen are always right and foreigners always wrong, nor would it be much more so to say that it is because English drivers like to make a close shave and foreigners as a rule give an obstacle a wide berth, for the latter fact, if it be an observed fact, may be the effect, not the cause, of the rule of the road. Can it be that the foreign rule was adopted where it was customary for the driver to sit alone on his seat and could therefore see equally well on both sides, and at the same time wished to have freedom to use his whip. STEPHEN A. MARSHALL

Diffusion of Scientific Memoirs

When, in reviewing Prof. Stokes' *Reprint*, I spoke of "the almost inaccessible volumes of the *Cambridge Philosophical Transactions*," I was referring *expressly* to the *Transactions* only, and to the period 1845-54. That there are *now* 120 "centres" in which "*Transactions* or *Proceedings*, or both" are accessible, is an interesting and important fact, but wholly beside the question raised by my remark. [I leave out of account copies sent to Honorary Fellows; for these are not more accessible than those obtained by Ordinary Fellows.]

The question at issue between the Secretary of the Society and myself is:—What was the state of matters in 1854? Mr. Glazebrook gives me data for the present time, and for 1869, only. From these it is not possible to obtain more than an approximate answer to the question. But, in default of further data, I assume that (in accordance with the published statistics of similar Societies) the number of Hon. Fellows of the C.P.S. has not changed since 1854; and that the increase of "centres" from 1854 to 1869 was nearly the same as from 1869 to the present time. It follows from Mr. Glazebrook's data that the number of "centres" in 1854 must have been about 40 only.

But I referred to *Transactions* alone, not to "*Transactions* or *Proceedings*, or both." To obtain a rough idea of the correction to be made on this account, I take the numbers for the *Royal Society of Edinburgh* (with which I am best acquainted, and which are at least as large as those for the *Royal Society*). In Mr. Glazebrook's form of statement, these numbers are at present

Hon. Fellows	56
Total number distributed	343

Deduct the first number, and there remains 287. But of these "centres" 96 (one-third, say) receive *Proceedings* only.

Hence it would appear that, in 1854 and previous years, to which alone I referred, the *Cambridge Philosophical Transactions* were to be found at some 27 "centres" only; say 10 at home and 17 abroad. Surely this would much more than justify the term "almost inaccessible"!

I cannot recollect having made any application for the C.P.S.'s publications, though I have often asked Cambridge friends why I did not get them regularly. But, according to Mr. Glazebrook's view, I should either have received all, *or none*.

The state of matters, in the three Edinburgh "centres" to which Mr. Glazebrook alludes, is at present as follows:—

All three "centres" have the *Transactions* complete; except the University Library, which wants vol. xiii. parts 1 and 2.

The Advocates' Library has *not* the *Proceedings*; the Royal Society wants vols. i. and ii., all but a few pages; and the University Library wants vol. iv. parts 1, 2, 3, 4, 5. Thus one "centre" has no *Proceedings*, another has almost half, and the third three-fourths.

I must, in concluding, repeat my hope that NATURE may do a new and great service to science by collecting full statistics as to the "centres" at which the publications of the various scientific Societies are accessible. P. G. TAIT

College, Edinburgh, January 26

Water in Australia

REFERRING to my letters in NATURE of May 12, 1881, and March 30, 1882, on the underground water supply of Australia, it is interesting to observe that the search for it is being actively carried on by some energetic colonists, and that their efforts are successful. The following extract from *The Queenslander* of May 26, 1883, shows what can be done:—

"The subterranean waterflow now proved to exist beneath the vast arid plains of the west has been tapped at yet another

point, and the discovery of another invaluable spring of fresh water is the result. Recently we have had many discoveries to record, all tending to encourage the search for underground water, on the supply of which the pastoral industry of this district so much depends; but none has been of more value to the discoverers or has tended more to encourage others to persevere in spite of difficulties. This latest discovery was made last week in the country known as the Pack-Saddle, forming the western portion of Messrs. Donelly and Co.'s Gnalta run. The well was started in the summer of 1881, but had to be abandoned some time after for want of water for the use of the men, and Mr. Donelly was urged to choose another site. He persisted, however, in continuing the original work as soon as surface water was available, and he has now come upon a practically inexhaustible spring. The flow was cut at 272 feet in a properly slabbed 6 feet × 3 feet shaft, and during the night following the water rose 172 feet, or within 100 feet of the surface. The discovery is worth every penny of 10,000*l.*, as it renders immediately available a large tract of good country hitherto dry and therefore comparatively useless. There is another fine well on Gnalta, from which 30,000 sheep have been watered in the dry season, and that discovered last week promises to be as good, if not better."

In my first letter I pointed out as one evidence of the underground water the growth of huge gum trees where there was no visible supply. In a recent number of the *Scientific American* it is stated that, on clearing out a well, the owner was surprised to find the bottom covered with a dense mass of fine, fibrous roots, which were traced to a Eucalyptus growing at a distance of fifty yards. The large Eucalypti are trees of remarkably rapid growth, which implies the absorption of large quantities of water. By what subtle sense did that root find out where water could be had, and travel so far to get it? Darwin has shown that there is some kind of irritability in the growing points of plants, and that it is sometimes communicable to distant parts. We shall probably come in time to admit that there is a nervous current in plants, though without visible nerves; and that this rudimentary system of sensation is accompanied by rudimentary desires, and even by rudimentary ideas, which guide the growing points in their search for the desired objects.

F. T. MOTT

Birstal Hill, Leicester, January 20

Deafness in White Cats

THIS subject has been of much interest to me, and otologists as well as evolutionists must feel indebted to your contributor in NATURE of December 13, Mr. Lawson Tait, for his efforts to determine the cause. May I be permitted, however, from an otologist's point of view, to draw attention to a possible source of error in conducting researches of this kind when deductions are made, as they were in this instance, from acoustic experiments mainly? I allude to Mr. Tait's method of determining the hearing power of the animal experimented on, namely, his cat, "Old Pudge," and the conclusions that he has drawn from the results obtained; thus he infers that purely "tympanic" deafness, consisting in an entire failure of the transmitting mechanism of the middle ear to respond to aërial undulations of sound, existed in the case of "Old Pudge," *because* the concussion produced by stamping on the floor could be heard by that animal, whilst the voice was not heard. Abnormal hearing of this kind, I am convinced, by no means establishes the fact that inner ear trouble does not exist, since such deaf-mutes as are believed to be defective in this regard are very sensitive to grave or deep tones—thunder, for example, being painful even to them. Pudge's cochlear (inner ear) functions were believed to be serviceable, inasmuch as he could use his voice; but such evidence cannot be accepted as conclusive, for absolutely deaf persons, who have been deprived of both "tympanic" and "cochlear" functions, are yet capable of making noises, and often of learning to speak after a fashion. Another point is also of interest in this connection: the ears of Pudge, it is said, were found to be normal in every respect, both as to their transmitting and perceptive functions, with the exception of the absence of a triangular gap from either tympanic membrane. In reference to this it may be said, in the first place, that it is difficult to understand how the delicate mucous membrane lining the tympanum retained its "normal" condition under such exposure; and, in the second place, these defects could scarcely be the cause of absolute deafness, since it is a well-known fact that quite good hearing often remains in the human subject where, from disease, much greater loss in the tympanic membrane has been sustained than was found to exist in the hearing organs of Pudge. Altogether it seems probable that in certain white cats great congenital deafness may exist, and that the animal, on finding aërial transmission of sound to be imperfect, comes finally, like man under similar circumstances, to disregard its use entirely, and place its reliance solely on sound that can be *felt*, as it were. Moreover, is it not probable also that the trouble, in some degree at least, may lie in the perceptive centre of the brain? It is a significant fact that in Pudge at least some disease of the nervous centres existed, since he was the subject of epileptic convulsions.

SAMUEL SEXTON

12, West Thirty-fifth Street, New York, January 3

FURTHER DISCOVERIES IN THE FLORA OF ANCIENT EGYPT[1]

SINCE my last communication on the Flora of Ancient Egypt (NATURE, vol. xxviii. p. 109) I have made some interesting new botanical discoveries in connection with the mummies of the twenty-first dynasty, found at Deir-el-Bahari in July, 1881, which I will now describe in some detail; the objects having been forwarded to the Museum of the Royal Gardens, Kew.

In the coffin of the Princess Nzi-Khonsu of the twenty-first dynasty there was a large number of well-preserved wreaths, in which I found three species of plants of the ancient flora not previously authenticated by specimens. Besides wreaths of the leaves of *Mimusops Schimperi* and the petals of *Nymphæa cærulea*, already described from examples found on the mummy of Ramses II., there were on the mummy of the Princess Nzi-Khonsu, daughter of Tontonthuti, numerous floral wreaths composed as follows: (1) folded leaves of a willow (*Salix safsaf*) strung on threads of the leaves of the date palm, and serving as clasps; (2) perfect flowers of the corn poppy (*Papaver rhœas*); (3) complete flower-heads of a corn flower (*Centaurea depressa*); and (4) complete flower-heads of a composite (*Picris coronopifolia*).

The flowers of *Papaver rhœas* equal in size those of the small form one has an opportunity of seeing in such abundance in the Mediterranean region in the spring months as a weed in cornfields, by roadsides, and on walls. In order to prevent the petals from falling, the flowers were picked in an unopened condition; and in drying in the vault the petals had shrivelled and shrunk up into a ball, to which circumstance is due the fact that in examining the moistened flowers all the inner parts appear before the eyes in a wonderful state of perfection. Not a stamen, not an anther is wanting; nay, one might almost say that not even a pollen-grain is missing. Rarely are such perfect and well-preserved specimens of this fragile flower met with in herbaria. The colour, too, of the petals is maintained in a high degree, as in dried specimens of the present day. It is a dark brown-red, that leaves a deep stain on the paper where the flowers have been soaked. The very caducous sepals were wanting in the flowers examined; but all the peduncles were thickly beset with the characteristic, horizontally-spreading, bristly hairs. The petals are destitute of the dark spot on the claw which is common to many varieties of the species. The naked ovary is shortly obovate in shape, or, in some of the very young flowers, cylindrical, though never so much elongated that one could doubt its belonging to the genuine variety described by Boissier in his "Flora Orientalis." The stigmatic disk is obtusely and broadly conical; and the rays vary in number from eight to ten. The edge of the stigmatic disk is bordered with orbiculate, auriculate, white appendages incumbent upon it. The anthers are oblong, twice as long as broad, and

[1] This article was sent by the author, Dr. G. Schweinfurth, to Sir Joseph Hooker, together with the botanical objects described therein. The original is in German, and the translation here given is as nearly literal as possible.—W. BOTTING HEMSLEY.

the filaments subulate. The smallness of the flowers (2½ cm. in diameter), the broad petals, the red colour, the bristly peduncles, the 8–10 stigmatic rays, the oblong oval anthers, the subulate filaments, &c., point conclusively to the determination of the plant as *Papaver rhœas*, var. *genuina*.

At the present time this species is found nowhere in Upper Egypt, and also appears to be absent from the whole Nile Valley, while it is met with in abundance near Alexandria and on the Mediterranean coast as a weed in cornfields.

The flower-heads of *Centaurea depressa*, the involucral part of which is 15 to 17 cm. in diameter, belong to a form that is now met with in Persia and Afghanistan; whereas in many countries—Greece, for instance—only small-headed varieties seem to occur. The peduncle served, as in the poppy flowers, to fix the heads in the garlands, which was not always the case in the ancient floral wreaths.[1] Two or three of the leaves are still left on many of the specimens. They are narrow-linear, almost sessile, and exhibit, besides the arachnoid-canescent pubescence characteristic of the species, the peculiar prickle-like tip, which is several millimetres long, and serves to distinguish *C. depressa* from its only allies *C. cyanus* and *C. cyanoides*. From most of the leaves, however, this brittle appendage has fallen, in consequence of repeated handling of the wreaths. Close under the base of the flower-heads appear some linear bracts, shaped like the upper leaves of the stem. In the ancient specimens these bracts were present in unequal numbers, from two to seven, and often wanting altogether. They do not overtop the whole involucre. This character was rather against the correctness of the identification, for such bracts are not usually present below the heads of *C. depressa*, though they are in *C. cyanoides*, which differs very much in having pappusless achenes. But I have seen a recent specimen (Afghanistan, Griffith, 3294) having one or two leafy bracts at the base of each head. In the recent forms of *Centaurea depressa*, the lanceolate teeth of the membranous margin of the involucral bracts are sometimes colourless, sometimes brown at the base. In the flower-heads of the twenty-first dynasty these teeth are deep brown in the middle, with a white margin and a white tip, and they are here, as the specific character requires, a little shorter than the breadth of the bract. The three or five teeth at the tips of the bracts are grown together about half their length. On the lowermost bracts of the involucre the teeth are quite decurrent and colourless; on the upper they are more limited in number—from eleven to fifteen—and only towards the tip. In consequence of the incautious handling of the wreaths when the coffin was opened, the beautiful ray-flowers, which in this species are exceptionally large, are mostly fallen away. In many heads, however, they are still attached, and exhibit a dark violet colour, similar to recently-dried specimens. The lobes of the limb of the corolla are broad, almost ovate and acuminate. Very well-developed achenes occur in the ancient flower-heads, affording indubitable evidence of the correctness of the determination of the species. The achene is light in colour, shining, slightly laterally compressed, and oblong-ovoid in shape. The areole incloses half the length of the achene, and at the base there are a few small hairs, as in recent specimens from Schiraz (Kotschy, 302), Afghanistan (Griffith, 3294), and from Sber (C. Koch), while others from Asia Minor are quite naked.[2] The intermediate bristles of the pappus are one-fourth longer than the achene, the inner ones half as long. The long prickly tips of the upper leaves, the large, broadly-lobed ray-flowers, and the achene bearing a pappus exceeding it in length, prove that the flower-heads of the mummy-wreaths belong to *Centaurea depressa*. This species is wanting in the present flora of Egypt as well as in that of the contiguous countries. It now occurs as a cornfield weed in all parts of Asia Minor, Armenia, Persia, Afghanistan, Beluchistan, and West Thibet; and Prof. Heldreich found it around Tripolitza, in Arcadia, and in the Attic Plain, near Hergellon. In the last-named country the species flowers in April. There are no localities for this plant in Syria and Palestine to my knowledge. Specimens of this Centaurea from ancient Egyptian wreaths are preserved in the museum at Leyden.[1] It is not stated, however, from what epoch they date.

Many of the wreaths of the mummy of Nzi-Khonsu consist entirely of willow leaves and the flower-heads of *Picris coronopifolia*, Asch.[2] The numerous features in the parts of the flower-heads which characterise this species are easily seen in the ancient specimens, and not a single peculiarity is apparent by which it might be distinguished from the recent small form with low-spreading branches, now so common on the outskirts of the desert.

The indumentum of the involucral bracts is particularly well preserved. The bracts themselves are long lanceolate with an undulated membranous naked edge, and taper off into a long point; while on the outside along the midrib they are furnished with one to three rows of spreading bristles, glochidiate at the tip, and between these a white arachnoid felt—the same kind of tomentum clothing the peduncles. The achenes of the ray are smooth and cylindrical, more or less curved, as thick at the tip as in the middle, and crowned with a pappus of short persistent bristles cohering about half their length. The achenes of the disk are broadly club-shaped, somewhat constricted at the tip, and provided between the ten angles with two rows of small round tubercles. The pappus consists of bristles plumose at the tips and is deciduous, and exceeds the achene in length five times.

The dissimilarity of the inner and outer achenes of the ancient Egyptian *Picris* at once shows that it belongs to the section *Spitzelia*, Schultz Bip. The smallness of the flower-heads and the nature of the indumentum prove that it belonged to the small desert form, still common about Thebes, and not to the large-headed, otherwise hairy, varieties (*Picris lyrata* and *P. pilosa*), only found in the neighbourhood of Alexandria, and on the coast of the Mediterranean Sea. The ultimate inflexion of the involucral bracts over the ripening achenes ("phyllis demum carinatis, incurvis") is perceptible in many of the flower-heads from the ancient wreaths.

Picris coronopifolia belongs to that set of desert plants which are usually only found on the border of the desert as far as the waters of the Nile reach by infiltration. It is not met with in the valleys and channels of the lower desert strips any more than among the weeds which follow cultivation in the black earth of the Nile alluvium. It generally grows associated with *Crepis senecioides*, *Leontodon hispidulum*, *Picris sulphurea*, *Lotus pusillus*, &c., which likewise belong to the flora characteristic of the borders of the desert. The flowering time of these plants in Middle Egypt is March and April. In February they only begin to develop, and it may be assumed that the flora of Thebes is from two to four weeks in advance of that of the neighbourhood of Cairo. From the occurrence of the flowers of *Picris coronopifolia* in the wreaths of the mummy of Nzi-Chonsu we may conjecture that the solemn rites of placing this princess in the vault took place in March or April. The assumption that it took place in February or May would be doubtful, and it is very

[1] Thus, for example, only flowers of *Sesbania ægyptiaca* with half of the calyx cut off were used.

[2] Hooker, "Fl. Brit. Ind.," iii. p. 385, in his diagnosis of the species has "basal areole bearded."

[1] According to Prof. P. Ascherson in *Zeitschrift für Ethnologie*, ix. Jahrg., 1877, and Dr. W. Pleyte in 2 Bylage tot de 35ste Jaarver-gadering der Ned.-Bat. Vereeniging, 29 Juli, 1882.

[2] Boissier, in his "Flora Orientalis," iii. p. 740, reduces this species to *Crepis radiata* (= *C. senecioides*, Del.), and this is done by many other authors. *Picris lyrata*, Del., and *P. pilosa*, Del., can only be regarded as varieties of *P. coronopifolia*, Asch. (*Leontodon coronopifolium*, Desf.).

unlikely to have happened in any other months of the year. At Thebes the floral carpet is quite dried up and destroyed as early as April, and in the district of Cairo in May, so that there would have been great difficulties attending the collection in one day towards the end of April of the large number of flower-heads requisite for the preparation of the wreaths of Nzi-Chonsu. And as far as the other flowers of these wreaths are concerned February to March are the only admissible months. This applies especially to the flowers of the poppy, which even in Alexandria disappear towards the end of April.

If we are able, from our knowledge of the seasons of the present Egyptian vegetation, to limit the interment of a mummy to a short series of months, it follows therefrom the fact, that in the case of the date of the funeral rites attending the placing of a mummy in the final tomb being originally indicated in the inscription on the coffin or elsewhere, light might be thrown on the theoretical determination of the relative Sothis (Sirius) periods. In chronological determinations, which, as far as concerns ancient Egypt, anterior to the time of the twenty-sixth dynasty, are still open to grave suspicion, the aid thus possibly attainable is not to be despised. We know from the hieroglyphical writings, the temple inscriptions and ornamental pictures of the temple, that the ancient Egyptians had a great predilection for their gardens; and we learn from the narratives of their crusades in distant countries that they gave a prominent place to foreign vegetable productions, even in their triumphal processions. Amongst objects met with in the funeral repasts and in the offerings in the tombs there are, moreover, so many products of evident foreign origin, that we cannot be surprised at finding that many of the flowers and leaves employed in the composition of the funeral wreaths and garlands could not have belonged to the native flora of the country, but must have been cultivated expressly for the purpose. This may, then, have been the case with *Centaurea depressa*, which, like *Alcea ficifolia* and *Delphinium orientale*, suggests Western Asia, and especially the countries of the Upper Euphrates. As far as *Papaver rhœas* is concerned, it may also be assumed that it was cultivated by the ancient Egyptians on account of its brilliantly coloured flowers, although this does not exclude the possibility, independently of any necessity for a change in the climate to have taken place in the interval, that the common poppy was not such an extraordinary rarity in the cornfields of that period as it is at the present time.

Among the mummies of the twenty-first dynasty discovered at Deir-el-Bahari, there may lie hidden a number of plant remains still unknown to me; as a careful search through the coffins, especially as far as those mummies are concerned which are still preserved with their wrappers intact, was for many reasons necessarily postponed. The garlands, particularly, in those coffins, composed as they are of various leaves and flowers, may be expected to furnish many novelties to the ancient flora of Egypt. Among a few fragments of the wreaths of Mimusops leaves and Nymphæa petals that have reached the Natural History Museum of Milan there accidentally appeared a detached corolla of a Jasmine, which may belong to *Jasminum sambac*, a species still commonly cultivated in Egyptian gardens. The Egyptian Museum in the Cairo suburb of Boulak contains in addition a number of plant remains of authenticated species taken from earlier explorations of tombs that would go to enrich the flora of ancient Egypt.

In the spring of last year Dr. Maspero discovered in the well-known burying-place of Nofert Sekeru, near Sheykh Abdel Gurna, Thebes, an unopened vault of later date, in which was a well-preserved female mummy of the Greco-Roman period. This mummy is swathed from head to foot in wreaths of the leaves of Mimusops, without any flowers. These leaves are larger (eight centimetres without the petiole), because fully grown, than those in the older garlands. The petioles are broken off short, and the whole construction of the wreaths is of a much ruder and more careless description. Specially interesting in this mummy is a wreath around the forehead composed entirely of the leaves of *Olea europæa*. These leaves are also folded and threaded edge to edge with the tips directed upwards; but the mode in which they are sewn together is different from the other wreaths, being done by a coarse string of a fibrous material as yet unknown. The Leyden Museum possesses similar funeral wreaths of olive leaves,[1] and in the Berlin Museum there are some bundles composed of branchlets of the olive tree. Whether the "wreath of justification" mentioned in the obituary of Osiris was such a wreath of olive leaves, or whether under this designation the garlands of Mimusops and willow leaves which encircled the neck and breast of the mummies were intended has not yet been ascertained.

Moreover, Theophrastus, Pliny, and Strabo authenticate the presence of the olive in Upper Egypt. According to Theophrastus (iv. 2, 9) the olive tree grew in the Theban province. According to Strabo (xvii. § 293) olive trees were only found in Fajum and in the vicinity of Alexandria. Now the olive tree flourishes in Lower and Middle Egypt, and very old trees exist in Fajum and in the Oases.

In a special glass case in the Egyptian museum at Boulak is a variety of objects which formed the funeral repasts and offerings in a vault at Dra Abu Negga (Thebes) of the twelfth dynasty (2200 to 2400 B.C.) Among them are the following vegetable products: grains of barley[2] and wheat; tubers of *Cyperus esculentus;* kernels of *Mimusops Schimperi;* fruits of *Punica gravatum*, *Ficus Carica*, *Balanites ægyptiaca*, *Hyphæne thebaica*, *Medenia argun*; a water-flask of *Lagenaria vulgaris*; two cones of *Pinus Pinea;* a mess of *Lens esculenta;* two seeds of *Faba vulgaris*, and one seed of *Cajanus indicus;* a broom made of *Ceruana pratensis*; a bowl full of capsules of *Linum humile* intermixed with pods of *Sinapis arvensis*, var. *Allionii*. Among the plants here cited the Linum deserves special consideration, for, notwithstanding our ample knowledge of its cultivation, thanks to the records of the early authors, botanists who have busied themselves with the investigation of the vegetable remains of ancient Egypt have hitherto not been able to determine with certainty the species of Linum cultivated.

Linum capsules of the twelfth dynasty exist in a very good state, together with the calyx and pedicel, the latter two centimetres long. They are all closed, although the seeds appear to have attained perfect maturity. The length of the capsules reaches 8 millimetres, and the breadth 6·75 millimetres; and the seeds are 5 mm. long. The dimensions given are very little inferior to those of the capsule of the Linum, cultivated in Egypt at the present day. In external characters it is so like the capsule of the flax now cultivated, that one detects no difference at first sight; and it is only after cutting the seed through that one becomes aware of the change wrought in the course of 4000 years. The proportionate size of the seed, which is much narrowed upwards, but above all the numerous long weak hairs which occur on the inside of the partitions of the capsule, leave no doubt as to the ancient flax belonging to the kind exclusively cultivated still in Egypt and Abyssinia, the *Linum humile*, Mill. (syn. *Linum usitatissimum*, Linn., var. *crepitans*, Schübl. and Martens).

Another coincidence in the ancient and modern Linum

[1] They belong, according to Dr. Pleyte, to a mummy of the time of Osorkon (twenty-second dynasty). See also De Candolle, "Physiologie," p. 696.

[2] In this museum is also preserved a bowl containing broken ears of barley of the time of the fifth dynasty (3300 to 3500 years B.C.) which was found near Sakhara.

cultivation is the presence among the ancient capsules of numerous seed-vessels of a species of mustard which is still the commonest and most flourishing weed in every flax field in Egypt. The pods of mustard are almost spherical in shape with a long point, and are seated on pedicels a little less than half the length of the whole pod. Judging from the shape described, the pods must belong to one of the two varieties, common in Egypt, of *Sinapis arvensis*, Linn., namely, *S. Allionii*, Jacq., and *S. turgida*, Del., for the common form of this species is distinguished by elongated pods. As the two varieties named can only be distinguished from each other with certainty by the degree of cutting of the leaves, it would be difficult to decide to which of the two the pods of the twelfth dynasty belong were it not for the circumstance that as *S. Allionii*, Jacq. (characterised by the long-pointed much-divided leaves), is the prevailing form at the present time in Middle Egypt, a probability offers itself that the ancient pods belong to this form. On the other hand *Sinapis arvensis*, Linn., var. *turgida*, Linn., affects the winter cornfields.

It may be assumed that this species of wild or colonised mustard answers to the Sinapis to which Pliny refers (lib. xix. 54 [8]), as a plant commonly met with under such conditions, and of which he asserts that the Egyptian was the best for yielding oil, and that the Athenians called it Napy, others Thapsi, and others again Saurion.

Lentils, as far as I know, have not hitherto been authenticated from the ancient graves. Pliny (lib. xviii. 31) mentions them as a product of Egypt, where two kinds of them were cultivated. The lentils of the twelfth dynasty appear in consequence of boiling and subsequent shrivelling to have lost a considerable part of their bulk. They are 3½ mm. in diameter, while the recent ones average 4½.

From *Ceruana pratensis*, a characteristic composita of the banks of the Nile, which has hitherto only been found in Nubia and Egypt, the ancients made those hard hand brooms, still met with in every part of Egypt, and used for sweeping out the houses and especially the privies; for which purposes they are offered for sale in all the markets. The Egyptian department of the British Museum contains a similar specimen.

Furthermore, the two pine cones (*Pinus Pinea*) noted belong to a species not previously known from the ancient Egyptian relics. Like *Parmelia furfuracea* and the juniper berries (*Juniperus phœniceus*), they point to the commercial relations that existed between Egypt and Greece, Asia Minor and Syria. The pine cones which were found in a large basket filled with numerous kinds of fine linen thread, fruits of the Doum palm and a small calabash of Lagenaria, are small and unripe, the scales clinging close together. It is evident that only such of these rare northern exotic fruits as were unsuitable for the table were put in the offerings.

Among objects not previously authenticated from ancient Egypt are the legumes *Faba vulgaris* and *Cajanus indicus*. Unger[1] suggests that the broad bean (*Faba*) was probably not found in the tombs because it was regarded as unclean.[2] The two seeds in question were found amongst dried grape-skins and matters of that kind. In shape and relative size they fully correspond to the variety cultivated on a large scale in Egypt at the present day. They are smaller, rounder, and thicker than the European broad bean.[3] The dimensions of the ancient beans are 10, 8, and 6½ mm.

Pliny (lib. xviii. 12 [30]) says of the broad bean that it was used in funeral solemnities; hence the priests ate none, &c. Perhaps the presence of the broad bean in the offerings of the twelfth dynasty had a meaning similar to that which it had for the Romans.

[1] *Sitzungsberichte der Kais. Akademie der Wiss., Wien.*, 1859, Band xxxix.

[2] Compare "Herodotus," ii. p. 37.

[3] The author most likely alludes to the variety called "field" or "horse-bean" in this country.—W. B. H.

Among the funeral offerings of the ancient Egyptians often occur messes of a pap of roughly cut or coarsely ground grain of barley. They are in small earthen bowls, placed on the floor of the vault like the other offerings. In Prof. Maspero's opinion these messes of barley, which are in no way suitable for human nourishment, answer to the Mola (*Mola salsa*) offerings of the Romans of earlier epochs; and I would hazard an explanation of the presence of the broad beans in the offerings of the twelfth dynasty as an example of a possible analogy between ancient Rome and ancient Egypt. For, supposing the correctness of Herodotus's account that the ancient Egyptians regarded the broad bean as unclean, that they ate it in no shape or form, and that their priests could not bear the sight of it, some explanation for its presence must be found. The single seed of *Cajanus indicus* found with the broad beans in no way differs from the Upper Egyptian variety with yellow flowers. The plant, which is cultivated and wild all over India, as well as in all parts of tropical Africa, is nowhere cultivated in Egypt, though it occurs here and there in a wild state in Upper Egypt. It is certainly one of the oldest cultivated plants in the world, a fact further attested by its discovery in the ancient tombs.

G. SCHWEINFURTH

METAMORPHISM AMONG DEVONIAN ROCKS

THE tract of Devonian rocks which stretches through the north of France and Belgium, and across Rhenish Prussia into Westphalia and Nassau, has furnished ample materials for geological disquisition. Among the problems which it presents to the observer, not the least important is the remarkable metamorphism of certain bands or areas of its component strata. Dumont first called attention to this feature in the Belgian Ardennes. It was subsequently shown by Lossen to be extensively developed in the Taunus. More recently the question has been attacked anew with all the appliances of modern petrography. M. Renard has subjected some of Dumont's original localities to a critical revision, which has resulted in a confirmation of the accuracy of that remarkable geologist's observations. The latest contribution to the literature of the subject is a paper (*Annales Soc. Géol. du Nord*, vol. x. p. 194) by Prof. Gosselet, who at first refused to admit the metamorphism contended for by Dumont and corroborated by M. Renard, but who now comes forward with independent evidence in its support, from another locality. He describes the arkose of Haybes and of Franc-Bois de Villerzies on the frontier of Belgium as having undergone such a metamorphism as to be no longer recognisable. M. Barrois reports that on examining microscopically some sections of the altered rocks, he found among them bi-pyramidal crystals of quartz with liquid inclusions and movable bubbles, as in the quartz of pegmatite. These crystals have been broken *in situ*, with conchoidal fractures, and the surrounding paste appears as if injected into them. This paste is composed of small irregular quartz-grains like those of schists, and is coloured by fibrous chlorite, so arranged as to impart a more or less schist-like structure. The chlorite, arising from alteration of biotite, is predominant in some specimens, while the quartz-grains preponderate in others. M. Barrois compares this altered arkose with some porphyroids and some granitic veins in Brittany recently studied by him. Prof. Gosselet shows that these crystalline intercalations are portions of the true Devonian strata, and he accounts for their highly altered condition by what he terms a metamorphism by friction. A portion of the Devonian rocks has slipped down between two faults and has undergone great lateral pressure, and has in consequence been heated sufficiently that metamorphism has been determined in it. The extent of change has been proportionate to the degree of pressure. The metamor-

phosed arkose is provisionally referred to the Gedinnian division of the system.

M. Renard is understood to be at work upon a detailed memoir on the metamorphosed rocks of the Ardennes, in which their chemical constitution and microscopic characters will be fully described.

THE RECENT STORM

THE great and destructive storm of Saturday and Sunday last may almost take rank as a historical event, seeing that on the Saturday evening atmospheric pressure fell considerably lower in Scotland than is known ever to have occurred in these islands since the barometer became an instrument of observation. This remarkable barometric fluctuation, as observed at Edinburgh, is shown by the following observations made on those two days, the observations being reduced to 32° and sea level :—

	Barometer Inches		Barometer Inches		Barometer Inches
Saturday.		Saturday.		Saturday.	
9.0 a.m.	28·934	5.30 p.m.	27·853	9.30 p.m.	27·467
2.0 p.m.	28·376	6.0 ,,	·819	10.0 ,,	·451
2.30 ,,	·266	6.30 ,,	·779	10.30 ,,	·464
3.0 ,,	·167	7.0 ,,	·721	11.0 ,,	·505
3.30 ,,	·064	7.30 ,,	·6 1	11.30 ,,	·565
4.0 ,,	27·984	8.0 ,,	·580	Sunday.	
4.30 ,,	·934	8.30 ,,	·516	3.0 a.m.	27·835
5.0 ,,	·921	9.0 ,,	·494	4.30 ,,	·968
				9.0 ,,	28·311

As the barometer was closely watched for some time before and after 10 p.m., and no change was observed, the reading 27·451 inches may be regarded as absolutely the lowest that occurred. Since the wind veered during the storm from S.E. by S.W. to N.W., the centre of the storm passed to the northward, and along its path still lower readings were doubtless recorded.

The following observations have been already received, showing in inches the lowest observed readings and the hour when they occurred :—Moffat, 27·662 at 10·15 p.m.; Marchmont, near Duns, 27·581 at 11 p.m.; Inverness, 27·516 at 11·10 p.m.; Fort William, 27·467 at 8 p.m.; Joppa, near Edinburgh, 27·464, Leith, 27·453, and Edinburgh, 27·451, at 10 p.m.; Glasgow, 27·427 at 9 p.m.; Dundee, 27·382 at 10·30 p.m.; Ochtertyre, near Crieff, 27·332 at 9·45 p.m.; and 27·400 is stated to have occurred at Aberdeen. With the observations made at the 160 stations of the Scottish Meteorological Society, it will, in a few days, be easy to trace the history of this extraordinary atmospheric depression in its passage across the island.

At Ben Nevis Observatory, the lowest reading of the barometer on Saturday, 23·173 inches, occurred at 8.30 p.m.; at noon, temperature was 15°, and at 10 p.m. 22°; at 7 p.m. the wind was S.E. force 8, and at 10 p.m., N.E. force 4.

In the sixty years preceding 1827, during which Mr. James Hoy made barometric observations, the lowest reading was 28·007 inches; during the last 43 years observations have been made at Culloden, and the lowest reading, observed by the late Mr. Arthur Forbes, was 27·984 inches at 11 a.m. on December 27, 1852. During the interval between these two long continued series of observations, Mr. George Innes, optician, made observations at Aberdeen; and on the occasion of the memorable storm of January 7, 1839, recorded an observation on that morning of 27·695 inches. On the same morning, at 9 o'clock, the lighthouses on the east of Scotland, which were near the centre of the storm at the time showed readings varying from 27·806 inches in the Firth of Forth, to 27·716 inches near Peterhead.

As these three series of observations extend over the last 120 years, it is evident that over at least the east of Scotland, from Inverness to the Tweed, atmospheric pressure fell on the evening of Saturday the 26th from a third to half an inch lower than has occurred during that extended period.

NOTES

WE are glad to be able to announce that Prof. Flower has been definitely appointed by the Trustees to the position of Superintendent of the Natural History Department of the British Museum, vacated by the recent resignation of Sir Richard Owen.

THE German Emperor, at the instance of the Berlin Academy of Sciences, has been pleased to make Prof. Sir William Thomson a Knight of the Order *Pour le Mérite* for Science and Art.

ACCORDING to an announcement made by Prof. E. Stefan at the last meeting of the Vienna Physical Society, Prof. S. von Wroblewski, of Krakow, has succeeded in solidifying hydrogen.

IT is reported that Prof. Wilhelm Klinkerfues, the well-known astronomer, shot himself on Monday in the Observatory at Göttingen.

WE are glad to see that the fishermen of Scotland have at last realised the necessity of a thorough scientific investigation into the habits of fish. At a meeting at Peterhead the other day the Solicitor-General for Scotland was requested to help the fishermen to obtain Government aid for the prosecution of such research; the country, it was admitted, is behind all others "in scientific information on fish." The Solicitor-General, Mr. Asher, admitted the lamentable deficiency of our knowledge of the habits of food fishes, and promised to do all he could to obtain a grant for the Committee of the Fisheries Board, who are now endeavouring, with the slender means at their command, to investigate the subject. "Prof. Ewart and his colleagues," Mr. Asher stated, "had entered upon an investigation which, if duly prosecuted, could not fail to be productive of immense results and advantages in connection with all kinds of fisheries."

AT the end of March the Austrian botanist, Mr. Joseph Knapp, Conservator des Herbariums des Allgemeinen Oesterreichischen Apothekervereines of Vienna, will go to Northern Persia (Azerbijan), with a scientific expedition for exploring the flora and fauna of that little-known province.

DURING February Prof. W. K. Parker will give a series of lectures at the Royal College of Surgeons on Mammalian Descent, as follows :—February 4th, Introductory; 6th, On Monotremes; 8th, On Marsupials; 11th, On Edentata; 13th, On Insectivora; 15th, Insectivora (continued); 18th, Insectivora (concluded); 20th, On the remaining Orders of Mammalia; 22nd, On Man (conclusion).

IN connection with the opening of the Turin Exhibition, the Italian Government offers a prize of 400*l.* to the inventor of the most practicable method for the transmission of electricity to a distance. The competition will be international.

WITHIN a few days the exhibition of the *Talisman* collection will be opened at the Jardin des Plantes of Paris, with diagrams exhibiting the circumstances of the operations, and the instruments which were used.

THE Asiatic Society of Bengal celebrated its centenary on Tuesday last week. The proceedings began with a special meeting, the Hon. H. Reynolds, the President of the Society, being in the chair. Six gentlemen, namely, Dr. Joule, Prof. Haeckel, Mr. Charles Meldrum, Prof. Sayce, M. E. Senart, and Prof. Monier Williams, were elected honorary members.

THE Cambridge University Press announces for publication "A Treatise on the General Principles of Chemistry," by M. M. Pattison Muir, M.A. This book is intended to give a fairly complete account of the present state of knowledge regarding the principles and general laws of chemistry; it is addressed to those students who have already a considerable acquaintance with descriptive chemistry, and it is hoped that by such students the book will be found complete in itself. An attempt is made to treat the chief theories of modern chemistry to some extent from an historical point of view, and to trace the connection between the older theories and those which now prevail in the science. Full references are given to all memoirs of importance. The first part treats of the atomic and molecular theory, and the application thereof to such objects as allotropy, isomerism, and the classification of elements and compounds; fairly complete accounts are also given of the methods and more important applications of thermal, optical, and other parts of physical chemistry. The second part is devoted to the subjects of chemical affinity, relations between chemical action and losses or gains of energy, and the various questions suggested by the expression "chemical equilibrium."

AT the weekly meeting of the Society of Arts on Wednesday last week, under the presidency of Sir John Lubbock, a paper was read by Mr. W. L. Carpenter, on "Science Teaching in Elementary Schools." The chairman said the subject under consideration was one of very great importance. The Duke of Devonshire's Commission had reported that the neglect of science and modern languages in our schools was a national misfortune; and though, no doubt, there was some improvement since that time, almost the same might be said now. Considering how much science had done, and was doing for us, the general, though happily now not universal, neglect of it in our schools was astonishing. If we did not avail ourselves to the utmost of the resources of nature, our great and growing population would become more and more miserable, and they would be distanced in the race by foreign nations. Mr. Carpenter said his object was not merely to draw attention to the crying need for elementary scientific instruction in our primary schools, but also to point out how such instruction could best be given, and to show that that could be done, and had been done on a large scale, with extraordinarily beneficial results to the children thus taught, without any more expenditure of time than at present. The one great mistake which vitiated the whole organisation of English education was the conception of intellectual training as the acquisition of information rather than as the development of the faculties. He pointed out the enormous value of science teaching in quickening the intelligence, as well as the very great practical value of the knowledge imparted. The special feature of the Liverpool School Board system was that the science demonstrations and experiments were given not by the ordinary staff of the school, but by a specially-appointed expert, whose sole duty it was to go round from school to school, giving practically the same lesson in each one until all had been visited, and abandoning altogether the use of text-books by the scholars. The results of that system were (1) the general quickening of the intellectual life of the school; (2) the sending of a large number of lads to science classes after leaving school; (3) the finding out of lads of exceptional scientific ability, and setting them on their road; (4) the attracting the attention of the ordinary teachers to science and to the results of teaching it. He concluded by urging that instruction in some branch of elementary science, preferably mechanics or physics for boys, and domestic economy for girls, should form a necessary part of the education of every child who remained in a public elementary school above Standard IV., that such instruction should be oral, that such teaching should be given during the ordinary school hours, and that such alterations should be made in the scale of grants under the new Code as should encourage the teaching of elementary science.

OUR readers may remember that some years ago Lieut. Julius von Payer, one of the discoverers of Franz Josef Land, gave up the sea for the brush; but he has carried his Arctic enthusiasm into art. He has for years been engaged on a series of four pictures illustrating the last expedition of Sir John Franklin, and according to the *Times* Paris Correspondent, the last of them, entitled "Starvation Cove," is just completed. Lieut. Payer has taken the greatest pains to acquaint himself with the minutest details of the expeditions of the *Erebus* and *Terror*, their formation and equipment, and the pictures will at least be interesting. We hope they may be exhibited in this country.

THE catalogue of the scientific books in the Reference Department of the Nottingham Free Library spins a list of about 750 titles out into a catalogue of nearly 40 pages, with between 50 and 60 entries upon each, and among them are a good collection of the most important *Journals* and *Transactions*. To a library the wide circle of whose frequenters forbids its shelves being thrown open to them all, it is doubtful whether a small collection of works with a full subject-catalogue is not of greater advantage than a large accumulation of books of which the librarian only is aware. But instead of giving any reference at all to the *subjects* treated in these books and papers, there is only given here the name of each *writer* and the heading under which his production may be found. This can be of little use to any student and none at all to the majority of those using a free library. A supplement of something less than 200 titles is added now, but the collection is so small at present that it is beneath criticism as to its deficiencies.

A TELEGRAM from Constantinople, Jan. 23, states that during the previous fortnight shocks of earthquake, varying in severity, have been felt throughout the district of Kalah-Jik, in the province of Castambul. Some of the minarets of the mosques have fallen in. Shocks also continue to be felt in Central Asia. One occurred at Tashkend a few days ago. A correspondent, writing from Vierno to the *Turkestan Gazette*, states that they have been lately very frequent, and somewhat severe at Oosh. Several shocks have also been recently experienced at Tiflis.

THE Naples Correspondent of the *Standard* writes:—"Prof. Silvestri, Director of the Observatory on Mount Etna, reported on the 15th inst. that frequent movements of the soil had taken place at Nicolosi and all the other villages near the site of the eruption of last March. Besides this, within a zone of about 60 km. in extent, the villages of Biancaritta, Aderno, Bronte, Maletto, Randazzo, Linguaglossa, and Piedimonte have experienced during the last few days subsultory and undulatory shocks; the most remarkable occurring on the evenings of the 10th and 14th inst. The oscillations moved in a north-easterly direction, along the mountain chain of Pilori, and were distinctly but slightly felt at Castiglione, Rovara, Castroreale, and as far as Messina. No damage was done, but at Randazzo and Linguaglossa, where the shocks were stronger, the people were much alarmed. At Catania, only the instruments of the Observatory registered the perturbation coincident with the above-mentioned shocks."

THE additions to the Zoological Society's Gardens during the past week include three Bonnet Monkeys (*Macacus sinicus* ♂ ♀ ♀) from India, a Toque Monkey (*Macacus pileatus*) from Ceylon, an Arabian Baboon (*Cynocephalus hamadryas* ♂) from Arabia, an Indian Gazelle (*Gazella bennetti* ♂) from India, presented by Capt. Spencer Stanhope; two Bonnet Monkeys (*Macacus sinicus* ♂ ♀) from India, presented by Mrs. St. John Mitchell; a Huanaco (*Lama huanacos* ♀) from Peru, presented

by Mr. J. W. Firth; four Harvest Mice (*Mus minutus*), British, presented by Mr. G. T. Rope; a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, presented by Mr. George Wood; a Great Grey Shrike (*Lanius excubitor*), British, presented by Master Arthur Blyth; two American Flying Squirrels (*Sciuropterus volucella*) from North America, presented by Mr. F. S. Mosely, F.Z.S.; a Cape Adder (*Vipera atropus*) from South Africa, presented by Mr. C. B. Pillans; a Black Tanager (*Tachyphonus melaleucus*), a White-throated Finch (*Spermophila albigularis*), a Tropical Seed Finch (*Oryzoborus torridus*), a Common Boa (*Boa constrictor*), a South African Rat Snake (*Spilotes variabilis*) from South America, a Cheela Eagle (*Spilornis cheela*) from Ceylon, two Illiger's Macaws (*Ara maracana*) from Brazil, a Common Guillemot (*Lomvia troile*), British, purchased; two Brown-tailed Gerbilles (*Gerbillus erythrurus*), born in the Gardens.

GEOGRAPHICAL NOTES

THE first report of Prof. Hull, dated from Gaza, January 1, has been received. It is necessarily brief, the details being reserved for the full report to follow, but it announces the success of the expedition so far. The professor has made a complete geological survey of the Wady Arabah and the Dead Sea, with a traverse across Southern Palestine. Capt. Kitchener, R.E., who accompanied him, has made a trigonometrical survey. Akabah he found to be laid down too far south; the south part of the Dead Sea as shown on the maps, is quite out of its true shape and position, and the Lisan has to be shifted three miles. From Gaza, when the rest of the party were in quarantine, Capt. Kitchener rode back to Egypt, accompanied by four Arabs only. He took a previously unknown route, particulars as to which will follow, and arrived at Ismailia after a ride of 200 miles. He was everywhere well received by the Arabs, who took him for a cousin of Sheikh Abdullah (the late Prof. Palmer), whose memory is still revered among them, and whose murder they still deplore. They are also reported to be deeply impressed with the energy and pertinacity of Sir Charles Warren's pursuit of the murderers. As regards the other members of Prof. Hull's party, Mr. Hart is reported to have made large additions to the flora; Mr. Lawrence has kept a continuous series of meteorological observations, and Mr. Gordon Hull has obtained a hundred photographs, large and small. Prof. Hull had still to execute two traverses of the country, in which he is no doubt at present engaged. The complete reports, both of himself and Capt. Kitchener, will be extremely important. They will probably be published in the journal of the Society.

WE have received the ninth issue of the *Geographisches Jahrbuch*. In the present volume, the reports which appeared in the first six publications on the additions successively made to our knowledge of extra-European parts of the earth are resumed; the new African annexations to geography being disposed of by Prof. K. Zöppritz, the Asiatic by Dr. Hans Lullies, and the Polar by Herr W. Wichmann. Two important departments in geography find for the first time distinct places assigned them in the present number; geographical onomatology and theoretic cartography. The former has indeed but very recently been recognised as the independent and important province of geography it really is. The first and as yet only comprehensive scientific work on the subject is that by its reviewer in the present *Jahrbuch*, Prof. J. J. Egli, "Versuch einer Allgemeinen Geographischen Onomatologie" (Leipzig, 1870-72), essay towards a general geographical onomatology. The name of a place is either immediately descriptive of its physical features ("nature-names," as Prof. Egli calls this class) or descriptive of some historical or other connection between the place and its earlier or later inhabitants or discoverers ("culture-names"), in either and every case is significant and interesting and an organic part of its geography.—Prof. Sigismund Günther, in his masterly review of theoretic cartography, first gives a brief yet clear and comprehensive "history of the development of geometrical cartography," taking notice more particularly of modern works on the subject, and then estimates recent works on projection.—Prof. von Oppolzer, reporting the progress made in European measurement of degrees, summarises the transactions of the sixth General Conference held on the subject at Munich, September 13-16, 1880. He calls special attention to the results deduced by von Bauernfeind from taking the measurement of the zenith simultaneously at Dobra and Kappellenburg, in which the same anomalies came to light as those pointed out years before by von Bayer. These anomalies are entirely parallel with those which appear in taking barometrical measurements of heights, and von Bauernfeind attributes them to the circumstance that the registered temperatures at given places form no correct criterion of the temperatures of the intermediate air-strata, the temperatures at the given places being to a certain extent determined by purely local influences. These conclusions are confirmed by Oppolzer's studies in astronomical refraction, in which analogous anomalies are to be explained by the fact that the universal law of diminution of temperature with ascent is modified in the lowest air-strata by local causes. In clear nights, *e.g.*, the temperature in the lowest atmospheric strata invariably rises with ascent up to a certain moderate height. During the day, on the other hand, in corresponding conditions, temperature diminishes with ascent at a rate considerably above the average. These facts afford Oppolzer a very simple explanation of hitherto puzzling phenomena.—In the review of geographical meteorology by Prof. J. Hann is presented a great treasure of data as to rainfall, nebulosity, atmospheric pressures, winds, &c.—In a map by Remon of the nebulosities of different parts of Europe and North Africa, the extremes are given at 20° in the Algerian Sahara, and 68° in the north-west of Europe. Cloudiness in general diminishes southwards and eastwards, as compared with the centre of Europe.—Space allows only of the bare mention of the review of the geography of plants by Prof. Drude; of animals, by Prof. Schmarda; of ethnology, by Prof. Gerland; of deep-sea exploration, by Prof. von Boguslawski; of the structure of the earth's surface, by Prof. von Fritsch; and of the method of geography, by Prof. Wagner.

WE understand that the expedition with which Mr. Wilfrid Powell has undertaken to explore New Guinea will leave this country about the beginning of March. It will consist of Mr. Powell, with four or five Europeans, including a naturalist and a geologist, and the work of traversing the thousand or twelve hundred miles which have been mapped out for the route is likely to occupy over a year. Mr. Powell has chartered a small screw steamer, in which the party will proceed up the Ambernoli river, a large stream in Dutch territory, on the north coast. The explorers will proceed up this river in a steam launch as far as they can get. The launch will then return to the steamer, and the party will strike in a south-westerly direction across the high central range of mountains which runs from east to west, called the Snow Mountains, or the Finisterre Mountains. When this difficult task has been accomplished, Mr. Powell will march to the east coast, where he will hope to find his screw steamer in Astrolabe Bay. After refitting, he will again strike westwards, across the south-east corner of the island, to Port Moresby. Mr. Powell will thus explore the country from north to south, avoiding the Fly River, or any other portion which has been visited by Europeans.

THE *St. Petersburger Zeitung* has received news from Khartoum about Dr. Junker. Herr Bohndorf, Dr. Junker's companion, has arrived at Khartoum, and reports that Junker is still in the Niam Niam country, and that his researches are favourably progressing.

THE last issue of the *Bulletin* of the St. Petersburg Academy of Sciences contains a letter of M. Bunge, the medical officer of the Lena polar meteorological station. The country around the station is but little fitted for collecting. It is a flat region, periodically covered by the tide, and there may be no question about sea-flora or sea-fauna to be found in the creeks that intersect the ground. The ice bear sometimes makes his appearance, as also the wolf, the fox, especially *Canis lagopus*, of which the neighbouring Yakuts catch about 300 every year; the *Mustela herminea* is not very rare. The Yakuts do not know lemmings, but one species at least, the *Myodes torquatus*, inhabits the delta. The reindeer come in large flocks in the summer, returning to the forest region in the autumn. They are killed when passing the streams, shooting being prohibited by the Yakut community. One *Ægocerus montanus* has been perceived, from a great distance, within the delta. Walruses, sometimes seals, and dolphins also enter the mouth of the Lena. As to the birds, M. Bunge gives a list of 101 species he has observed or shot during his journey. The water invertebrata are

very poorly represented in the Lena. As M. Bunge gives great attention to the collecting of skulls of animals, his collection promises to be of great value, as also his collection of human skulls taken from the coffins that dot the *tundra*—the Yakuts merely putting them on the surface between a few rough planks. It is worthy of notice that, whilst having many opportunities for visiting the sick Yakuts in the neighbourhood, M. Bunge has not yet noticed a single case of scurvy; it is quite unknown among them.

WE have received a separate copy from the forthcoming number of the *Izvestia* of the Russian Geographical Society of a notice of the remarkable Russian expeditions to the Pamir, carried on during last summer. It is sufficient to cast a glance at the map that accompanies this note to ascertain that "the Roof of the World" has now been quite deprived of the veil of mystery that covered it for centuries past. Many years since Russian travellers penetrated into it, and studied detached portions as they followed the course of the rivers which led to these gigantic plateaux, inclosed between still higher mountains. Pursuing his researches for several consecutive years, Dr. Regel and his companions have explored the valleys of the Panj and of its numerous tributaries, penetrating as far south as Sist (37° N. lat.) and as far east as the sources of Shakh-dere, 72° 50′ E. long. An immense bend to the west of the Panj River beneath Kala-vamar, due to the presence of a high chain of mountains running north-east, and a wide lake, Shiva, 11,000 feet high, situated to the west of this bend, discovered by Dr. Regel, considerably modify our former maps of the western part of the Pamir region. But the expedition of last summer, which consisted of MM. Putiata, of the general staff, Ivanoff, geologist, and Bendersky, topographer, throws quite a new light on the still less known eastern Pamir. The expedition has literally covered with a network of surveys the whole of this region from 39° 30′ N. lat. to the sources of the Vakhan-daria, in 37° 10′, and from 72° 10′ to 75° 20′ E. long., penetrating thus twice to the foot of the Mustag-aga, or Tagarma Peak. The great Pamir chain, between the Shakh-dere and the Upper Panj has been crossed at four places, 100 miles distant, and the Russian surveys have been brought into connection with those of the pundit M. S. The expedition seems to have established that the pundit M. S. was misled, and that the Ak-su is really the upper part of the Murghab. The other results of this expedition are also very important: not only a map on the scale of five versts to an inch of the whole of this wide region has been drawn, but also the heights of a very great number of points have been determined by barometrical and trigonometrical measurements; large geological and botanical collections have been brought in, as well as many drawings, and a dictionary of the Shugnan language. Detailed reports will follow, the foregoing information being due to a preliminary letter of M. Ivanoff.

A TELEGRAM from Nerchinsk, in Siberia, states that M. Joseph Martin, the French traveller, passed through that place recently on his way to Irkutsk. M. Martin has (says a Reuter's telegram) explored the country from the Lena to the Amur, and has crossed the intervening Starovi Mountain range He has collected a large amount of geographical and geological information concerning the region which he has traversed.

MR. SCHUVER, the Dutch African explorer, has been murdered at Bahr Gazal, in South Kordofan.

ACCORDING to the latest number of the *Annalen der Hydrographie und maritimen Meteorologie* the greatest depth of the Atlantic is 8341 metres; this was found in 19° 39′ 10″ N. lat., and 60° 26′ 5″ W. long. The next greatest depression of the sea bottom is in 19° 23′ 30″ N. lat., and 66° 11′ 45″ W. long., where 7723 metres were found.

THE AIMS AND PROSPECTS OF THE STUDY OF ANTHROPOLOGY[1]

THOSE who are present at this meeting need scarcely be reminded of the importance of the subject which is our common bond of union, that which is defined in the prospectus of the Institute as "the promotion of the science of mankind by the accumulation of observations bearing on man's past history and present state in all parts of the globe."

But those present are a very small fraction indeed of the persons in this country to whom this great subject is, or should be in some one or other of its various divisions, a matter of deep interest, and as it is possible that the words which it is my privilege and duty as your president to address to you on this occasion may be read by some who are not yet so much conversant with the aims of anthropology and the means for its cultivation which this Institute affords as those who have taken the trouble to come here this evening, I hope that you will pardon me if I bring before you some general considerations, perhaps familiar to all of you, regarding the scope and value of the science the advancement of which we have at heart.

One of the great difficulties with regard to making anthropology a special subject of study, and devoting a special organisation to its promotion, is the multifarious nature of the branches of knowledge comprehended under the title. This very ambition, which endeavours to include such an extensive range of knowledge, ramifying in all directions, illustrating and receiving light from so many other sciences, appears often to overleap itself and give a looseness and indefiniteness to the aims of the individual or the institution proposing to cultivate it.

The old term ethnology has a far more limited and definite meaning. It is the study of the different peoples or races who compose the varied population of the world, including their physical characters, their intellectual and moral development, their languages, social customs, opinions, and beliefs, their origin, history, migrations, and present geographical distribution, and their relations to each other. These subjects may be treated of under two aspects—first, by a consideration of the general laws by which the modifications in all these characters are determined and regulated; this is called general ethnology: secondly, by the study and description of the races themselves, as distinguished from each other by the special manifestations of these characters in them. To this the term special ethnology, or, more often, ethnography, is applied.

Ethnology thus treats of the resemblances and differences of the modifications of the human species in their relations to each other, but anthropology, as now understood, has a far wider scope. It treats of mankind as a whole. It investigates his origin and his relations to the rest of the universe. It invokes the aid of the sciences of zoology, comparative anatomy, and physiology; and the wider the range of knowledge met with in other regions of natural structure, and the more abundant the terms of comparison known, the less risk there will be of error in attempting to estimate the distinctions and resemblances between man and his nearest allies, and fixing his place in the zoological scale. Here we are drawn into contact with an immense domain of knowledge, including a study of all the laws which modify the conditions under which organic bodies are manifested, which at first sight seem to have little bearing upon the particular study of man.

Furthermore, it is not only into man's bodily structure and its relations to that of the lower animals that we have to deal; the moral and intellectual side of his nature finds its rudiments in them also, and the difficult study of comparative psychology, now attracting much attention, is an important factor in any complete system of anthropology.

In endeavouring to investigate the origin of mankind as a whole, geology must lend its assistance to determine the comparative ages of the strata in which the evidences of his existence are found; but researches into his early history soon trench upon totally different branches of knowledge. In tracing the progress of the race from its most primitive condition, the characteristics of its physical structure and relations with the lower animals are soon left behind, and it is upon evidence of a kind peculiar to the human species, and by which man is so pre-eminently distinguished from all other living beings, that our conclusions mainly rest. The study of the works of our earliest known forefathers, "prehistoric archæology," as it is commonly called, although one of the most recently developed branches of knowledge, is now almost a science by itself, and one which is receiving a great amount of attention in all parts of the civilised world. It investigates the origin of all human culture, endeavours to trace to their common beginning the sources of all our arts, customs, and history. The difficulty is what to include and where to stop; as, though the term "prehistoric" may roughly indicate an artificial line between the province of the anthropologist and that which more legitimately belongs to the archæolo-

[1] Address delivered at the anniversary meeting of the Anthropological Institute of Great Britain and Ireland, January 22, 1884, by Prof. Flower, LL.D., F.R.S., P.Z.S., &c., President.

gist, the antiquary, and the historian, that the studies of the one pass insensibly into those of the other is an evident and necessary proposition. Knowledge of the origin and development of particular existing customs throws immense light upon their real nature and importance, and conversely, it is often only from a profound acquaintance with the present or comparatively modern manifestations of culture that we are able to interpret the slight indications afforded us by the scanty remains of primitive civilisation.

Even the more limited subject of ethnology must be approached from many sides, and requires for its cultivation knowledge derived from sciences so diverse, and requiring such different mental attributes and systems of training, as scarcely ever to be found combined in one individual. This will become perfectly evident when we consider the various factors or elements which constitute the differential characters of the groups or races into which mankind is divided. The most important of these are—

1. Structural or anatomical characters, derived from diversities of stature, proportions of different parts of the body, complexion, features, colour and character of the hair, form of the skull and other bones, and the hitherto little-studied anatomy of the nervous, muscular, vascular, and other systems. The modifications in these structures in the different varieties of man are so slight and subtile, and so variously combined, that their due appreciation, and the discrimination of what in them is essential or important, and what incidental or merely superficial, requires a long and careful training, superadded to a preliminary knowledge of the general anatomy of man and the higher animals. The study of physical or zoological ethnology, though it lies at the basis of that of race, is thus necessarily limited to a comparatively few original investigators.

2. The mental and moral characters by which different races are distinguished are still more difficult to fathom and to describe and define, and although the subject of much vague statement, as there are few people who do not consider themselves competent to give an opinion about them, they have hitherto been rarely approached by any strictly scientific method of inquiry.

3. Language.—The same difficulties are met with in the study of language as in that of physical peculiarities, in the discrimination between the fundamental and essential, and the mere accidental and superficial resemblances, and in proportion as these difficulties are successfully overcome will be the results of the study become valuable instead of misleading. Though the science of language is an essential part of ethnology, and one which generally absorbs almost the entire energies of any one who cultivates it, its place in discriminating racial affinities is unquestionably below that of physical characters. Used, however, with due caution, it is a powerful aid to our investigations, and in the difficulties with which the subject is surrounded, one which we can by no means afford to do without.

4. The same may be said of social customs, including habitations, dress, arms, food, as well as ceremonies, beliefs, and laws, in themselves fascinating subjects of study, placed here in the fourth rank, not as possessing any want of interest, but as contributing comparatively little to our knowledge of the natural classification and affinities of the racial divisions of man. When we see identical and most strange customs, such as particular modes of mutilation of the body, showing themselves among races the most diverse in character and remote geographically, we cannot help coming to the conclusion that these customs have either been communicated in some hitherto unexplained manner, or are the outcome of some common element of humanity, in either of which cases they tell nothing of the special relations or affinities of the races which practise them.

This subject of ethnography, or the discrimination and description of race characteristics, is perhaps the most practically important of the various branches of anthropology. Its importance to those who have to rule, and there are few of us now who are not called upon to bear our share of the responsibility of government, can scarcely be overestimated in an empire like this, the population of which is composed of examples of almost every diversity under which the human body and mind can manifest itself. The physical characterestics of race, so strongly marked in many cases, are probably always associated with equally or more diverse characteristics of temper and intellect. In fact, even when the physical divergences are weakly shown, as in the case of the different races which contribute to make up the home portion of the empire, the mental and moral characteristics are still most strongly marked. As it behoves the wise physician not only to study the particular kind of disease under which his patient is suffering, and then to administer the approved remedies for such disease, but also to take into careful account the peculiar idiosyncracy and inherited tendencies of the individual, which so greatly modify both the course of the disease and the action of remedies, so it is absolutely necessary for the statesman who would govern successfully, not to look upon human nature in the abstract and endeavour to apply universal rules, but to consider the special moral, intellectual, and social capabilities, wants, and aspirations of each particular race with which he has to deal. A form of government under which one race would live happily and prosperously would to another be the cause of unendurable misery. No greater mistake could be made, for instance, than to apply to the case of the Egyptian fellah the remedies which may be desirable to remove the difficulties and disadvantages under which the Birmingham artisan may labour in his struggle through life. It is not only that their education, training, and circumstances are dissimilar, but that their very mental constitution is totally distinct. And when we have to do with people still more widely removed from ourselves, African Negroes, American Indians, Australian or Pacific Islanders, it seems almost impossible to find any common ground of union or *modus vivendi*; the mere contact of the races generally ends in the extermination of one of them. If such disastrous consequences cannot be altogether averted, we have it still in our power to do much to mitigate their evils.

All these questions, then, should be carefully studied by those who have any share in the government of people of races alien to themselves. A knowledge of their special characters and relations to one another has a more practical object than the mere gratification of scientific curiosity; it is a knowledge upon which the happiness and prosperity, or the reverse, of millions of our fellow-creatures may depend.

It is gratifying to find, then, that there are in our own country—for on this occasion I will not speak of what is being done elsewhere—many signs that the prospects of a thorough and scientific cultivation of anthropology in its several branches are brightening.

I may first mention the publication of the final Report of the Anthropometric Committee of the British Association for the Advancement of Science, of which formerly the late Dr. W. Farr, and recently our vice-president, Mr. Francis Galton, have been chairmen, and in which Mr. Charles Roberts, Dr. Beddoe, Sir Rawson Rawson, and some other of our members have taken so active a part. This Report, and those which have from time to time been issued by the Committee during the progress of the work, contain a large mass of valuable statistical information relating to the physical characters, including stature, weight, chest girth, colour of eyes and hair, strength of arm, &c., of the inhabitants of the British Isles, illustrated by maps and diagrams. Excellent as has been the work of the Committee, there is still much to be done in the same direction, and larger numbers of observations even than those already obtained are in many cases necessary to verify or correct the inferences drawn from them. This is thoroughly acknowledged in the Report, which states in one of the concluding paragraphs that "the Committee believes that it has laid a substantial foundation for a further and more exhaustive study of the physical condition of a people by anthropometric methods, and that its action will prove that it has been useful as an example to other scientific societies and to individuals in stimulating them, as well as directing them in the methods of making statistical inquiries relative to social questions."

It is satisfactory to learn that many portions of the work thus inaugurated will be carried on by bodies specially interested in particular departments, as the Collective Investigation Committee of the British Medical Association, and the Committee of the British Association for collecting photographs and defining the characteristics of the principal races of the United Kingdom, a subject in which Mr. Park Harrison is taking so deep an interest.

It should be mentioned that the original returns upon which the reports of the Committee are based, including much information which has not yet been analysed and tabulated, on account of the time and labour such a process would involve, as well as the instruments of investigation purchased with funds supplied by the British Association, have been, by the consent of the Council of the Association, placed under the charge of the officers of this Institute.

It is very satisfactory, in the next place, to be able to record that our great centres of intellectual culture are gradually

waking up from that state of apathy with which they have hitherto regarded the subject of anthropology.

In Oxford the impulse given by the genius and energy of Rolleston has begun to bear fruit. The University has taken charge of the grand collection of ethnological objects most liberally offered to it by our former president, General Pitt-Rivers, and has undertaken not only to provide a suitable building for its reception but also to maintain it in a manner worthy of the scientific discernment and munificence displayed by the donor in collecting and arranging it. Furthermore Oxford has shown her wisdom in affiliating to herself the most learned of English anthropologists in the widest sense of the word, one of the few men in this country who has made the subject the principal occupation of his life. I need scarcely say that I refer to another of our former presidents, Mr. E. B. Tylor. By conferring a Readership in Anthropology upon him Oxford has instituted the first systematic teaching of the subject yet given in any educational establishment in this country, and it is a great credit to the oldest University that it should thus lead the way in one of the most modern of sciences. It is, however, only a beginning; the whole of the great subject is confined to the teaching of one individual with modest stipend, and not admitted to the dignity of the professoriate. In the École des Hautes Études at Paris anthropology is taught theoretically and practically in six different branches, each under the direction of a professor who has specially devoted himself to it, aided, in some cases, by several assistants.

In Cambridge also there are many hopeful signs. The recently-appointed Professor of Anatomy, Dr. Macalister, is known to have paid much attention to anatomical anthropology, and has already intimated that he proposes to give instruction in it during the summer term. An Ethnological and Archæological Museum is also in progress of formation, which, if not destined to rival that of Oxford, already contains many objects of great value, and a guarantee of its good preservation and arrangement may be looked for in the recent appointment of Baron Anatole von Hügel as its first curator.

Perhaps in no place in the world could so varied and complete an anthropological collection be expected as in the national museum of this country, which should be the great repository of the scientific gleanings of the numerous naval, military, exploring, and mercantile expeditions sent out by the Government or by private enterprise for more than a century past, and penetrating into almost every region of the globe. Our insular position, maritime supremacy, numerous dependencies, and ramifying commerce, have given us unusually favourable opportunities for the formation of such collections, opportunities which unfortunately in past times have not been used so fully as might be desired. There is, however, a great change coming over those who have charge of our national collections in regard to this subject. Thanks to the foresight and munificence of the late Mr. Henry Christy, and the well-directed energies of Mr. Franks and his colleagues, the collection illustrating the customs, clothing, arts, and arms of the various existing and extinct races of men, in the British Museum, is rapidly assuming an importance which will be a surprise to those who see it for the first time arranged in the large galleries formerly devoted to mammals and birds. Even the grand proportion of space allotted to this collection in the rearrangement of the Museum is, I am told, scarcely sufficient for its present needs, to say nothing of the accessions which it will doubtless receive now that its importance and good order are manifest.

A national collection of illustrations of the physical characters of the races of men, fully illustrated by skeletons, by anatomical specimens preserved in spirit, by casts, models, drawings, and photographs such as that which exists in the Muséum d'Histoire Naturelle at Paris, is still a desideratum in this country. The British Museum till lately ignored the subject altogether, and in the beginning of the century actually expelled such specimens of the kind as had accidentally found their way within its walls. Recently, however, skulls and skeletons of man have been admitted, and since the removal of the zoological collections to the new building at South Kensington their importance as an integral part of the series has been recognised, and their exhibition in the osteological gallery will doubtless stimulate the growth of what we may trust will be ultimately a collection worthy of the nation, although unfortunately, from causes too well known, the difficulties of procuring pure examples of many races are gradually increasing, and in some cases have become well-nigh insuperable. The museum contains at present 407 specimens illustrating human osteology, of which 10 are skeletons more or less complete.

In the meantime the College of Surgeons of England has done much to supply the deficiency. During the last twenty years it has let few opportunities pass of attracting to itself, and therefore saving from the destruction or lapse into the neglected, valueless condition into which small private collections almost invariably ultimately fall, a large number of specimens, now, it is to be hoped, placed permanently within the reach of scientific observation. The growth of this collection may be illustrated by the fact that, whereas at the time of the publication of the Catalogue in 1853 it consisted of 18 skeletons and 242 crania, it now contains 89 more or less complete skeletons and 1380 crania, nearly all of which have been added during the last twenty years. This is, moreover, irrespective of the great collection of Dr. Barnard Davis, purchased in 1880 by the College, which was thus the means of preserving intact, for the future advantage and instruction of British anthropologists, an invaluable series of specimens otherwise probably destined to have been dispersed or lost to the country for ever. This collection consists of 24 skeletons and 1539 crania, making, with the remainder of the College collection, a total of 3032 specimens illustrating the osteological modifications of the human species. These are all in excellent order, clean, accessible, and catalogued in a manner convenient for reference, although somewhat too crowded in their present locality to be readily available for observation.

Large as is this collection, and rich in rare and interesting types, it is far from exhaustive; many great groups are almost or entirely unrepresented even by crania, and the series of skeletons is (with the exception of one race only, the Andamanese) quite insufficient to give any correct idea of the average proportions of different parts of the framework. In fact, such a collection as would be required for this purpose must be quite beyond the resources of, as well as out of place in, any but a national museum.

The collections illustrating anatomical anthropology in the University museums of Oxford, Cambridge, Edinburgh, and Dublin have all greatly increased of late, but for the reasons just given they can never be expected to attain the dimensions required for the study of the subject in its profoundest details. The small, but very choice collections formed by the officers of the medical department of the army, and kept in the museum of the Royal Victoria Hospital at Netley, and that of the navy at Haslar Hospital, are, I believe, in a stationary condition, but in good preservation. Our own collection, which also contains some valuable specimens (notably the complete skeleton of one of the extinct Tasmanian aborigines, presented by the late Mr. Morton Allport), and which during the past year has been catalogued for the first time by Mr. Bloxam, has not been added to, owing to a feeling which the Council has long entertained, and which induced them to part with the ethnological collection, that a museum, entailing as it does, if worthily kept up, a very considerable annual expense, is not within the means of the Institute, at all events not until the more pressing claims of the library and the publications are fully satisfied.

This leads me to speak, in conclusion, of the work accomplished during the past year by the Institute, and of its present position and future prospects.

I must first refer to that portion of the retrospect of the year which always casts a certain sadness over these occasions—the losses we have sustained by death. Happily these have not been numerous, and do not include, as has been the case in many former years, any from whom great work in our own subject might still have been expected. Though we were all proud to number William Spottiswoode, the President of the Royal Society, among our members, and though we all honoured him for his accomplishments in other branches of science, and loved him for his work as a man who rose high above his fellows in his chivalrous sense of honour and simple dignity of demeanour, we could not claim him as a worker at anthropology.

Lord Talbot de Malahide's antiquarian pursuits frequently verged upon our own subjects in their proper sense, and he was often present at our meetings, and a very recent contributor to our journal. He had, however, reached the ripe old age of eighty-two.

From the list of our honorary members we have lost a still more venerable name, that of Sven Nilsson, Professor in the Academy of Lund. He was born on March 8, 1787, and died on November 30 of last year, and was therefore

well on in his ninety-seventh year. His long-continued and laborious researches in the zoology, palæontology, anthropology, and antiquities of his native land gave him a high place among men of science. Among a host of minor contributions he was the author of a standard work on the Scandinavian fauna; but that by which he was best known to us is the book of which the English translation, edited by Sir John Lubbock, bears the title of "The Primitive Inhabitants of Scandinavia; an Essay on Comparative Ethnography, and a Contribution to the History of the Development of Mankind."

The number of our ordinary members has been fairly kept up, the additions by election having slightly exceeded the losses by death and resignation; but a larger increase in the future will be necessary in order to carry on the operations of the Institute in a successful manner, especially under the new conditions to which I shall have to advert presently. Even by the most careful management our treasurer has not succeeded in bringing the expenditure of the year quite within our ordinary income.

The journal, I am glad to report, has been brought out with exemplary punctuality, under the able and energetic supervision of our director, Mr. Rudler. To this part of our operations I think we may look with unmixed satisfaction, the number, character, and variety of the communications contained in it being quite equal to those of former years.

With regard to our future, the next year will probably be one of the most momentous in our annals, as we have determined upon a great step, no less than a change of domicile. It was ascertained in the course of last summer that we could only remain in our present quarters at an increased rent upon that which we had hitherto paid, and we therefore considered whether it would be possible to obtain as good or better accommodation elsewhere. It happened fortunately that the Zoological Society was about to move into new freehold premises at No. 3, Hanover Square, and would have spare rooms available for the occupation of other societies. A committee of the Council was appointed to examine and report upon the desirability of moving, and negotiations were entered into with the Council of the Zoological Society which have ended in our becoming their tenants for the future. We shall have for the purposes of our library, office, and Council meetings, two convenient rooms on the second floor immediately above the library of the Zoological Society, and for the purpose of storing our stock of publications a small room on the basement. We shall also have the use of a far more handsome and commodious meeting room than that which we occupy at the present moment, and in a situation which is in many respects more advantageous. Let us trust that this change may be the inauguration of an era of prosperity to the Institute, and of increased scientific activity among its members.

THE FORMATION OF SMALL CLEAR SPACES IN DUSTY AIR[1]

IN the introduction a few remarks are made on the growing interest in everything connected with dust, whether it be the organic germs floating in the air, or the inorganic particles that pollute our atmosphere. Prof. Tyndall's observations on the dark plane seen over a hot wire[2] are referred to, Lord Rayleigh's recent discovery of the dark plane formed under a cold body[3] is described, and attention called to Dr. Lodge's experiments described in a letter to NATURE, vol. xxviii. p. 297.

The experiments described in this paper were made in a small dust-box, blackened inside, glazed in front, and provided with a window at one side. For illumination two jets of gas inclosed in a dark lantern were used. The light entered the dust-box by the side window and could be condensed on any part of the inside of the box, by means of two lenses fixed in a short tube, and loosely attached to the front of the lantern. Magnifying glasses of different powers were used for observation. The dusts experimented on were made, some of hydrochloric acid and ammonia, some by burning sulphur and adding ammonia, some by burning paper, magnesium, or sodium. Calcined magnesia and lime were also used, as well as ground charcoal. These three last substances were stirred up by means of a jet of air.

[1] Abstract of a paper read to the Royal Society of Edinburgh, January 21, 1884, by Mr. John Aitken.

[2] "Essays on the Floating-Matter in the Air," p. 5. (Longmans, Green, and Co., 1881.)

[3] NATURE, vol. xxviii. p. 139.

For testing the effects of slight difference of temperature, tubes in some form or other were generally used. These tubes were closed at the front, projected through the back of the dust-box, and were brought close to the glass front for observation under strong magnifying power. The tubes were heated or cooled by circulating water through them, in a small tube passing through their interior.

Suppose the experiments to be begun by introducing a round tube into its place in the dust-box and then filling the box with any dust, everything being then left for some time so that all the apparatus may acquire the same temperature. If the light be now allowed to fall on the box, and be quickly brought to a focus on the tube, it will be found that the dust is in close contact with it on the top and sides, but *underneath* there will be seen a clear space. Close examination will show the particles to be falling on the upper surface of the tube, and coming into contact with it, while underneath a clear space is formed by the particles falling out of it. If the tube is now slightly cooled, a downward current is formed, and the currents of dustless air from below the tube meet under it, and form a dark plane in the centre of the descending current. It is shown that gravitation can, under favourable conditions, produce this separation of the dust quickly enough to keep up a constant supply of dustless air. No increase of effect is produced by a lower temperature. A temperature of − 10° C. makes the dark plane thinner, because it increases the rate of the descending current and carries away the purified air more quickly.

A form of apparatus was arranged to get rid of this separating effect of gravitation. It consisted of an extremely thin and flat piece of metal. This test-surface was placed *vertically* in the dust-box. The air in passing over this piece of apparatus was not caused to take up a horizontal movement at any part of its passage. The result was that even with a temperature of − 10° C. the dust kept close to its surface, and no dark plane was formed in the descending current. The dark plane in the cold descending current seems, therefore, not to be an effect of temperature, but is the result of the action of gravitation on the particles under the body. A dark plane was, however, observed when working with this flat surface when cooled, but it was not formed in dusty, but in foggy air, and was found to be due to the evaporation of the fog particles when they approached the cold surface.

If a very little heat, instead of cold, is applied to the round tube in the previous experiment, then the dark space under the tube rises and encircles the tube and the two currents of clear air unite over the tube and form the dark plane in the upward current. But in addition to this heat has been found to exert a repelling effect on the dust. This was proved by putting the thin vertical test-surface in the dust-box and heating it, when it was found that the dust was repelled from its surface, and a dark plane formed in the ascending current, neither of which effects was obtained with cold. The dust begins to be repelled with the slightest rise of temperature, and the dark space in front of the test-surface becomes thicker as the temperature rises. An experiment is then described in which air flowing up between two parallel glass plates is caused to pass from side to side of the channel by the repelling action of heat at different points.

For testing the effects of higher temperatures a platinum wire heated by means of a battery was used. The platinum wire was bent into a U-shape, the two legs being brought close together. This wire was fixed in the dust-box with the bend to the front, and the legs in the same horizontal plane, the two copper wires to which it was attached being carried backwards and out of the box. By this arrangement a clear view was obtained all round the wire, and other advantages secured. Experimenting with this apparatus it was found that every kind of dust had a different sized dark plane. With magnesia and other indestructible dusts it was very thin, with the sulphate dust it was much thicker, and with the sal-ammoniac dust thicker still. So thick was it with the two latter kinds of dust that the dark planes over the two legs expanded and formed one plane. As the particles could be seen streaming into the dark space under the wires, it was obvious that these large dark planes were not caused by repulsion, but by the evaporation or by the disintegration of the dust particles. When making the experiment in a mixture of different kinds of dusts, the hot wire was surrounded by a series of zones of different brightness, and having sharp outlines. The size of the different zones was determined by the temperature necessary to evaporate the different kinds of dust present, and

outside these zones was another, caused by the evaporation of the water from the particles.

The conclusions arrived at from these experiments are that the downward dark plane is produced by this separating action of gravitation, in the space under the cold body, and that the upward dark plane is produced (1) by the separating action of gravitation, (2) by the repulsion due to heat, (3) by evaporation, and (4) by disintegration.

The effect of centrifugal force is considered. It is pointed out that as the air, in its passage over a body such as a tube, curves as much in one direction as it does in another, therefore any centrifugal effect produced in the one part will be reversed in the other. An experiment is described in which an air current is caused to curve through 180° in its passage round the edge of a thin plate, and without any curving in the opposite direction, but no decided centrifugal action could be detected.

The motions of the dust particles produced by the repulsion of the hot surface suggested that electricity might play some part in these phenomena. Experiments were made to test this. The hot body was insulated and connected with an electroscope; but no electrical disturbance was observed, nor could any electrification be got from the dust and hot air streaming up from the hot wires. The effects of electrification were studied by insulating and charging the hot surface. The effect was found to be the opposite of the heat effect. If the potential is slight, and the temperature high, the heat is able to keep the dust off the surface of the body and the dark plane district, but if the temperature falls, or the potential is increased, a point is reached when the electrical attraction overcomes the heat effect, and the dust particles break in upon and destroy the dark space.

It was observed that after the dust particles were electrified they tended to deposit themselves on any surface near them, and experiments were made to determine the best conditions for purifying air in this manner. It was found to be best done by causing as rapid a discharge of electricity as possible, by means of points, surfaces being placed near them to increase the electrification of the dust, and to augment the rate of the currents of air which were driven from the points. These surfaces became places on which the dust deposited itself before losing its charge. A large flask was found to be rapidly cleared of a cloud of dust by means of a point—the dust being almost entirely deposited on the inside surface of the flask. If the end of the conductor in the flask terminated in a sphere, but little effect was produced. Electricity has also been found capable of depositing the very fine dust of the atmosphere. The air in a large flask was purified much more quickly by means of the electric discharge than it could have been by means of an air-pump and cotton-wool filter.

It is shown that a wet and hot surface repels dust more than twice as strongly as a hot dry one. From this it is concluded that the heat and moisture in our lungs exert a protecting influence on the surface of the bronchial tubes and tend to keep the dust in the air which is ebbing and flowing through them from coming into contact with their surfaces. This was illustrated by placing a hot and wet surface in a current of dense smoke, where it remained some time without receiving a speck of soot, while a similar surface, but cold, was blackened with the smoke. It is pointed out that on account of the irregularities on the surface of the tubes, and of the more violent movements of the air in the lungs, and on account of curves and projecting edges, the protection in the lungs is not perfect. Still it is thought that this repelling action at these surfaces must have some influence, and it seems possible it may explain some climatic effects, as it is evident that the lungs will be much better protected in such places as Davos Platz, where the air is cold and dry, and the repelling forces at a maximum, than at places like Madeira, where the air is warm and moist and these forces are at a minimum. This point can, however, only be determined satisfactorily by anatomical examinations of lungs which have lived under the different conditions.

In the experiments it was observed that dust not only tended to move away from hot surfaces, but also that it was attracted by cold ones, and attached itself to them. To study this effect glass plates were put in different positions near the hot platinum wire. Very beautiful impressions of the dark plane can be obtained by placing a piece of glass vertically and transversely over the hot wire. The hot air in flowing over the glass, deposits its dust on the surface of the plate leaving a clear line in the middle, indicating where the dustless air of the dark plane had passed. In this way the dust is trapped on the glass to which it adheres with some firmness, and not only the impressions but the dark planes themselves may thus be preserved.[1]

Other experiments to study the repulsion and attraction of hot and cold surfaces were made by placing glass plates on both sides of the hot wire. An interesting result was obtained when the plates were about 1 mm. apart. Using magnesia powder, the particles could be seen rising in the current, and approaching the hot wire; they were then observed to be violently repelled towards the cold surface, to which they adhered. If there was sufficient difference of temperature, not a single particle of dust was carried by the current past the hot wire.

A thermic filter is then described. In this filter the air is passed through the space formed between two concentric tubes. One tube is kept cold by a stream of water, and the other heated by means of steam or a flame. This instrument was shown in action; one end of the filter was connected with a glass flask, in which the condition of the air was tested. So long as the difference of temperature was kept up, and the current not too rapid, the air passing through it showed no signs of producing cloudy condensation on the pressure being reduced, showing that the filter had trapped all, even the invisible dust particles.

Some experiments on the effect of diffusion on the distribution of dust at the surface of a diaphragm are described. When carbonic acid diffuses into a space, the dust comes close to the diffusing surface, but if hydrogen is the diffusing gas, a clear space is formed in front of the diaphragm.

An explanation is then offered of the repulsion of dust by hot surfaces and its attraction by cold ones. It seems possible, that the dust might be repelled in the same way as the vanes of a Crookes' radiometer, by a radiation effect. That this was not the true explanation was, however, proved by placing in the dust-box a polished silver flat test-surface, one half of which was coated with lamp-black, when it was found that the dark space in front of the lamp-black was not any thicker than that in front of the polished metal. It is thought that the repulsion is due to the diffusion of the hot and cold air molecules. The hot surface repels because the outward diffusing molecules are hot, and have greater kinetic energy than the inward moving ones; and as the side of the dust particle next the hot surface is bombarded by a larger number of hot molecules than the other side, it is driven away from the hot surface. The attraction of a cold surface is explained by the less kinetic energy of the outward than of the inward diffusing molecules. Some experiments are referred to, to show that the rate at which gas molecules diffuse indicate that this diffusion effect is sufficient to account for the repulsion and attraction of the dust.

If the explanation here given is correct, then the dust is repelled in the same way as a vane of a radiometer when placed in front of a surface fixed inside the radiometer bulb, and hotter than the residual gas, the principal part of the energy producing the motion being transferred from the hot surface to the repelled surface by the kinetic energy of the molecules, and not by radiation.

In illustration of the tendency of dust to move from hot and to deposit itself on cold surfaces, the following experiments were made. Two mirrors, one hot and the other cold, fixed face to face and close to each other, were placed in a vessel filled with a dense cloud of magnesia, made by burning magnesium wire. After a short time the mirrors were taken out and examined. The hot one was quite clean, while the cold one was white with magnesia dust. In another experiment a cold metal rod was dipped into some hot magnesia powder; when taken out it had a club-shaped mass of magnesia adhering to its end, while a hot rod attracted none.

This tendency of dust to leave hot surfaces and attach itself to cold ones explains a number of familiar things, among others it tells us why the walls and furniture of a stove-heated room are always dirtier than those of a fire-warmed one. In the one case the air is warmer than the surfaces, and in the other the surfaces are warmer than the air. This effect of temperature is even necessary to explain why so much soot collects in a chimney. It explains something of the peculiar liquid-like movements of hot powders, and perhaps something of the spheroidal condition.

For practical applications, it is suggested that this effect of temperature might be made available in many chemical works for the condensation of fumes, and that it might also be used

[1] Specimens of these trapped dark planes were shown at the meeting, some of them made of white powder deposited on blackened glass, others of charcoal deposited on opal glass.

for trapping soot in chimneys. A small trap of this kind was shown. It consisted of a tall metal tube or chimney, surrounded by another tube slightly larger. The products of combustion are taken up the centre tube and down the intervening space. The heat of the gases is thus made to do its own filtering. This apparatus being placed over a smoky lamp, it trapped out most of the soot, and deposited it on the inside of the outer tube. This arrangement of apparatus is too delicate and troublesome for general use, and it is suggested that, as by simply cooling gases in presence of plenty of surface much of its dust is deposited, it might be possible and advantageous under certain conditions to purify air by heating and cooling it a number of times, which could be done at a small expense by means of regenerators.

Experiments were also made by discharging electricity into the smoke in a chimney. This also produced a marked diminution in the blackness of the escaping smoke. The supply of electricity of sufficiently high potential is however a difficulty for the present.

A VAST DUST ENVELOPE[1]

SCIENTIFIC men have evinced extraordinary interest in the wonderfully brilliant sunsets that have for some time past been observed in different parts of the world. Various theories have been advanced, but all are agreed that the real cause is not yet definitely determined. At the Brevoort House yesterday, a *Tribune* reporter spent a couple of hours with Prof. S. P. Langley, astronomer at Allegheny Observatory, Allegheny, Penn. His views upon the topic of the transmissibility of light through our atmosphere are stated below :

"At first I supposed the sunset matter a local phenomenon, but when the reports showed it to have been visible all over the world, it was obvious that we must look for some equally general cause. We know but two likely ones, and these have been already brought forward. One is the advent of an unusual amount of meteoric dust. While something over ten millions of meteorites are known to enter our atmosphere daily, which are dissipated in dust and vapour in the upper atmosphere, the total mass of these is small as compared with the bulk of the atmosphere itself, although absolutely large. It is difficult to state with precision what this amount is. But several lines of evidence lead us to think it is approximately not greatly less than 100 tons per diem, nor greatly more than 1,000 tons per diem. Taking the largest estimate as still below the truth, we must suppose an enormously greater accession than this to supply quantity sufficient to produce the phenomenon in question; and it is hardly possible to imagine such a meteoric inflow unaccompanied with visual phenomena in the form of 'shooting stars,' which would make its advent visible to all. Admitting, then, the possibility of meteoric influence, we must consider it to be nevertheless extremely improbable.

"There is another cause, which I understand has been suggested by Mr. Lockyer—though I have not seen his article—which seems to be more acceptable—that of volcanic dust; and in relation to this presence of dust in the entire atmosphere of the planet, I can offer some little personal experience. In 1878 I was on the upper slopes of Mount Etna, in the volcanic wastes, three or four hours' journey above the zone of fertile ground. I passed a portion of the winter at that elevation engaged in studying the transparency of the earth's atmosphere. I was much impressed by the fact that here, on a site where the air is supposed to be as clear as anywhere in the world, at this considerable altitude, and where we were surrounded by snow-fields and deserts of black lava, the telescope showed that the air was filled with minute dust particles, which evidently had no relation to the local surroundings, but apparently formed a portion of an envelope common to the whole earth. I was confirmed in this opinion by my recollection that Prof. Piazzi Smyth, on the Peak of Teneriffe, in mid-ocean, saw these strata of dust rising to the height of over a mile, reaching out to the horizon in every direction, and so dense that they frequently hid a neighbouring island mountain, whose peak rose above them, as though out of an upper sea. In 1881 I was on Mount Whitney, in Southern California, the highest peak in the United States, unless some of the Alaskan mountains can rival it. I had gone there with an expedition from the Allegheny Observatory, under the official direction of General Hazen, of the Signal Service, and had camped at an altitude of 12,000 feet, with a special object of studying analogous phenomena. On ascending the peak of Whitney, from an altitude of nearly 15,000 feet the eye looks to the east over one of the most barren regions in the world. Immediately at the foot of the mountain is the Inyo Desert, and on the east a range of mountains parallel to the Sierra Nevadas, but only about 10,000 feet in height. From the valley the atmosphere had appeared beautifully clear. But from this aërial height we looked down on what seemed a kind of level dust-ocean, invisible from below, but whose depth was six or seven thousand feet, as the upper portion only of the opposite mountain range rose clearly out of it. The colour of the light reflected to us from this dust-ocean was clearly red, and it stretched as far as the eye could reach in every direction, although there was no special wind or local cause for it. It was evidently like the dust seen in mid-ocean from the Peak of Teneriffe—something present all the time, and a permanent ingredient in the earth's atmosphere.

"At our own great elevation the sky was of a remarkably deep violet, and it seemed at first as if no dust was present in this upper air, but in getting, just at noon, in the edge of the shadow of a range of cliffs which rose 1,200 feet above us, the sky immediately about the sun took on a whitish hue. On scrutinising this through the telescope it was found to be due to myriads of the minutest dust particles. I was here at a far greater height than the summit of Etna, with nothing around me except granite and snow-fields, and the presence of this dust in a comparatively calm air much impressed me. I mentioned it to Mr. Clarence King, then Director of the United States Geological Surveys, who was one of the first to ascend Mount Whitney, and he informed me that this upper dust was probably due to the 'loess' of China, having been borne across the Pacific and a quarter of the way around the world. We were at the summit of the continent, and the air which swept by us was unmingled with that of the lower regions of the earth's surface. Even at this great altitude the dust was perpetually present in the air, and I became confirmed in the opinion that there is a permanent dust shell inclosing the whole planet to a height certainly of about three miles (where direct observation has followed it), and not improbably to a height even greater; for we have no reason to suppose that the dust carried up from the earth's surface stops at the height to which we have ascended. The meteorites, which are consumed at an average height of twenty to forty miles, must add somewhat to this. Our observations with special apparatus on Mount Whitney went to show that the red rays are transmitted with greatest facility through our air and rendered it extremely probable that this has a very large share in the colours of a cloudless sky at sunset and sunrise, these colours depending largely upon the average size of the dust particles.

"It is especially worth notice that, as far as such observations go, we have no reason to doubt that the finer dust from the earth's surface is carried up to a surprising altitude. I speak here, not of the grosser dust particles, but of those which are so fine as to be individually invisible, except under favouring circumstances, and which are so minute that they might be an almost unlimited time in settling to the ground, even if the atmosphere were to become perfectly quiet. I have not at hand any data for estimating the amount of dust thrown into the air by such eruptions as those which recently occurred in Java and Alaska. But it is quite certain, if the accounts we have are not exaggerated, that the former alone must have been counted by millions of tons and must in all probability have exceeded in amount that contributed by meteorites during an entire year. Neither must it be supposed that this will at once sink to the surface again. Even the smoke of a conflagration so utterly insignificant, compared with nature's scale, as the burning of Chicago, was, according to Mr. Clarence King, perceived on the Pacific Coast; nor is there any improbability that I can see in supposing that the eruption at Krakatoa may have charged the atmosphere of the whole planet (or at least of a belt encircling it) for months with particles sufficiently large to scatter the rays of red light and partially absorb the others, and to produce the phenomenon that is now exciting so much public interest. We must not conclude that the cause of the phenomenon is certainly known. It is not. But I am inclined to think that there is not only no antecedent improbability that these volcanic eruptions on such an unprecedented scale are the cause, but that they are the most likely cause which we can assign."

[1] From the *New York Daily Tribune*, January 2. Communicated by rof. Piazzi Smyth.

THE ORIGIN OF THE SCENERY OF THE BRITISH ISLANDS[1]

THE insular position of Britain, which we are accustomed to regard as an essential and aboriginal feature of the country, is merely accidental, and has not always been maintained. The intimate relation of Britain with the Continent is well shown by the Admiralty charts. If the west of Europe were elevated 200ft.—that is, the height of the London Monument—the Straits of Dover, half of the North Sea, and a large part of the English Channel would be turned into dry land. If the elevation extended to 600ft.—that is, merely the united heights of St. Paul's and the Monument—the whole of the North Sea, the Baltic, and the English Channel would become land. There would likewise be added to the European area a belt of territory from 100 to 150 miles broad, stretching to the west of Ireland and Scotland. A vast plain would unite Britain to Denmark, Holland, and Belgium, and would present two platforms, of which the more southerly would stretch from what are now the Straits of Dover northward to the northern edge of the Dogger Bank. The steep declivity separating the two plateaux is doubtless a prolongation of the Jurassic and Cretaceous escarpments of Yorkshire. It is trenched at either end by marked depressions, of which the western is a magnificent valley through which the united waters of the Rhine and Thames would flow between the Dogger Bank and the Yorkshire cliffs. The eastern gap would allow the combined Elbe and Weser to escape into the northern plain. Possibly all those rivers would unite on that plain, but, in any case, they would fall into a noble fjord which would then be revealed following the southern coast line of Norway. Altogether an area more than thrice that of Britain would be added to Europe. By a total rise of 1,800 feet, Britain would be united to the Faroe Islands and Iceland; while the Arctic and Atlantic Oceans would be separated. From its position on the oceanic border of a continent, Britain has been exposed to a great variety of geological change. In such a position marine erosion and deposit are most active, and a slight upheaval or depression, which would have no sensible effect in the interior of a continent, makes all the difference between land and water. Moreover, there appears to be a tendency to special disturbance along the edge of an ocean. America affords the most marked proofs of this tendency, but in the structure of Scandinavia and its prolongation into Scotland and Ireland there appear to be traces of similar ancient ridging up of the oceanic border of Europe.

There is a remarkable convergence of geological formations in Britain, each carrying with it its characteristic scenery. The rugged crystalline rocks of Norway reappear in the Scottish Highlands; the fertile Chalk, with its smooth downs and gentle escarpment, stretches across to us from the north of France; the great plains of North Germany, strewn with the debris of the northern hills, extends into our eastern lowlands; even the volcanic plateaux of Iceland and Faroe are prolonged into the Inner Hebrides and the north of Ireland.

The present surface of Britain is the result of a long, complicated process in which underground movements, though sometimes potent, have only operated occasionally, while superficial erosion has been continuous, so long as any land has remained above the sea. The order of appearance of the existing features is not necessarily that of the chronological sequence of the rocks. The oldest formations have all been buried under later accumulations, and their re-emergence at the surface has only been brought about after enormous denudation. In its general growth, Britain like the rest of Europe has, on the whole, increased from the north by successive additions along its southern border. The oldest upheavals ridged up the Palæozoic rocks into folds running north-north-east and south-south-west, as may yet be seen in Scotland, in the Lake Country, and in Wales. By a later series of folds the younger Palæozoic rocks were thrown into north and south and east and west ridges, the latter of which still powerfully affect the topography in southern Ireland, and thence through South Wales and Belgium. An east and west direction was followed by the more important subsequent European disturbances, such as those that upheaved the Pyrenees, Jura, and Alps. Some of the latest movements that have powerfully affected the development of our scenery were those that gave the Secondary rocks their general tilt to south-east. It is very doubtful if any part of the existing topography can be satisfactorily traced back beyond middle or older Tertiary time. The amount of erosion of some of the hardest rocks of the country since that date has been prodigious, as may be seen in the fragmentary condition of the volcanic plateaux of the Inner Hebrides.

The main topographical features of Britain may be arranged as mountains, tablelands, valleys, and plains. All our mountains are the effect of erosion on areas of land successively upheaved above the sea. In the development of their forms, the general outlines have been mainly determined by erosion independent of geological structure; while the details have been chiefly guided by structure, but partially also by the rate and kind of erosion. Ruggedness, for example, has resulted primarily from structure, but has been aggravated by greater activity of erosion. The mountainous west, with a greater rainfall and steeper slopes, is more rugged than the mountainous east. The tablelands of Britain are of two orders—1, those of deposit, which may be either (*a*) of sedimentary rocks, horizontal or nearly so, as in the millstone grit and Jurassic plateaux of Yorkshire, or (*b*) of volcanic rocks, as in the wide plateaux of Antrim, Mull, and Skye; 2, those of erosion, where, as the result of long-continued degradation, a series of plicated rocks has been cut down into a more or less uniformly level surface, as in South Wales. By the elevation of such a surface into a high plateau, erosion begins anew, and the plateau is eventually trenched into a system of ridges and isolated hills, as has happened in the Highlands. The valleys of Britain are the result of erosion either (*a*) guided by geological structure, as in what are called longitudinal valleys, that is, valleys which run along the strike or outcrop of formations, as the Great Glen and Glen Spey in Scotland and the valleys of the Trent and Avon in England; or (*b*) independent of geological structure, as in the transverse valleys which embrace the great majority of British examples. Our plains have been produced by the spreading out of *detritus* by the operation of rain and rivers, as in river terraces and alluvial plains; by the sea, as in raised beaches; or by land-ice and floating-ice, as in the glacial drifts of the Lowlands. The existing watershed of Britain is profoundly significant, affording a kind of epitome of the geological revolutions through which the surface of the country has passed. It lies nearer the west than the east coast. The western slope being thus the steeper, as well as the more rainy, erosion must be greater on that side, and consequently the watershed must be slowly moving eastward. Probably the oldest part of the watershed is to be found in the Highlands, where its trend from north-north-east to south-south-west was determined by the older Palæozoic upheaval. Its continuity has been interrupted by the dislocation of the Great Glen. After quitting the Highlands it wanders across the Scottish Lowlands and Southern Uplands, with no regard to the dominant geological structure of these districts, as if, when its course was originally determined, they had been buried under so vast a mass of superincumbent rock that their structure did not affect the surface. Running down the Pennine Chain the watershed traverses a region of enormous erosion, yet from its general coincidence with the line of the axis of elevation, we may perhaps infer that the anticline of the Pennine Chain has never been lost under an overlying sheet of later undisturbed rocks. The remarkable change in the character of the watershed south of the Pennine Chain carries us back to the time when the great plain of the Secondary rocks of England was upraised with a gentle inclination to east and south-east. The softer strata between the harder escarpment-forming members of the Jurassic series and the Palæozoic rocks of the Pennine Chain were worn away, and two rivers carrying off the drainage of the southern end of that chain flowed in opposite directions, the Avon turning south-west and the Trent northwards. By degrees these streams moved away across the broadening plain of softer strata as the escarpments emerged and retreated. At the same time streams collected the drainage from the uprising slope of Secondary rocks and flowed south-eastward. Successive lines of escarpment have since been developed, and many minor watersheds have arisen, while the early watershed has undergone much modification, these various changes pointing to the continuous operation of running water.

[1] Abstract of the first of five lectures by Archibald Geikie, F.R.S., Director-General of the Geological Survey, given at the Royal Institution, January 29.

SOCIETIES AND ACADEMIES

LONDON

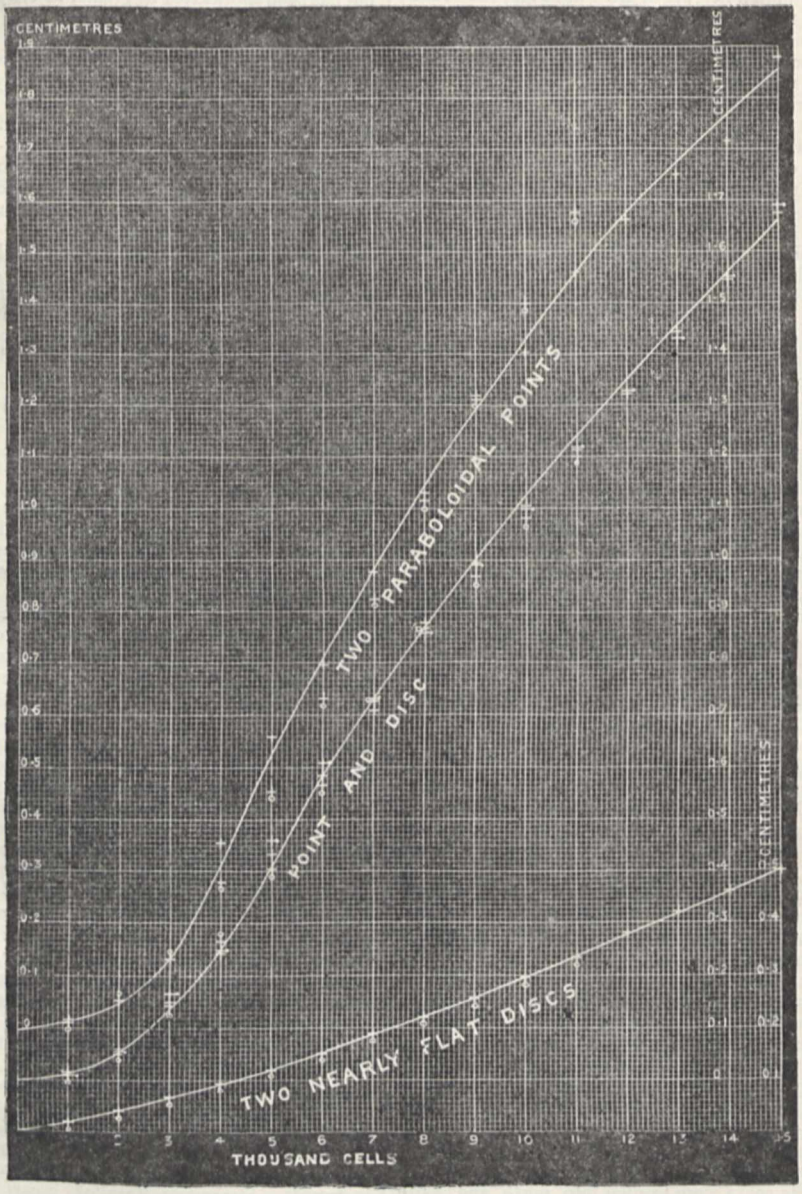
Royal Society, December 13, 1883.—"Experimental Researches on the Electric Discharge with the Chloride of Silver Battery." By Warren De La Rue, M.A., D.C.L., Ph.D., F.R.S., and Hugo W. Müller, Ph.D., F.R.S.

SECOND POSTCRIPT TO PART IV. "PHIL. TRANS.," PART II., VOL. CLXXIV.

Striking Distance.—In a postscript to Part IV. of our researches,[1] we stated that, with 14,400 cells, partly of the rod form, partly of the chloride-in-powder form, the length of the spark between paraboloidal points was 0·7 inch (17·8 mm.), and between a point and disk 0·62 inch (15·7 mm.), and that it does not appear, therefore, that the law of the spark being as the square of the number of cells holds good beyond a certain number.

These results were obtained at the Royal Institution; since the removal of the battery to our laboratory we had not, at the date of the postscript to Part IV. of our researches, charged up the whole of it. Recently, however, we have put the battery in thorough order, by scraping the zinc rods[1] of the cells already charged up and added newly made up cells to bring up the total to 15,000 cells, all of the rod form.

Having the whole 15,000 cells in perfect order, we thought that it would be desirable to make fresh determinations of the striking distance, increasing the potential a thousand cells at a



time, between two very slightly convex disks (planes), a point and disk, and two paraboloidal points. These points are one-eighth of an inch (3·175 mm.) in diameter, and three-eighths of an inch (9·525 mm.) long. In the case of a point and disk, the point was like one of those used for two points, and the disk was $1\frac{5}{16}$ inch [3·334 cm.] in diameter. The two planes used were $1\frac{6}{16}$ inch [3·334 cm.] in diameter.

As the points, particularly the negative, are deformed by the discharge, the precaution was taken to touch up the point after each discharge in the shaping-tool, screwed to the mandril of the lathe, mentioned in Part I. of our researches,[2] and thus to restore them to a true paraboloidal form.

Results were obtained which are plotted down in the diagram.

The several results, the different sets being distinguished by plain crosses or crosses with a dot, are laid down on the diagram, Fig. 1, to which are also added other results already published from former experiments; these latter have a ring on one of the members of the cross.

[1] *Phil. Trans.*, part ii. vol. clxxiv. p. 477, separate copy p. 249.

[1] We are at present making experiments in order to prevent the deposit of oxychloride of zinc on the zinc rods by covering the charging fluid with a layer of paraffin oil.

[2] *Phil. Trans.*, part i. vol. clxix. p. 79, separate copy p. 25.

From these curves were deduced the numbers given in Table I., II., III. in C.G.S. units.

TABLE I.—*Two Disks*

E.M.F. in volts	Striking distance in centimetres	Difference of potential per centimetre. Volts	Intensity of force	
			Electro-magnetic	Electro-static
1,000	0·0205	48,770	$4·88 \times 10^{12}$	163
2,000	0·0430	46,500	4·65 ,,	155
3,000	0·0660	45,450	4·55 ,,	152
4,000	0·0914	43,770	4·38 ,,	146
5,000	0·1176	42,510	4·25 ,,	142
6,000	0·1473	40,740	4·07 ,,	136
7,000	0·1800	38,890	3·89 ,,	130
8,000	0·2146	37,280	3·73 ,,	124
9,000	0·2495	36,070	3·61 ,,	120
10,000	0·2863	34,920	3·49 ,,	116
11,000	0·3245	33,900	3·39 ,,	113
12,000	0·3566	33,652	3·37 ,,	112
13,000	0·4068	31,957	3·20 ,,	107
14,000	0·4463	31,369	3·14 ,,	105
15,000	0·4882	30,725	3·07 ,,	102
15,450	0·5029	30,722	3·07 ,,	102

TABLE II.—*A Paraboloidal Point and a Disk*

E.M.F. in volts	Striking distance in centimetres	Difference of potential per centimetre. Volts	Intensity of force	
			Electro-magnetic	Electro-static
1,000	0·0123	81,103	$8·11 \times 10^{12}$	270
2,000	0·0567	35,274	3·53 ,,	118
3,000	0·1379	21,755	2·18 ,,	73
4,000	0·2447	16,347	1·63 ,,	54
5,000	0·4029	12,410	1·24 ,,	41
6,000	0·5631	10,655	1·07 ,,	36
7,000	0·7039	9,945	0·99 ,,	33
8,000	0·8447	9,471	0·95 ,,	32
9,000	0·9709	9,270	0·93 ,,	31
10,000	1·0874	9,196	0·92 ,,	31
11,000	1·1990	9,174	0·92 ,,	31
12,000	1·3058	9,190	0·92 ,,	31
13,000	1·4078	9,234	0·92 ,,	31
14,000	1·5145	9,244	0·92 ,,	31
15,000	1·6116	9,307	0·93 ,,	31
15,450	1·6600	9,307	0·93 ,,	31

TABLE III.—*Two Paraboloidal Points*

E.M.F. in volts	Striking distance in centimetres	Difference of potential per centimetre. Volts	Intensity of force	
			Electro-magnetic	Electro-static
1,000	0·0173	57,866	$5·79 \times 10^{12}$	193
2,000	0·0493	40,568	4·06 ,,	135
3,000	0·1282	23,409	2·34 ,,	78
4,000	0·3078	12,996	1·30 ,,	43
5,000	0·5107	9,790	0·98 ,,	33
6,000	0·6845	8,766	0·88 ,,	29
7,000	0·8496	8,239	0·82 ,,	27
8,000	1·0117	7,908	0·79 ,,	26
9,000	1·1602	7,757	0·78 ,,	26
10,000	1·2913	7,744	0·77 ,,	26
11,000	1·3130	7,785	0·78 ,,	26
12,000	1·5243	7,873	0·79 ,,	26
13,000	1·6271	7,990	0·80 ,,	27
14,000	1·7146	8,165	0·82 ,,	27
15,000	1·7961	8,351	0·84 ,,	28
15,450	1·8500	8,351	0·84 ,,	28

An inspection of the diagram, drawn on a reduced scale from the curves as originally laid down, shows that the curve for approximate planes (slightly convex, to insure the centres being the most prominent) is continuously concave, whereas those for both point and disk and two points are concave only for a certain distance, and then turn off and become convex. Moreover, it is seen that the intensity of force per centimetre decreases continuously up to 15,450 volts in the case of planes; but that, in the case of a point and disk, and also in that of two points, the decrease ceases after a certain potential has been reached, and that then it increases so as to become nearly a constant quantity. Between a point and a disk the potential per centimetre at 9,000 volts and beyond is very nearly 9,200; consequently, if the law holds good, to produce a spark 1 decimetre (3·94 inches) long, 92,000 volts, one 1 metre (39·37 inches) long, 920,000 volts,[1] and a flash of lightning 1 kilometre (0·621 mile) in length, a potential of 920,000,000 volts would be required, but this potential would be lessened by the diminution of the atmospheric pressure at the height of a kilometre, namely 607·4 mm. (799,210 M), or a mean pressure of 713·8 mm. (939,211 M) between 1 kilometre and the earth. Taking the mean pressure 939,211 M, it would require 864,000,000 volts to produce a discharge between a cloud (regarded as a point) 1 kilometre high and the earth.

It is extremely difficult to conjecture how a cloud can become charged to such an enormous potential, unless the charged molecules balance each other (as those of a stratum in a vacuum tube may be conceived to do) until a disturbing cause breaks up the arrangement; and then the whole of them are discharged in one direction with their aggregate potential.

We may add that less than 15,000 cells would not have sufficed to make out the fact that the intensity of force to produce a discharge between a point and disk or two points becomes a constant after 9,000 to 11,000 cells has been reached.

The following table gives the ratios of the striking distances between a point and a disk and two points respectively, taking those between two disks as unity. And also the relation between the striking distances between a point and a disk and between two points, taking those between a point and a disk as unity.

Cells	Ratio between point and disk to that between two disks	Ratio between two points and that between two disks	Ratio between two points and that between a point and disk
With 1,000	0·60	0·84	1·40
,, 2,000	1·32	1·15	0·87
,, 3,000	2·09	1·94	0·93
,, 4,000	2·68	3·37	1·26
,, 5,000	3·42	4·34	1·27
,, 6,000	3·82	4·65	1·22
,, 7,000	3·91	4·72	1·21
,, 8,000	3·94	4·71	1·20
,, 9,000	3·89	4·65	1·20
,, 10,000	3·80	4·51	1·19
,, 11,000	3·69	4·35	1·18
,, 12,000	3·58	4·18	1·17
,, 13,000	3·46	4·00	1·16
,, 14,000	3·39	3·84	1·13
,, 15,000	3·30	3·68	1·12
			Mean 1·16

The striking distances from which the above ratios are calculated are those obtained from the smoothed curves.

January 17.—"Evidence of a Large Extinct Australian Lizard (*Notiosaurus dentatus*, Ow.)," by Sir Richard Owen, K.C.B., F.R.S., &c.

This evidence is based on a small fragment, seemingly of coal, with roots of two teeth adherent thereto, transmitted to the author from the Department of Mines, Sydney, New South Wales; but stated to be from a Pleistocene deposit. The author had

[1] To produce a spark between a point and a disk used for example as the dischargers of an induction coil—

In length	It would require in E.M.F. volts
1 inch	23,367
1 foot	280,400
1 yard	841,230

noted that vegetable fossils from the same formation and locality presented a similar jet-black colour, and glistening petrified fracture. The paper details a series of comparisons with known recent and fossil Saurians. The size and striated exterior of the teeth suggested, at first, crocodilian affinity. But closer comparisons, aided by application of the microscopic test to the tissues of both the bone and tooth, led to a conclusion of the affinities of the fossil reptile represented by the fragment of mandible and attached parts of teeth. It was equal in size to the extinct horned lizard *Megalania*, which had an armature of the mouth like that of a tortoise. *Notiosaurus* was a toothed and pleurodont lizard, like the large existing *Hydrosaurus* of Australia, but of more than twice its size.

Linnean Society, January 17.—Sir John Lubbock, Bart., president, in the chair.—Mr. A. S. Pennington was elected a Fellow of the Society.—Dr. R. C. A. Prior exhibited and made remarks on a series of useful timbers from British Guiana. These were all hard woods, among which may be mentioned the "greenheart" (*Nectandra rodiei*); the "ducalibolly," a rare, red wood used in the colony for furniture; "wamara," a very hard wooded tree sixty feet high, used by the natives for clubs, &c.; "letterwood" (*Brosimum aubletii*), useful for inlaying and making very choice walking sticks; "hyawabolly" (*Omphalobium lamberti*), a rare tree of twenty feet high, known commercially as zebra wood.—Mr. H. N. Ridley drew attention to a fasciated branch of holly from Herefordshire, in which certain of the leaf-branches were curiously interwoven.—A presumed portrait of Linnæus, in oil, was exhibited on behalf of Mr. F. Piercy.—A paper was read by Mr. J. G. Baker, viz. a review of the tuber-bearing species of *Solanum*. As they stand in De Candolle's "Prodromus" and other botanical works, the tuber-bearing Solanums are estimated as belonging to twenty distinct species. Mr. Baker thinks that not more than six of those are really distinct, viz. (1) *Solanum tuberosum*, a native of the dry, high regions of the Andes from Chili northwards to Venezuela, reappearing in other varieties in Mexico and the Rocky Mountains; (2) *S. maglia*, an inhabitant of the damp coasts of Chili, as far south as lat. 44° to 45°; (3) *S. commersoni*, a low-level plant of Uruguay, lately introduced as a novelty under the name of *S. ohrendii*; (4) *S. cardiophyllum*, a little-known species from the Mexican highlands; (5) *S. jamesii*, a native of Mexico and the Rocky Mountains; and (6) *S. axycarpum*, a native of Central Mexico. The two last have the tubers very small. All our cultivated races of potato belong to *S. tuberosum*; but the plants gathered by Darwin in the Chonos Archipelago, and that experimented upon by Solme at Chiswick, are both *S. maglia*. The author attributes the deterioration of the potato partly to its being cultivated in too humid climates, and partly to the tuber having been unduly stimulated at the expense of the other organs of the plant. There are many hundred species of Solanum known which do not produce any tubers, but maintain their ground in the world by their seeds alone, and he urges that, in order to extend the power of climatic adaptation of potato species, (2), (3), and (4) should be brought into cultivation and tried both as pure specific types and as hybridised with the numerous forms of *S. tuberosum*.—The next paper read was by Mr. A. D. Michael, on the "Hypopus" question or life history of certain Acarina. From a careful series of experiments and observations he concludes that true "Hypopi" are not adult animals, but only a stage, or heteromorphous nymphs of *Tyroglyphus* and allied genera. Nor do all individuals become "Hypopi," which latter stage takes place during the second nymphal ecdysis. It seems a provision of nature for the distribution of the species irrespective of adverse conditions. "Hypopi" are not truly parasitic, nor confine themselves to any particular insect. A new adult form described is called by the author *Disparipes bombi*, and he believes there are other species of the genus. Donnadieu's bee parasites are admitted to be adults, though it is uncertain if they are identical with Dufour's *Trichodactylus*.—Dr. M. C. Cooke made a communication on the structure and affinity of *Sphæria pocula*. Its position has hitherto been unquestioned, since originally described by Schweinitz in 1825. Dr. Cooke, however, shows from microscopical examination that structurally it is Hymenomycetal, and not Ascomycetal, being allied to the genus *Polyporus* or *Porothelium*. He designates it as *Polyporus* (*Mesopus*) *poculus*, Schwein., allied perhaps in habit to *P. pendulus*, but in substance to *P. rhipidium*.—A paper by Mr. W. Joshua was read, viz. notes on some Burmese Desmidieæ, in which he figures and describes new and interesting species.—Novitates Capensis was the title of a paper by Mr. Henry Bolus, and mainly confined to diagnoses of new or rare orchids from South Africa.

Institution of Civil Engineers, January 22.—Sir Frederick Bramwell, F.R.S., vice-president, in the chair.—The paper read was on the adoption of standard forms of test-pieces for bars and plates, by Mr. William Hackney, B.Sc., Assoc.M.Inst.C.E.

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Royal Society, January 7.—T. Stevenson, C.E., vice-president, in the chair.—Papers were read on the approximation to the roots of cubic equations by recurring chain fractions, by Mr. E. Sang, and on the researches of M. E. de Jonquières on periodic continued fractions, by Thomas Muir, M.A. The author showed that the results which M. de Jonquières is from time to time communicating to the French Academy are merely particular cases of a more general result which he communicated to the Society some years ago.—A paper was also read on new forms of nerve-terminations in the skin of mammals, by S. Hoggan, M.B., the latter being communicated by Prof. Turner.—A second paper was laid on the table on a diagnosis of the phanerogamous plants of Socotra, by Prof. Bayley Balfour.—A communication was read on the Tunicata of the *Porcupine* Expedition by Prof. Herdman.—An arrangement of the metals in an electro-frictional series was submitted by A. Macfarlane, M.A., D.Sc. As the result of a large number of quantitative experiments, he found that the arrangement of the metals according to the amount of negative electricity produced upon them by a constant amount of friction (without abrasion) is as follows:—Gold, 181; platinum, 136; tin, 126; silver, 102; copper, 100; lead, 62; nickel, 59; brass, 59; iron, 56; aluminium, 50; zinc, 45; magnesium, 43; antimony, 38; German silver, 32; bismuth, 22.

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