THURSDAY, DECEMBER 21, 1882

DISEASES OF MEMORY

Diseases of Memory; an Essay in the Positive Psychology. By Th. Ribot. International Scientific Series, Vol. XLIII. (London: Kegan Paul, Trench, and Co., 1882.)

A WORK on such a subject as this from the pen of M. Ribot, cannot fail to be a good work, and although in the one which he has published there is not much originality either in respect of facts or of theories, it is of value as a clearly arranged account of what we know concerning the psychology of memory, united with philosophically wholesome views of interpretation.

It is first shown that the word memory, as ordinarily used, has a triple meaning: "the conservation of certain conditions, their reproduction, and their localisation in the past" (recollection). The third element here, which is most purely a part of consciousness, appears to be an element superadded to the other two. Neglecting it therefore in the first instance, the author seeks to "reduce the problem to its simplest terms, and try to discover how, without the aid of consciousness, a new condition is implanted in the organism, is conserved and reproduced; in other words, how memory is formed independently of all cognition." Here it is well shown that all analogies drawn from inorganic sources are misleading—such as the facts of insolation, photography, &c. "Conservation, the first condition of recollection, is found, but that alone; for in these instances reproduction is so passive, so dependent upon the intervention of a foreign agent, that there is no resemblance to the natural reproduction of the memory. Hence, in studying our subject, it must never be forgotten that we have to do with vital laws, not with physical laws; and that the bases of memory must be looked for in the properties of organic (? organised) matter, and nowhere else."

The first true analogy to be found is that of muscular fibre responding more feebly at first to the excitation transmitted by a motor nerve than it afterwards does when it has frequently been stimulated, allowing natural periods of repose. This is taken to be a true analogy, because in nerve as in muscle, "everywhere we perceive, with an increase of activity and proper intervals of repose, an increased power of organic functions." But even here, we think, the objection might fairly be made that the analogy is scarcely sound, inasmuch as there is no evidence to prove that the increase of power in a muscle due to use, is due to an increase in the power of the individual fibres. We think some better parallels might have been chosen from the region of muscle physiology—such, for instance, as the effect of the constant current in leaving behind it for several minutes after it has ceased to pass through a muscle a change in the excitability of the fibres, so that they are less responsive to a renewal of the current in the same direction, and more so to its passage in the opposite direction. The following paragraph, however, is in our opinion above all criticism, and should be well burnt into the memory of all who write about memory.

"The true type of organic memory—and here we enter the heart of our subject—must be sought in the group of facts to which Hartley has given the appropriate title of secondary automatic actions, as opposed to those automatic functions which are primitive or innate. These secondary automatic actions, or acquired movements, are the very basis of our every-day existence. . . . In a general way it may be said that the limbs and other sensorial organs of the adult act with facility only because of the sum of acquired and co-ordinated movements which forms for such part of the body its special memory, the accumulated capital on which it lives, and through which it acts—just as the mind lives and acts in the medium of past experience. To the same category belong those groups of movements of a more artificial character which constitute the apprenticeship of the manual labourer, and are called into action in games of skill, bodily exercise, &c."

The first requisite to the formation of these automatic movements is association, the original material being provided by primitive reflex actions, which require by frequent repetition or practice to be properly grouped, some combined and others excluded. Such organic memory resembles psychological memory in all but one point—the absence of consciousness. Thus all the following features are common to both: "acquisition, sometimes immediate, sometimes gradual; repetition of the act necessary in some cases, useless in others; an inequality of the organic memory according to individuals—it is rapid with some, slow, or totally refractory with others (awkwardness is the result of a deficient organic memory). With some, associations once formed are permanent; with others, they are easily lost or forgotten. We observe the arrangement of actions in simultaneous or successive series, as if for conscious recollection, and here is a fact worthy of careful notice; each member of the series *suggests* what is to follow."

Touching the changes produced in nerve-tissue, which constitute the objective side of memory, M. Ribot properly observes that it is scarcely safe to speculate, as they are beyond the reach of histology or of histo-chemistry, though facts in abundance prove that some such changes take place, and the probability is, as expressed in a quotation from Maudsley, that "every impression leaves a certain ineffaceable trace; that is to say, molecules once disarranged and forced to vibrate in a different way, cannot return exactly to their primitive state." But over and above this particular modification, which may be supposed to be impressed upon the molecular constitution of the nervous elements concerned in an act of memory, M. Ribot points out that there must be a "second condition, which consists in the establishment of stable associations between different groups of nervous elements." This, we think, is a most important point, and one which, in our author's opinion, has not hitherto received the attention that it deserves. In his own words, "It is of the highest importance that attention should be given to this point, viz. that organic memory supposes not only a modification of nervous elements, *but the formation among them of determinate associations for each particular act*, the establishment of certain *dynamic* affinities, which, by repetition, become as stable as the primitive anatomical connections. In our opinion, the important feature with regard to the basis of memory is not only the modification impressed upon each element,

but the manner in which a number of elements group themselves together and form a complexus." Thus it follows that "a rich and extensive memory is not [merely] a collection of impressions, but [also] an accumulation of dynamical associations, very stable and very responsive to proper stimuli."

The essay then proceeds to consider more especially the case of conscious as distinguished from organic memory:—"The brain is like a laboratory full of movement, where thousands of occupations are going on at once. Unconscious cerebration, not being subject to restrictions of time, operating, so to speak, only in space, may act in several directions at the same moment. Consciousness is the narrow gate through which a very small part of all this work is able to reach us. . . . What has been said of physiological memory applies in a general way to conscious memory; only a single factor has been added." But "dynamical associations have a much more important part to play in conscious memory than in unconscious memory."

These we think are the more important of M. Ribot's preliminary considerations. We have no space to consider others which follow, or to enter into the details of those diseases of memory which constitute the main subject of his work. These diseases are classified under the divisions of General Amnesia, Partial Amnesia, and Exaltations of Memory. Each of these divisions is abundantly illustrated by examples, which, while being adduced in corroboration of philosophical views on the mechanism of memory, furnish in themselves reading of a curiously entertaining kind. We may conclude by rendering, in the words of the author's own summary, the general conclusions which he deems his study of the diseases of memory to have established:—

"1. In cases of general dissolution of the memory, loss of recollections follow an invariable path; recent events, ideas in general, feelings, and acts.

"2. In the best-known case of partial dissolution (forgetfulness of signs), loss of recollection follows an invariable path; proper names, common nouns, adjectives and verbs, interjections, gestures.

"3. In each of these classes the destructive process is identical. It is a regression from the new to the old, from the complex to the simple, from the voluntary to the automatic, from the least organised to the best organised.

"4. The exactitude of the *law of regression* is verified in those rare cases where progressive dissolution of the memory is followed by recovery; recollections return in an inverse order to that in which they disappear.

"5. This law of regression provides us with an explanation for extraordinary revivification of certain recollections when the mind turns backwards to conditions of existence that had apparently disappeared for ever.

"6. We have founded this law upon this physiological principle: Degeneration first affects what has been most recently formed; and upon this psychological principle: the complex disappears before the simple, because it has not been so often repeated in experience.

Finally our pathological study has led us to this general conclusion: Memory consists of a process of registration of variable stages between two extreme limits, the new state, the organic registration."

GEORGE J. ROMANES

EASTERN ASIA

Im Fernen Osten, Reisen des Grafen Bela Szechenyi in den Jahren 1877-1880. Von Gustav Kreitner, Mitglied der Expedition. Two Vols. (Vienna, 1881.)

AFTER rambling for more than three years over a great part of Japan and China, the forerunners of Count Szechenyi's party reached the Irawadi delta in March, 1880, in such a plight that they were actually refused admission to Jordan's Hotel in Rangoon. The expedition was undertaken, not to seek the cradle of the Magyar race in Central Asia, as was given out at the time, but simply to seek distraction from a heavy domestic affliction experienced by the Count in 1876. It was organised with the disregard of economic considerations so characteristic of the open-handed Hungarian nobility, and consisted originally of four members—the Count, Balint de Szent Kotolna, philologist, Ludwig von Loczy, geologist and Gustav Kreitner, geographer. Unfortunately Balint got no further than Shanghai, where his health completely broke down. Hence the linguistic results were *nil*, notwithstanding the sensational story circulated in some American papers regarding a Magyar-speaking nomad tribe said to have been discovered in the Gobi desert. These marauders were stated to have captured and condemned the whole party to death. But on overhearing them casually exchange a few words in Hungarian, the nomad chief, overcome with emotion, fell on his knees, and addressed Count Bela "in the purest Magyar," acknowledging him and his associates as their long-lost brethren, descendants of the warlike hordes, who migrated westwards ages ago, but whose memory was still kept alive in the yurts of their Asiatic kinsmen. This story throws a curious light on the analogous statements long current in popular writings touching the Irish, Welsh, and Basque-speaking Delawares, Algonquins, Guaranis, and other American aborigines. The only difference is that in these critical times such veracious accounts have no longer much chance of surviving their authors.

The expedition has found a competent historian in its geographer, Gustav Kreitner, whose chief fault is perhaps an excessive Teutonic conscientiousness, which omits nothing, and leaves little to the imagination of the reader. Hence these bulky volumes, mostly going over tolerably beaten ground, are apt to grow all the more tedious that the journey was on the whole singularly free from stirring adventures. The camp was broken into and looted during the night by some prowling Tanguts in Mongolian Kansu; a terrific sandstorm nearly overwhelmed the caravan on the skirt of the Gobi; Herr Kreitner on one occasion got entangled in the intricacies of the loess region in North China; an attempt to penetrate into the precincts of a Buddhist monastery at Batang was met by a shower of stones from the doughty but inhospitable llamas; lastly the train conveying the explorers from Prome to Rangoon narrowly escaped the flames of a burning jungle in Pegu. But there was little else to record of an exciting character, beyond the ordinary incidents, mishaps, and hardships of eastern travel.

On the other hand many opportunities were afforded for original observations on the lands and peoples visited by the expedition, which has certainly materially increased

the stock of our information on oriental matters. In Yesso the Ainos were carefully studied by Herr Kreitner, whose independent testimony fully confirms this writer's views regarding the Caucasic affinities of those aborigines. "That the Ainos have nothing in common with the Japanese and Chinese is evident even from a cursory glance. The cranial formation is nobler, the forehead higher and broader, the prominent nose firmer. But it is the horizontal position of their large brown eyes that more especially assimilates them to the Caucasic type" (p. 318). A minute examination of the hair resulted in the curious discovery that its seeming abundance is due rather to its coarse texture than to its denser growth on a given square surface. In this respect it appears to be inferior even to that of the Japanese, at least on the scalp, while the body is on the other hand covered with a fur coat averaging 40 millimetres in length, and in the ratio of about 30 hairs to the square centimetre. The contradictory statements regarding the Aino complexion were shown by a practical experiment to be due to the more or less grimy state of the subjects examined. "The more I rubbed the lighter became the dark colour of the Aino, and the browner grew my hand. How often has the complexion of this race been described as darker than that of the Japanese, by those who forget to apply the test of soap and water!" (p. 296).

In this thoroughly practical spirit many other controversial points, doubts, and mystifications were cleared up. The colour of the "button" on the Mandarin's cap is commonly supposed to indicate official rank. But "such is not the case. It is a mere decoration or order. Very frequently we noticed Mandarins with the red button (first and second mark of distinction) taking his place *after* others decorated with the blue (third) or even with the gold (eighth) button" (p. 190). In the same way by a series of shrewd calculations based on a few given data it is plausibly shown that the population of China has been enormously over-estimated, and that instead of 300 or 400 millions it does not probably exceed 150,000,000, or 100,000,000 less than that of British India! (p. 556). In connection with this point, the opium question raised by over-zealous missionaries and political free-lances, is demonstrated to be a pure bogus. The practice, not always injurious, and in certain fever-stricken districts positively beneficial when kept within moderate bounds, would seem to be indulged in by not more than 850,000–900,000 altogether. The inveterate opium smokers are reduced to about 700,000, or not much more than ½ per cent. of the whole population, taking it even at its lowest estimate.

Archæologists will rejoice to hear that the famous Nestorian monument of Signan-fu, hitherto reported as "lost or missing" since the Panthay rebellion, has been re-discovered by our explorers. For a time neglected and overlooked during those terrible times, it has been recently set up in a place of honour within the precincts of a Buddhist monastery to the west of the city. Three impressions of the well-known inscription were taken, together with a copy of another which has lately been added to the reverse side of the slab, and which runs thus: "A pious Mandarin caused this stone to be restored over twenty years ago, and set up where it now stands." In the same neighbourhood a brick inscribed with the symbol of the Han dynasty was also obtained from a pagoda said to be over 2000 years old.

From Sining-fu an excursion was made to the monastery of Kum-bum, partly for the purpose of testing Huc's extraordinary account of the famous tree of Buddha. The result must be told in the author's words:—

"A few steps brought us to the chief temple. Before it stood, surrounded by a railing, the tree concerning which the Abbé Huc tells us that its leaves bear the natural impress of Buddha's likeness and of the Tibetan alphabet. We sought in vain for such phenomena. Neither image, nor letters, but a waggish smile playing about the corner of the mouth of the elderly priest escorting us. In answer to our inquiries he informed us that *a long time ago*, the tree really produced leaves with Buddha's image, but that at present the miracle was of rare occurrence. A few God-favoured men alone were privileged to discover such leaves. The last so favoured was a pious Mandarin, who visited the monastery seven or eight years ago. Next day Count Szechenyi succeeded in finding a leaf on which a rude likeness of Buddha had been etched, probably with some acid. The llamas allow no one to pluck leaves or blossoms from the tree, and the leaves that fall are carefully collected and sold to the pilgrims as a specific against affections of the larynx. The tree belongs to the Oleaceæ, and I believe it to be Syringa L. (white lilac), which in all probability reached Europe originally from China" (p. 708).

A careful survey was made of the vast region of "yellow earth," to which a total area of at least 360,000 square miles is assigned in the Hoang-ho basin. The origin of this unstratified loess formation is assigned with Richthofen to the weathering of the rocks on the lofty Tibetan plateaux, combined with the prevailing west winds, by which the pulverised particles are wafted eastwards. From a rough calculation of the rate of the deposit, which in Shensi was found to attain a thickness of 1800 feet, a period of at least 260,000 years is supposed to have been needed to remove the detritus from the plateaux to the lowlands.

One of the most cherished objects of Count Szechenyi was to reach Lhassa from the east or north-east. But like Prejevalsky, Gill, Desgodins, and so many other recent explorers, he was baffled all along the Tibeto-Chinese frontier line from Kuku-Nor to Batang. Hence no new territory was anywhere traversed except a small district south of Batang on the road to Tali-fu. Here a fresh route was struck across the Chung-tien plateau, which occupies the extreme west of Se-chuen, within the great bend of the Kinsha-kiang. In this Alpine region several altitudes were taken, some new wild tribes were visited, but no opportunity was afforded of throwing any fresh light on the many interesting hydrographic problems which still await solution in South-East Asia. At Tatsien-lu these problems formed a chief topic of discussion with the Abbé Desgodins, who has probably more practical knowledge of the subject than any living European. The question was again approached during the now familiar route from Tali-fu to Bamo across the narrow, gorge-like valleys of the great Indo-Chinese rivers. The result of these discussions and observations is set forth in the accompanying map of China and East Tibet, which substantially adheres to the lines already laid down on D'Anville's map, prepared in 1735 on data previously collected by the Jesuit missionaries in China. Here the Sanpu appears as the upper course of the

Brahmaputra ; the Great and Little Irawadi, forming the two upper branches of the main Burmese artery, are carried through the unexplored Pomi country as far as 32° N. ; while the Lu-Kiang (Salwen) and Lantsan-Kiang (Me-Khong) are both traced still higher to 34° N. 92° E. within a short distance of the Murui-ussu (Yangtze-kiang) valley. Thus the basins of five of the great Asiatic streams are crowded at one point into a narrow space of less than 280 miles, where the several water partings are formed merely by a series of lofty ridges following in rapid succession between Sechuen and East Assam. Such a hydrographic disposition is of course elsewhere absolutely unparalleled, and is altogether of such a phenomenal character that it can hardly be finally accepted until the main rivers are actually traced to their respective sources.

The jealousy with which the Tibetan frontier is everywhere guarded Herr Kreitner is disposed to attribute rather to the Lhassa than to the Pekin authorities. The Chinese government is represented as possessing very little practical power in Tibet, which is gradually becoming a sort of fee simple of the Sacerdotal class. The Dalai-lama himself is a mere puppet in the hands of this priestly caste, which has set up no less than 103 living Buddhas altogether, and which now embraces two-thirds of the population of Tibet, grinding the rest to dust, and living in opulence, idleness, and profligacy on the contributions of the countless devotees who periodically visit the vast monastic establishments overshadowing the land. The whole trade of the country is monopolised by the llamas, "who buy in the cheapest and sell in the dearest market," and whose efforts are steadily directed against the intrusion of all foreign competition. These llamas are the greatest curse that ever afflicted an ignorant and superstitious people, plundering and oppressing them in their combined capacity of sorcerers, priests, traders, money-lenders, serf-owners, and landed proprietors. "No Tibetan peasant claims as his own the land he tills, or the house he builds. All is held at the will of the llamas, who eject him whenever he dares to brave their displeasure. And in the power, rapacity, and boundless authority of these priests must be sought the impassable barriers which have hitherto encircled the whole land. By them is Tibet closed to the outer world, and by them will it long remain hermetically sealed" (p. 855).

The work is abundantly illustrated by original woodcuts, which, if not always remarkable for artistic merit, are at least always to the point. It is also unfortunately disfigured by several mis-statements and inaccuracies, some of which are quite unaccountable. Thus the length of the Suez Canal is given at 80 instead of 100 English miles. The Wahhabis are brought to the west of Mecca, where they have never been seen since their overthrow by the Egyptians in 1819. Harakiri and other customs, legally abolished since the Revolution of 1868, would appear to be still practised in Japan. The Shogun is still the "Tykun," while the Mikado, representing the oldest monarchy in the world, is said to have sprung "from the Kubo (Shogun) dynasty, founded in 1603"! Shintoism is described in one place as "a Buddhist sect," and in another, although rightly called the original national religion, it is wrongly said to be now mostly superseded by Buddhism and the Confucian moral system. The upper course of the Yangtze-Kiang, we are told, is called the "Murui-ussu" by the Tibetans, who certainly do not speak Mongolian. The Tibetans themselves are stated to be called "Si-fan" by the Chinese, and at p. 831 the extraordinary statement is made that Tibet "ist leblos auf Thierwelt," the very opposite being notoriously the case.

A. H. KEANE

OUR BOOK SHELF

Die Insekten nach ihren Schaden und Nutzen. Von Prof. Dr. E. Taschenberg. Mit 70 Abbildungen. Pp. 1-300, 8vo. (Leipzig : G. Freytag, 1882.)

THIS forms the fourth volume of a German series of popular works issued under the title "Das Wissen der Gegenwart." It consists of an examination of certain insects injurious, or otherwise, in field, garden, and forest. The author is a man of scientific training, and as a specialist has acquired that practice of accuracy of statement that necessarily results from the education of a specialist. Much of the contents will prove useful to Englishmen who can read German ; a portion, however, concerns insects that happily do not occur with us. The figures are mostly very good, many are excellent, a few are indifferent. We recognise most of them as reproductions, or reductions, from varied sources. The "Colorado Beetle" is introduced, and appears somewhat strangely out of place in a work that almost exclusively concerns German insects. Possibly the opportunity for indulging in a little satire (p. 124) may form sufficient excuse. But the author aims his satire at the wrong butt. He alludes to newspaper reports as to Colorado beetles having been sent over by Irish Americans, in order to spite "Englanders," but omits to suggest that the "scare" existed long before these newspaper reports.

Out in the Open. A Budget of Scraps of Natural History gathered in New Zealand. By T. H. Potts, F.L.S. (Christ Church, 1882.)

THIS little volume contains a reprint of a number of interesting papers contributed by the author from time to time to the *New Zealand Country Journal.* These chiefly relate to the ferns and birds of the country, but comprise also an account of a visit in 1878 to Hikurangi, where the Maoris were seen at home. In another paper a good account of the Kia (*Nestor notabilis*) is given. It would seem that it does not do much damage to the flocks of sheep except during periods of severe snow, when the parrots are deprived of their usual food. The work is evidently the result of a good deal of intelligent observation carried on over a number of years.

Catalogue of Mammalia in the Indian Museum, Calcutta. By John Anderson, M.D., F.R.S. Part I. (Calcutta : printed by order of the Trustees, 1881.)

THIS part contains the Primates, Prosimidæ, Chiroptera, and Insectivora of the Indian Museum, Calcutta. Till 1865 this Museum was the property of the Asiatic Society of Bengal, and a catalogue of the mammalia therein was drawn up in 1863 by the late Edward Blyth, so well known to all Indian naturalists of that period. The collection has increased enormously since, from in 1863 150 species of the four orders catalogued by Dr. Anderson to 252 at present existing in the Museum of these same orders. Extensive and important details are given about many of the more remarkable species, especially the Primates. The synonimic lists seem well worked out, and this part will have a value for the working naturalists far beyond that of a mere catalogue. We trust the second part will soon be published, and we congratulate the Trustees on the excellent work done by their superintendent.

The Microscope and some of the Wonders it Reveals. By Rev. W. Houghton, M.A., F.L.S. Fourth Edition. (Cassell, Petter, and Galpin.)

IT seems sufficient to notice the appearance of the fourth edition of this little volume, which, like so many works issued by the same firm, bears no date of its appearance.

The Flora of Essex County, Massachusetts. By John Robinson. (Salem, 1881.)

THIS enumeration of the plants of Essex county embraces, besides the Phanerogams, the Vascular Cryptogams, and the algæ (marine) and lichens among the Thallophytes. Essex County would seem to be an attractive field to the botanist. Besides open country, deep woods and numerous swamps, the Merrimac furnishes a fine fertile valley. The freshwater ponds, over fifty in number, are from four to four hundred acres in extent, and are rich in water-plants. A sub-alpine flora is to be met with, while a long sea-coast affords suitable dwelling-places for a large number of plants peculiar to such quarters. To this well compiled flora an interesting series of sketches of the lives of some of the early botanists of the district—Cutler, Osgood, Oakes, Pickering—is attached.

Catalogue of the Fossil Foraminifera in the British Museum (Natural History). By Prof. T. Rupert Jones, F.R.S. (London: Printed by order of the Trustees, 1881.)

THE Foraminifera which are in a living state to be found widely distributed in the seas of the present day, are also known to enter as fossils into the composition of several of the stratified rocks, forming in some places such vast thickness of limestone, as to command the attention of the Palæontologists. It is found somewhat difficult to draw the line between recent and fossil forms; and it would seem to be equally difficult to be sure what is a foraminiferous form and what is not. In this most useful catalogue, however, all descriptive details and all controversial questions are omitted. Eozoon appears in the list, and so also does Orbitoides. The classification adopted is that of H. B. Brady, and the species are grouped according to their local occurrence and geological age.

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 ensure the appearance even of communications containing interesting and novel facts.*]

The Aurora and its Spectrum

IN the recent correspondence in your columns on the subject of the aurora, no notice has been taken of an old observation by Anjou, in Siberia, that whenever the aurora flashed up past the moon, a halo was formed. This, with numerous other observations, which need not be detailed here, have led me to the conclusion that suspended crystals of ice have most probably something to do with the aurora; and my object in writing is to suggest to some of your readers who are well equipped with suitable apparatus, that if they could contrive to pass a glow or phosphorescent discharge of electricity through fine-falling or loosely-compacted snow, they might very possibly be rewarded by the discovery of the origin of the green and red lines in the aurora spectrum.

Mr. Capron's experiments seem to show conclusively that it is not an air spectrum, and it is also evident that the conditions of discharge in an atmosphere laden with ice crystals are very different from those in the clean vacuum tubes usually employed by experimenters.

While on the subject perhaps I may be permitted to add one small contribution to the question. I have examined most of the auroras recorded by the Meteorological Office during the last four or five years with reference to the synoptic conditions of pressure with which they are associated. The result is, that though the larger number may be grouped round a few types of pressure distribution, it is not easy to see any one constant condition. RALPH ABERCROMBY

21, Chapel Street, London, S.W., December 18

Swan Lamp Spectrum and the Aurora

MR. J. RAND CAPRON'S experiment with the Swan lamp is very interesting; but his inference that the aurora may not be an electric discharge in the upper atmosphere because it does not show nitrogen lines in the spectrum is hardly justified by the experiment. On the contrary, the true significance of that experiment appears to be that there is a certain degree of rarefaction of the air (or vacuum) at which the nitrogen lines disappear. Such a vacuum is given by the Swan, and probably other electric incandescence lamps. According to Mr. Capron's result, when more air got into the bulb and vitiated this fine vacuum, the nitrogen lines appeared. We may say, then, that if the aurora is an electric discharge in the upper air, the rarefaction must be approximately that of a Swan lamp, if there are no nitrogen lines visible in the spectrum of the light. To study this further some one ought to examine the discharge in vacuum tubes containing air at different degrees of density. J. MUNRO

West Croydon, December 18

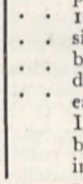
The Meteor of November 17

Mr. CAPRON'S letter (p. 149) gives an interesting confirmation of the meteoric nature of the light seen on November 17; as showing that it is physically impossible that it can be an aurora, according to accepted theories of that light. Setting aside the impossible estimate of forty-four miles, it should be noticed that the heights assigned are in close agreement, 170 miles being merely stated, like other elements in my letter, as a minimum. The oblique direction of the meteor from 10° altitude in due east to horizon in due south-west, as shown by several observations, is another evidence of its extra-terrestrial origin.

Bromley, Kent W. M. F. P.

Invertebrate Casts

THE communication in NATURE, vol. xxvii. p. 46, induces me to state the following fact. Engaged this summer in an economic survey of the North Transcontinental Survey for the North Pacific Railroad in the camp just opposite Umatilla, near the Columbia River, Washington Territory, I observed, on June 26, the nympha of a new species of Ophiogomphus, then very common, emerging out of the water for transformation. The Columbia River had been very high, the water beginning to recede, was still more than 30 feet higher than usual. The country around the camp belonged to the so-called sagebrush desert, but near the river was a bank of wet sand, flat and smoothed by the receding water. There were no plants around, and only one willow tree, now about 100 feet distant from the river, for five miles on one side and twelve on the other side. I had observed before on the sand a number of traces like the diagram. In the middle a straight furrow, and on each side two series of equidistant dots. By chance I was able to discover that these tracks are made by the nympha of Ophiogomphus (family *Gomphina* in *Odonata*). The straight furrow is made by the end of the abdomen, which is heavy and slides upon the ground. The forelegs are shorter, and make, with the end of the tibia, the inner series of dots. The other legs are longer, and make the outer series. More remarkable was it that the furrows were made in a straight line from the water to tree, as it is scarcely probable that a nympha so near its transformation can see well at a distance of about 100 feet. Nevertheless I caught the nympha just at the end of the track—which I saw made—in ascending the tree. The two outer series of dots are one inch distant one from the other. I remember having seen an account of similar tracks on fossil slabs, but I have not been able to find the publication. H. A. HAGEN



Cambridge, Mass., November 27

The Scream of the Young Burrowing Owl sounds like the Warning of the Rattlesnake

WHILE working upon the tertiary beds of the plains east of the Rocky Mountains recently, I had numerous opportunities of making observations on the habits of those peculiar creatures the Burrowing Owls (*Speotyto hypogœa*). Among others made at the time is one relating to the extraordinary similarity between the sound of the cry of the young owl when disturbed, and that of the warning of the Rattlesnake (*Crotalus confluentus*), which I do not find to have been noticed by ornithologists. My attention was first called to the peculiar likeness by my friend, Dr. V. T. McGillicuddy, who had in his possession a couple of owlets nearly as large as the adults. The capture of a number of both snakes and birds enabled me by experiment to determine to what extent one might be deceived by the resemblance. At the distance of a few feet the shrill tremulous scream would deceive persons quite familiar with the sound of the rattling of the Crotalus. When not noticing or thinking of the birds, their cry produced on us the same effect as the sudden springing of the rattle by an angry snake. The experiments left no doubt that the cries produced a similar effect on other animals which unwittingly disturbed young owls. And in this way they led to a consideration of the possible benefit of this close resemblance, or, as it might be called by some, mimicry. As you know, the birds are fond of the deserted holes of different burrowing animals, especially so of those of various Spermophiles or Prairie Squirrels. They are common in and about colonies of the so-called "Prairie Dogs" (*Cynomys ludovicianus*), where they take possession of vacant burrows, and sometimes even of those in use, sooner or later dispossessing the rightful owners, as the dogs seem disinclined to bring eyes and noses into contact with the sharp beaks and claws in the passages however familiar they may be with the birds around the mouths of the dwellings. In the same localities the snakes are numerous, and the squirrels form a considerable portion of their prey. Naturally enough the rodents—as also the weasels, foxes, and coyotes (*Canis latrans*)—dread the fangs and venom, and recognise and profit by the warning. May it not be that the peculiar protest or scream of the young owl, by its resemblance to the danger-signal, insures safety by preventing the approach of the mammals, and, possibly, of the dull-eared snakes themselves? The scream of the old bird is rather more hoarse and somewhat less like the shrilling of the serpent. On ordinary occasions, the note of this owl is a cackling or chuckling chatter or laugh, varied with what seem very much like imitations of the barking and squealing of the squirrels. When caught, it gives utterance to the hoarse, long-drawn, rattling scream. The owlets ate greedily of fresh meat, stopping to utter their strange cry of alarm at every attempt to approach them. In behaviour the adults were similar, but much less tractable. One, which had his wing broken, was allowed the freedom of the camp, and usually he stowed himself under the waggon. A halt in a "dog-town" one day brought him near one of the holes, which after a time he discovered. At once his soldierly walk quickened; it became a quick step as he neared the opening. Chuckling to himself, down into the darkness he plunged, and that was the last we saw of him. S. GARMAN

Cambridge, Mass., U.S.A., December 3

Fertilisation of the Common Speedwell

IF Mr. Ransom will refer again to my letter, he will see that it was written in order to draw attention to the *adaptation* of the flower for cross-fertilisation, and not especially to the *fact* that Diptera in settling upon it, draw down the stamens. This latter, if we consider the close attention paid of late years to the commoner European wild flowers, has in all probability been frequently observed before. As I have not seen Schenck's handbook, I would be glad if Mr. Ransom will quote the passage to which he refers. On looking at my note-book I find that not only *V. officinalis*, but also *V. Chamædrys* and *V. Beccabunga* are shown as fertilised in the same manner. May I suggest that the separation of the stamens, and the difference of inclination between stamens and pistil, have been brought about in order to prevent self-fertilisation? The looseness of the corolla would then, in such a flower as *V. Chamædrys*, bring the anthers to a level with the stigma when an insect alighted upon it, and would thus promote cross-fertilisation. From want of more extended observations, however, I could not say what would happen in the case of a proterogynous species, or of such a flower as *V. spicata*. In reply to Mr. Ransom, I may add that I have nowhere stated *V. officinalis* to possess larger flowers than *V. hederæfolia*, and that Mr. Darwin ("Cross and Self-fertilisation," p. 369), in a brief reference to the genus, simply states that *V. agrestis* is self-fertilising, and mentions species of Syrphidæ as visiting the flowers of *V. hederæfolia* and *V. officinalis*.

A. MACKENZIE STAPLEY

The Owens College, Manchester, December 15

Complementary Colours at the Falls of Niagara

IF Mr. Cross, whose letter on the above subject appears in Nature (vol. xxvii. p. 150), will make what is for him a very short excursion from Boston to Niagara, he will see a very perfect and permanent illustration of contrast-colours. In the American fall, the pure, green, even sheet of water is "trimmed," as it were, at regular intervals by broad bands of foam, which although, of course, really white, appear of a delicate rose-pink hue. I noticed, and "made a note of this" ten years ago, and again this year. The effect heightens the beauty of the beautiful fall, and I am surprised that no poet has made capital out of it. I should like to call attention to the rapidity with which the Canadian fall is deepening its horse-shoe. An immense mass broke off near the middle of the curve in October, 1874 (many windows in the adjacent museum were broken by the concussion), and altogether the fall has receded twenty-four feet in ten years. H. G. MADAN

Eton College, December 15

M. DUMAS

THE following is a translation of the addresses delivered in the Paris Academy of Sciences on the 4th inst., on occasion of a commemorative medal being presented to M. Dumas:—

The President, M. Jamin, said: Gentlemen and dear Fellow-Members: The Academy considers it a duty to celebrate the golden wedding of those fellow-members who have honoured it during half a century, a duty which is always dear to us, but to-day is dearer than ever; for M. Dumas now completes his fiftieth Academic year. You have had prepared, by an able artist, a medal which happily recalls his features, and must perpetuate them; it bears on the back this inscription:

A M. DUMAS
SES CONFRÈRES, SES ÉLÈVES, SES AMIS,
SES ADMIRATEURS.

I have nothing to add, except that it is not all his admirers, all his friends, all his scholars, but only those who sit here; the Academy has not been willing to share with any stranger the duty of a homage which it has exclusively reserved to itself. I have the honour to offer in your name, with respect, to our illustrious and venerated fellow-member, this token of our affection and of our gratitude.

My dear Teacher: If you will carry back your thoughts to the commencement of your career, you may well be content with your lot and with yourself. When twenty-two years of age, you were at Geneva; you began with Prevost, by discoveries that are still celebrated in physiology, on the urea, on the blood, and on generation. From that moment your name was known, and you acquired confidence in yourself. Then you perceived two things: the first, that physiology must be built upon chemistry, that chemistry was not made, and that it was necessary to make it; the second, that Geneva was not a large enough theatre for your projects. And so you came to Paris, having no other wealth than yourself, than your courage, than a programme resolutely determined, than the will to fulfil it, than confidence, still unconscious of the future that was promised you. Now the time has advanced, your dreams have been realised, your hopes exceeded, and you have reached the highest degree of glory a savant can conceive. Like Franklin, you may

say: If I were to recommence my life, I could not seek anything better.

It is between that departure and this point of arrival that the most brilliant phase of your career is placed. Your discoveries followed one another like improvisations. The composition of ethers was unknown, you analysed them; you enunciated the law of substitutions and of the conservation of chemical types; a constant preoccupation brought you frequently to the atomic theory, that fundamental base of chemistry; and you furnished, for measurement of the density of vapours, a method so simple and so perfect that it is easy to the most unskilful; we know what light it has thrown on the study of organic compounds. But it belongs not to me to speak of your innumerable researches. The scholar may not arrogate to himself, without irreverence, the right of praise or of criticism; in presence of the teacher, he has only the right of respect.

But it is permitted him to remember, and who does not remember, the charm and the marvels of your teaching at the Athénée, at the École Polytechnique, at the Sorbonne, at the École de Médicine, at the Collége de France, at the École Centrale? Everywhere that you have appeared, and you have appeared everywhere, youth and ripe age have been drawn, held, charmed, carried away, to such an extent, that it may be said that you have even rendered more service by the vocations you have decided, than by your own proper works.

Fifty years ago, this Academy opened her gates to you; she has intrusted to you since, and ever congratulates herself for it, the formidable heritage of her illustrious perpetual secretaries. The French Academy has seated you in the chair of Guizot, a professor like yourself; but we have not been therefore jealous. They honoured you, and we did not lose you. Then comes the moment when preoccupations of another order have been imposed by your very renown; you have resigned yourself to those duties which enlarged your *rôle*, because your authority was necessary, because science mixes with all, because chemistry addresses itself to the lighting, sanitation, hygiène, and all the industrial requirements of a large city.

Circumstances have now set you free from manifold cares, and restored you to sciences and to letters. These possess you wholly; and whether it be art or industry, physics or chemistry, electricity or astronomy, it is to you people apply, it is your authority they seek. They find you ever ready for work, ever equal to the most difficult missions. When one recapitulates the work you have accomplished, the services of every kind you have rendered, the discoveries you have made, the lectures you have given in all the chairs, the literary works you have written, the ideas you have sown—all this existence, in fine, which has never known rest, one is astonished that you have not taken more than half a century to fulfil so large a programme; and when one has the happiness of seeing you and hearing you, one marvels that a half-century of labour without truce has still left you so much of youth to expend. It is because, of all human passions, that of study is the most healthy, because it leaves to the organs all their force, to the mind all its serenity—for it is wisdom.

Enjoy, my dear teacher, enjoy these fruits; all the good things that come from God have been given you without stint; genuine happiness, a health which nothing has affected, hearty good will towards all, a mental vision which has not ceased to grow; and all human recompenses have come to be superadded; an authority which makes itself felt and survives all *régimes*, a respect which disconcerts envy, and the affection of your fellow members which has prompted the gift of this medal: it is merely a small fragment of gold, but it will be precious to you, because it is amalgamated with our gratitude.

M. Dumas then spoke as follows:—

Mr. President and my dear Fellow-Members: Since my earliest steps in the way of science, the Academy has been to me the object of a reverence so profound that I cannot receive, without the most lively emotion, the inestimable present with which she honours the close of my career.

As far back as sixty years ago she gave a kindly attention to the work of my youth; half a century ago she received me into her bosom; and since then she has not ceased to accord to me marks of her esteem and of her confidence; nothing had prepared me, however, to think that among my fellow members many should wish even now to call themselves my scholars. Of all the testimonies to which an old teacher might lay claim, the secret has been found of offering that one which is dearest to his heart. Your kindness overwhelms and confounds me!

Ah, my beloved scholars, I go back often enough to these thirty years of an apostolate, which has not been sterile, thanks to the talents of disciples like you; but I believed the remembrance of it to be buried in the tomb of companions in the fight, whom we have lost, or to have passed from the memory of those who survive them. These prelections, then, of another time, of a time so happy, are still not forgotten, since you have wished to recall, in a durable way, on this medal, impressions that are ordinarily apt to be soon attenuated or even extinguished.

You are right! The Professoriate must be honoured, because speech is a power; because from the height of his public chair the professor fulfils a sacred mission. His loyal and penetrating conviction warms hearts, and raises minds towards the disinterested regions of the Ideal. He reflects the present state of science, like a faithful mirror, he prepares the discoveries of the future, he revives the grand traditions of a glorious past. Opening his whole heart and all his thought to his auditors, he teaches them to love the truth, to respect genius, to cherish the fatherland, and to serve it well.

Whoever has found himself surrounded by attentive youth, taking fire at the accents of the teacher, vibrating to his emotions, hastening full of faith towards the conquests indicated to its ardour, that man, believe me, has known the noblest enjoyments of the human soul.

But stay, there is a greater joy still; it is that experienced in seeing oneself outstripped by those to whom one formerly showed the way. This joy you have caused me to taste every day. May you, for the honour of French science, and for the moral greatness of our dear country, you who are of more value than I, have in your turn scholars who surpass you in genius, and equal you in heart.

Mr. President, and all of you my dear Fellow-Members, receive once more the profound expression of my grateful sentiments; the medal which I receive from your hands will be piously preserved by my family as the dearest of souvenirs of my existence, and by my descendants as the most honourable of titles of nobility.

THE METEOROLOGICAL OBSERVATORY ON BEN NEVIS

THE importance of high-level stations in any satisfactory handling of the scientific and practical problems of meteorology which have now come prominently to the front, is everywhere recognised, and accordingly in almost all civilised countries such stations have been established, and their number is steadily increasing. On the continent of Europe, many of the more salient positions available for high-level stations are already occupied in France, Spain, Italy, Switzerland, Austria, Hungary, Germany, and Russia; and as regards other countries, the United States, Mexico, India, and our Australian colonies, have also established stations at great elevations, in an energetic prosecution of this important department

of meteorology. Singularly enough, Great Britain alone stands aloof from participation in the general movement, and notwithstanding the heavy responsibility which her geographical position and vast pecuniary interests and resources impose upon her, none of the mountains that rear their heads in the very tracks of the storms which sweep over Europe from the Atlantic, is yet occupied by either observatory or station for systematic and continuous observation of the weather, the highest station in these islands being Dalnaspidal, which is only 1450 feet above the level of the sea.

At high-level stations near the equator, where temperature varies but little throughout the year, atmospheric pressure, which may be regarded as measuring the mass of air overhead, is subject also to very small variation. Thus at Bogota, in South America, 8727 feet high, where the mean temperatures of January and July are respectively 57°·2 and 56°·2, the normal atmospheric pressure is 22·048 inches and 22·058 inches. Let us look now at the results obtained at Pike's Peak, where a first-class meteorological observatory was established by the United States Government about ten years ago, at a height of 14,151 feet above the sea. Mr. Henry A. Hazen, in a recently published paper on "The Reduction of Air-pressures to Sea-level at Elevated Stations," shows that the normal pressure on Pike's Peak is 0·632 inch less in winter than in summer. The difference is mainly due to the low temperature of winter as compared with that of summer; the reason being that the atmosphere in winter being condensed by the cold, sinks below the summit of the mountain, thus giving a lower pressure there. Now since a lowering of the temperature implies a proportionate condensation, or greater massing of the atmosphere in its lower strata, with a corresponding diminution of pressure in the upper regions, it necessarily follows that at considerable heights in the northern hemisphere the normal pressure is relatively higher in equatorial regions during the winter months, as compared with any other season of the year, than in higher latitudes at the same heights; and that generally the diminution of the normal pressure in the upper regions is in proportion to the lowness of the temperature of the lower strata. From this state of things it results that, during the colder months, the upper atmospheric currents flow northwards in greater volume, velocity, and persistency, bearing with them the higher temperature and humidity of lower latitudes. It is doubtless from the disturbing influences thus called into play, particularly the disturbing influence of the aqueous vapour from the Atlantic, that the notoriously stormy weather of the winters of North-Western Europe is to be traced.

But the fluctuations of pressure at great heights in the atmosphere are not merely seasonal changes following the annual march of temperature through the year; they also follow the changes of temperature which occur from day to day, notably those great and striking changes of temperature which accompany storms. Now it is the investigation of these changes, together with changes in the humidity, cloudiness, and motions of the atmosphere, in their relations to the cyclones and anticyclones of Europe, with the stormy and settled weather that respectively accompanies them, which give to meteorological observations made on Ben Nevis their international significance.

The observations made during the summer of 1881 on the top of Ben Nevis, in connection with the Scottish Meteorological Society, by Mr. Wragge, with an enthusiasm, physical endurance, and undaunted devotion to the work beyond all praise, have now been to some extent discussed, with the result that they amply bear out the strong opinion here advanced of their great value in forecasting weather. The time was sufficiently extended for the determination of the approximate normal differences between observations at the top of the Ben and at Fort William, near sea-level. During the unsettled weather of the summer of 1881, departures from the normal values, and these departures often large, were of frequent occurrence. Now the remarkable and frequent differences from the normals thereby disclosed in the vertical distribution of atmospheric temperature, humidity, and pressure in the aërial stratum between the top of Ben Nevis and sea-level, taken in connection with the weather that followed, give the strongest grounds for the assurance that observations made on the top of Ben Nevis would contribute invaluable aid, if directly wired to London, in framing forecasts of weather for the British Islands and North-West Europe generally. The observations also threw no little light on several controverted points respecting the movements of cirrus clouds, upper currents, and the time when the centres of storms reach higher and lower levels respectively.

The observations were resumed last summer on a more extended scale, the new observations embracing a more complete investigation into the varying states of the atmospheric stratum between the top of the mountain and the sea, by a string of intermediate stations at different heights, and by a very elaborate and carefully worked out system of ozone observations. The weather of 1882 differed materially from that of 1881, and when the observations of 1882 come to be discussed, they will doubtless yield new results in the further extension of our knowledge of weather phenomena. Among the new results may be mentioned the remarkable observations with the hygrometer in the second week of August and at the equinox. The most striking of these were the observations of September 21, when the dry and wet bulbs on the top of the mountain read as follows:—

		Dry	Wet			Dry	Wet
		°	°			°	°
9	a.m. ...	49·1 ...	39·4	10·30	a.m. ...	51·9 ...	39·0
9·30	,, ...	49·5 ...	39·7	11	,, ...	51·1 ...	37·6
10	,, ...	49·4 ...	37·9	11·30	,, ...	53·7 ...	41·4

the barometer at Fort William being high at the time and nearly steady. No such relatively warm and dry air was recorded at Fort William where during the time the temperature was only from 1°·9 to 4°·6 higher than that of Ben Nevis, instead of the normal difference 15°·7. It is instructive to note that these hygrometric states of the atmosphere were observed on the top of Ben Nevis, during, or more strictly speaking, towards the termination of a rather protracted and heavy storm from the north, which rolled huge breakers on the beach of the Moray Firth, and poured down deluges of rain on the high northern slopes of the mountain range stretching from near Foyers to Huntly, which flooded the rivers to an unusual height. The unwonted warmth and dryness of the air, and the deluges of rain that fell immediately to the northward, warrant us in classing the singular phenomena recorded by Mr. Wragge on the top of Ben Nevis on the morning of September 21, as quite analogous to the föhn of Switzerland. If the supposition be a correct one, the difference between the two classes of phenomena is, that whilst the föhn of Switzerland has its origin in a saturated atmosphere discharging its superabundant vapour in deluges of rain on the southern slopes of the Alps, and after crossing these mountains, descending the northern steeps of the mountain-range as a dry warm wind, the föhn of Ben Nevis had its origin in the highly saturated air, which, advancing from the North Sea, discharged its vapour on the higher slopes looking down on the Moray Firth, and after ascending to some height, thereafter blew down on Ben Nevis as a descending wind, characterised by a dryness and relative warmth rarely felt at lower levels. The value of these observations from their important bearings on the theory of storms and other atmospheric movements, cannot easily be over-estimated by the meteorologist, and it is important to note that the observations

at none of the lower stations gave indications of the ascensional and descensional movements of the atmosphere to which attention is here directed.

We observe from a circular we have before us, signed by the Duke of Richmond and Gordon, President of the Scottish Meteorological Society, that the Society has obtained from Mrs. Cameron Campbell of Monzie, a suitable site for the proposed observatory on the top of Ben Nevis, that the grounds and buildings are to be invested in the Royal Society of Edinburgh, and that the charge and management of the observatory will be in the Council of the Scottish Meteorological Society, in conjunction with two representatives of the Royal Society of Edinburgh, and one representative of the Royal Society of London, the representatives of the former Society being Prof. Tait and Prof. Chrystal, and that of the latter Sir William Thomson.

It is satisfactory to learn that a good beginning has been made towards raising the 5000*l.* required to establish the observatory, by a number of noblemen and gentlemen, who have intimated handsome subscriptions to the fund. Since, however, a large sum remains yet to be subscribed, we earnestly hope that in the interests of science the remaining balance of the 5000*l.* will soon be subscribed, so that next summer may see the Ben Nevis Observatory an accomplished fact.

NOTES ON THE GEOLOGY OF HONGKONG

WRITING in 1843, Dr. Abel determined the main structure of the island to be of basaltic trap, granite, siliceous and schistose rock. Mr. Kingsmill in 1865, in his excellent papers on the Geology of the Kwangtung Province, was the first to notice the trachytic porphyry of Victoria Peak (1823), the summit of which overlooks the town. This trachytic rock has been apparently forced upwards through the granite after the overflowing and partial hardening of the trap on the west side of the island. It was Mr. Kingsmill also who explained the nature and formation of the pseudo-boulders, with which the island is so plentifully covered. Towards the extreme south-east, near Cape d'Aguilar, these pseudo-boulders assume very large dimensions, and their weather-beaten aspect proves that the chemical action of water and plants, which forced them from the parent rock, occurred a long time ago. Indeed the island must have undergone great changes in course of time; the hill beyond Shekko, for instance, must have been originally nearly or quite as high as Victoria Peak, whereas its present elevation is not more than 500 feet. The rapid action of the heavy rains and rich vegetation is nowhere more apparent than in the high hill (directly back of the peak from which the colony takes its name) known as the Hog's Back, or High West. Its eastern slope is literally covered with pseudo-boulders, rendering the ascent from that side not a little dangerous, and in the rainy season large masses of rock are borne down into the valley beneath.

Now that the population of the island has increased, amateur geologists and mineralogists have become tolerably plentiful, and frequent excursions are made, hammer in hand, to the less known and wilder portions of the island. In this manner traces have been found of not a few minerals and several interesting rocks. Silver has been observed in small quantities, also galena, lead, and iron pyrites; slate near Aberdeen, syenite and dolorite on a cliff overlooking that one-time piratical *rendezvous*, Saiwan, feldspar and grey mica abundant.

One of the most interesting finds is that of molybdenite, near the village of Sau-ki-van. Molybdenite, molybdenum glance MoS_2, was not known hitherto to be among the mineral products of China. Germany, Sweden, and Cornwales are the chief localities for this rare mineral, and it has been found in several parts of the United States. The South China specimens show all the well-known characteristics of European molybdenite—colour, lead-grey, streak the same; thin foliated hexagonal plates, closely resembling graphite; flexible, non-elastic laminæ, H. = 1-2, G. 4, 5. A local chemist corroborated the determination by analysis, and found the composition to be—

Sulphur	= 40·0
Molybdenum	= 60·0
Molybdenum sulphide	= 100·0

It will be seen from this analysis that there is a slight decrease in the quantity of sulphur, compared with European molybdenite. Dana gives the composition of American molybdenum sulphide as follows:—

Sulphur	= 41·0
Molybdenum	= 59·0
	100·0

The mineral was found in small lumps imbedded in the granite. F. WARRINGTON EASTLAKE

Hongkong, November

TRANSIT OF VENUS, 1882—*BRITISH EXPEDITIONS*

AN operation which requires for its success the collection of nearly simultaneous astronomical observations over widely separated portions of the earth's surface must always be liable to great risks of failure. These risks may be diminished by a careful selection of stations, and an increase in their number; but they can never be entirely removed.

The telegrams already received show, however, that the British expeditions have been most fortunate; and the success of the work is now assured.

This is not the proper place for a technical discussion of the different methods which may be adopted for the determination of the sun's distance from a discussion of observations of Venus in transit; but it is desirable that some facts should be stated which may enable the reader to form some conception of the strength of the method which has been relied upon in the organisation of the British expeditions, and the probable accuracy of the sun's distance which may be deducible from a careful discussion of the observations which have been collected.

On December 6, 2h. 20m. G.M.T., the sun was distant from the earth about 90,620,000 miles, whilst at the same time Venus was distant only about 24,330,000 miles. The ratio of these two numbers is very accurately known, but the expression of either of these two distances in terms of any unit of length which is directly known to us, as a mile, is a point of great difficulty on account of the small dimensions of our earth, of which the diameter is only about 7912 miles, in comparison with such distances as those of Venus and the sun.

The greatest possible displacement of Venus, as seen projected on the sun's disc from any two places on the earth's surface is only about a twenty-ninth part of the solar diameter. It is from such displacements that the relation between the distances of Venus and the sun and the separation of the observers, which is known in miles, is established; but the maximum displacement is never practically available.

These displacements may be measured in many different ways: we can take photographs of the sun's disc at the different stations, and afterwards measure from the photographs the distances between the centres of the planet and the sun, as seen at the different stations; or the distances between the centres may be directly measured with a heliometer or any equivalent instrument; or we may avoid the difficulties and errors

which arise from the use of all such measuring instruments, use the sun itself as our circle of reference, and infer the displacements by observing the differences in time at which Venus is apparently in contact with the sun's limb, as seen from the opposing stations. The last method is that upon which reliance has been chiefly placed in the organisation of the British expedition. For the success of this method, we have to place observers at two sets of opposed stations, at one of which Venus is thrown, from the effects of perspective, towards the centre of the sun at ingress, whilst at the other set of stations Venus is thrown from the effects of perspective from the centre. The former stations are called stations of accelerated ingress, the latter those of retarded ingress.

The stations of the egress observations are chosen from similar considerations, and divide themselves into stations of accelerated egress and retarded egress. In the selection of stations, the most important points are, that the effects of the apparent displacements on the difference in the times of contact should be considerable, that the climatic conditions should be generally favourable, and that the altitude of the sun should be sufficient to render a good observation possible.

The principal stations selected for the British observations of accelerated ingress were Madagascar and the Cape; but it is hoped that good observations may have been secured by Mr. Meldrum, the director of the observatory at Mauritius, although the altitude of the sun is very low for that station at the time of contact. The observers at Madagascar were the Rev. S. J. Perry and the Rev. W. Sidgreaves, with Mr. Carlisle as an assistant. The instruments provided were excellent 6-inch equatorials. The expedition was placed under the care of Commander Aldrich, of H.M.S. *Fawn*, with instructions to establish the observers near the coast on the south-western part of the island. A telegram has been received, stating that the *Fawn* had returned to Natal, and that the observations had been perfectly successful.

The observations at the Cape have also been successful. At the Observatory there, Mr. Gill reports that seven observations of contact were made. The instruments available at this station were a fine 7-inch telescope by Merz, which belongs to the Observatory, and a new 6-inch equatorial by Grubb, sent out by the Committee for the observation of the transit, and a good Dollond, which was used at the last transit, with an aperture of nearly four inches, and Mr. Gill's heliometer. The goodness of the contact observations with the latter instrument may be open to doubt, from the construction of the instrument with a divided object-glass. Three of the contacts must, I fear, have been made with inferior instruments, but at least three good observations of contacts have been made at this station alone.

Mr. Marth, who is in charge of the station at Montagu Road, on the railway between Cape Town and Beaufort West, reports that two good observations of contact have been secured. The observers at this station were Mr. Marth and Mr. C. M. Stevens, with Corporal Thornton as assistant. The instruments provided were a 6-inch equatorial by Grubb and the fine Dallmeyer instrument which was kindly lent by Dr. Warren de la Rue for the observation of the transit.

At Aberdeen Road, Mr. Finlay, B.A., First Assistant at the Cape Observatory, and Mr. Pett, Third Assistant, were the observers. The instruments were 6-inch equatorials by Simms, provided by the Committee; a marine artilleryman, Gunner Shean, was sent out from England with the instruments, and was attached to the party as an assistant. The observations have been perfectly successful, and the definition is reported to have been fine.

Mr. Neison has also observed the contacts at Durban, Natal, with a fine equatorial provided by the liberality of the colonists for the observations. Therefore we have at least ten first-rate observations of the internal contact at the phase accelerated ingress made upon one uniform plan and with instruments of the same class.

The longitudes of all the Cape stations have been directly connected with that of the Cape Observatory by telegraph, and the longitude of that station has recently been connected by telegraphic determination with Greenwich.

The Greenwich times of the phase of accelerated ingress range from about 2h. 11m. 0s. for Madagascar to 2h. 12m. 8s. for the Cape Observatory. The Greenwich mean time for the general body of observations known to have been secured would not differ greatly from 2h. 11m. 48s.

But the observations made of this phase would have been perfectly useless unless observations for comparison with them had been made at stations of retarded ingress.

The stations selected for the observation of retarded ingress were Jamaica, Barbadoes, and Bermuda. But the Canadian Government also provided three 6-inch telescopes; and one of their observers, Lieut. Gordon, Director of the Observatory at Toronto, came over to England to secure the necessary additions to the instrumental means, and to Oxford to make himself acquainted with the arrangements of the other British stations. It is to be feared that this spirited conduct on the part of the Canadian Government has not been followed by the success which could have been wished; but no official reports have yet been received from the Canadian stations.

The phase of retarded ingress has been successfully observed by all the observers sent out in the British expeditions, and the observations, from the telegrams received, appear to have been perfectly satisfactory.

The observers at Jamaica were Dr. Copeland and Capt. Mackinlay, R.A. Mr. Hall was to have observed the contact at another part of the island away from telegraphic communication, and he has not yet reported.

The observers at Bermuda were Mr. Plummer, Lieut. Neate, R.N., and Capt. Washington, R.E.

The observers at Barbadoes were Mr. Talmage and Lieut. Thomson, R.A.

We have therefore, at these stations alone, seven good observations of retarded ingress.

The Greenwich times of the phase of retarded ingress range from about 2h. 22m. 35s. at Barbadoes, to 2h. 24m. 25s. at Bermuda. The Greenwich mean time for all the observations will not differ greatly from 2h. 23m. 33s., and the available difference between the opposed stations of accelerated and retarded ingress will therefore be about 700s., and an error of five seconds in the determination of the difference of the observers would not give rise to an error of 700,000 miles in the determination of the sun's distance, because 5 seconds is only the 140th part of the available interval. But even if the separate results at a station should occasionally disagree, 10 seconds of time *inter se* there is no reason whatever why the mean difference in time between the opposed stations derived from seven good contacts at one end, and ten at the other, should have an error of three seconds of time. So that from the British observations of ingress alone it should be possible to estimate the sun's distance within 300,000 miles.

The stations at Bermuda, Jamaica, and Barbadoes, which served for retarded ingress, are also available for accelerated egress.

The egress observations at Jamaica and Barbadoes are reported as satisfactory. Those at Bermuda were apparently only picked up through clouds. It is possible, therefore, that the Bermuda observations may not be available, on this account, for combination with the other observations; but with the Jamaica and Barbadoes observations alone we have at least four good contacts.

These accelerated egress contacts were made, roughly, about 7h. 47m. Greenwich mean time.

Corresponding to these, we have for the phase retarded egress the New Zealand observations and the observations by Ellery and his staff at Melbourne. The observers at New Zealand were Lieut.-Col. Tupman, R.M.A., and Lieut. Coke. The internal contacts must have been made about 8h. om. 30s. G.M.T.

Observations of this phase which were secured by Mr. Ellery and his assistants at Melbourne must have been made about 8h. 1m. 30s. G.M.T.

The failure of the Brisbane observations through clouds and the partial failure at least of the Bermuda observations at egress have considerably weakened the weight of the determination of the sun's distance from the egress observations. But the observations secured with the large available difference of time of about 840s. should most certainly give a determination of the sun's distance from the egress observations alone with an error less than 500,000 miles.

Besides the above observations, Capt. Wharton, H.M.S. *Sylvia*, has been provided with two good telescopes; and, if the weather has been favourable, will have secured observations both of the ingress and egress, having established himself at some station on the South American continent, not far from the Falkland Islands.

The Greenwich mean times of internal contact at Capt. Wharton's station may be taken at about 2h. 15m. at ingress, and 7h. 52m. at egress. The computed times for the contacts at Capt. Wharton's station would be but little affected by any error in the assumed mean distance of the sun, but they are influenced as much as the other stations by any error in the assumed distance between the centres of Venus and the sun at which the contacts take place. Observations, therefore, at such a station are of importance as a check upon the results obtained from the comparison of results from stations of greatly accelerated and retarded phase.

The longitudes of stations in Jamaica and Barbadoes have already been connected with Greenwich through Washington by the American observers by means of telegraphy. Lieut. Neate has determined the longitude of Bermuda through Washington, by the conveyance of chronometers between Bermuda and New York, where Washington time is available. Arrangements have been definitely made for Lieut. Darwin, R.E., to connect Port Darwin with Singapore, and thus the telegraphic longitude of the Australian and New Zealand stations, which have already been connected together, will be determined.

The longitude of the Madagascar station has been determined by the conveyance of chronometers between Durban, in Natal, and Madagascar, the sea rate of the chronometers being ascertained by their rates during the voyage between Durban and Cape Town.

It will be seen, therefore, that there will be no difficulty in the discussion of the observations from the want of accurate knowledge of the position of the observing stations.

The observations of the British Expeditions have been made by observers of skill, with excellent instruments, under approximately similar conditions of illumination and with sufficient optical powers. The observers have all been trained to observe the same kind of contact, and that one of so distinctive a character that no doubts about the time record which refers to the kind of contact required for comparison with those made at other stations should be possible. This point is one of the utmost importance. In all attempts to determine the sun's distance from these contact observations we have to assume that the "contacts observed" took place with the *same* angular separation of the centres of Venus and the sun as seen from the observers' position on the earth's surface. There is no reason whatever why this assumption should be true unless the "contacts observed" are contacts of the same class. There is an interval of more than 20m. between the "external contact" at a station and the "internal contact" at the same station. If, therefore, any one should combine the time of external contact at one station with the time of internal contact at another station, without allowing for the motion of the earth and Venus, in the interval of about twenty minutes he would obtain a startling but very erroneous result for the sun's distance. The error thus indicated would, however, differ nothing in kind, but only in degree from those which have, to some extent, unfortunately, brought this method of contact into doubt.

The success of the British observations, particularly at ingress, has, however, been so complete, that the method of contact will now have a fair trial.

I await the result with perfect confidence. Neither the method of contact nor any other known method can, with our present instrumental means, settle the sun's distance to a hundred thousand miles. But the extreme range of possible uncertainty, as shown by the difference between the results obtained from Mr. Gill's heliometer measures of Mars east and west of the meridian at the opposition of 1877, and those obtained from the differences in North Polar distances between Mars and stars on the meridian as observed at our principal northern and southern observatories at the oppositions of 1862 and 1877, is about 1,700,000 miles. All our other recent determinations, which have stood the test of examination, fall within these limits, and do not generally differ much from 92,000,000 miles. The contact observations of the British expedition will, I feel confident, fix the true distance, without any greater error than 300,000 miles, and should settle the question whether either of the extreme values mentioned can be the true distance, or whether their mean is not much nearer the truth than either of them.

E. J. STONE

We have received the following additional communications on the transit:—

THE observation of the transit of Venus here to-day was attended with a remarkable, and I think hitherto unnoticed phenomenon.

When the planet had entered nearly one-half its diameter on the solar disc, its contour was barely traceable outside by the faintly luminous line of light noticed by previous observers. But in addition to this a spot of light extending through nearly 30° of the planet's circumference, and from its periphery *inwards* for about one-fourth of the radius was distinctly seen. The brightness appeared greatest at the outside, and faded toward the centre. This appearance was noted by me through the great equatorial, by the aid of a polarising eye-piece, and a magnifying power of 244. The position-angle of the bright spot was approximately 178°, as estimated by me (for, owing to the fact that the polarising eye-piece has no position-circle, only an estimate was possible).

At the same time an assistant (Mr. J. E. Keeler), observing with a telescope of only 2¼ inches aperture and a power of 70, was able to see the same bright spot quite independently, and estimated its position-angle at 168°. The position-angle of the planet itself on the solar disc was approximately 147°. The bright spot was therefore distinctly on one side of a line passing through the centres of the sun and Venus.

The observation was repeated at intervals through passing clouds for seven or eight minutes, and whatever may be its interpretation, of the fact of observation there can be no question.

There would seem to be no analogy between this very peculiarly disposed and definite bright spot upon the planet's edge, and the small central spots described by

some (and whose existence is denied by others) which have been seen on Mercury and Venus in transit, when they have completely passed on to the disc.

S. P. LANGLEY,
Director of the Observatory
Allegheny Observatory, Allegheny, Pennsylvania,
December 6

THE transit was observed here in a cloudless sky up to sunset, but the low position and great atmospheric disturbance rendered measurements and observations of contact unreliable.

When Venus was half in on the sun, I distinctly perceived a fine curved thread of subdued light on the south-eastern edge outside the sun, and not reaching to the latter, nor extending far on any side. With three-fourths on, the thread of light reached round the remaining fourth outside, and completed the periphery. The segment of light disjoined, as when first observed, would seem to indicate a superior refractive power of the planet's atmosphere in the locality at the time.

A short time before complete ingress, the solar cusps appeared to project out from the disc in double concave forms to join the aureole. The aureole disappeared after complete ingress, but the outer portion of the planet seemed much less dark than the central, which was perfectly black within a dark brown ring of from 5″ to 10″ in breadth. I saw no trace of the black drop or ligament, and, indeed, I should imagine that the aureole crossing the position of the ligament would prevent its appearance. I found nothing like a satellite. I thought the micrometer showed a diameter of the planet rather greater from east to west than from north to south, but the *boiling* of the limbs prevented any measures that could be depended on. I remarked no distortion of the planet as recorded by observers of the previous transit.

JOHN BIRMINGHAM

Millbrook, Tuam, December 8

IN a published letter, dated "Palermo, December 13, 1882," Signor Cacciatore, Director of the Royal Observatory there, writes as follows:—"The observations of the transit of Venus, effected at our Observatory, present results, both as regards the direct observations and the spectroscopic, to which the attention of astronomers and physicists may fairly be invited. Prof. Ricco, with the spectroscope, when the planet was on the sun's disc, and her image entered upon and left the slit, observed near the spectral line B of the more refrangible side, a very weak absorption band, and also near the line C he saw traces of obscuration, but much more weak and uncertain. The same phenomenon, P. Tacchini writes me, was observed by him at Rome. Moreover, my direct observations yielded an indication of the ingress of the atmosphere of Venus upon the sun, as, from those of Prof. Millosevich in Rome, this indication was obtained on the external portion of the planet. The agreement of such observations made in different places is of no little importance for determination of the existence and the constitution of the atmosphere of Venus."

NOTES

M. BERTRAND, perpetual secretary of the Paris Academy of Sciences, intimates that the French Government is anxious to collect any information relating to Fermat, whose statue will be unveiled very shortly at Toulouse. Those who possess any documents relating to Fermat are requested to communicate with the secretary of the Institute.

THE Johns Hopkins University Circulars contain a great amount of important scientific, as well as other information, concerning the work of that institution, which is rapidly developing into one of the most comprehensive and efficient institutions for research and education anywhere. In the number for November, for example, we have notes on the papers read by members of the University at their various societies as well as elsewhere, in mathematics, physics, philology, biology, &c., synopses of recent American scientific journals (mostly issued from the University), besides abstracts of lectures, critical notes on various subjects, and much other information. From the seventh Annual Report moreover, it is evident that the University has taken a strong hold on the American people, and that both in the spirit and the letter it is amply fulfilling the intentions of the founder. The list of the academical staff alone, professors, associates, lecturers, instructors and assistants, fills three pages, while the account of work in the various departments shows that research has become a part of the everyday life of the institution.

PROF. TYNDALL will on Thursday next (December 28), at the Royal Institution, at three o'clock, give the first of a course of six lectures (adapted to a juvenile auditory) on Light and the Eye.

THE death is announced of Dr. Theod. Lud. Wilh. von Bischoff, formerly Professor of Anatomy and Physiology at Munich University, as well as keeper of the Anatomical Institute in that city. He died on December 5 last, aged seventy-five.

ON December 1 the Agricultural Museum of Berlin was opened to the public. The curator, Herr Settegast, has arranged the zootechnical division in a commendable manner. Numerous paintings and sketches illustrate German domestic animals in their agricultural aspect. In the zoological division there are a number of interesting skeletons and skulls, amongst them a human skull from the shell-tombs at Santos (Brazil).

THE French official journal publishes a report on oyster culture, which is in favour of the Portuguese oyster. It appears that 100 grammes of the flesh of this mollusc contains about 1·10th gramme of iodine, bromine, and chlorine, just twice as much as the common oyster.

MESSRS. FOSTER AND MARTIN, of Melbourne, have sent us a graceful photograph of the comet, about which we have had so much correspondence. The photograph was taken with a 3-inch euryscope of 24 inch focus on an ordinary camera, not equatorially mounted, which doubtlessly accounts for the elongation of the nucleus. The photograph is creditable to Messrs. Foster and Martin, though it is not the first time a comet has been photographed; more than a year ago we reproduced the photograph of the comet of the period, taken by Dr. Janssen of Paris.

Acta Mathematica is the name of a new mathematical journal which will appear this month, simultaneously published in Stockholm, Berlin, and Paris. The editor in chief is Prof. J. Mittag-Leffler, of Stockholm, and the publication has been promised the support of the most distinguished mathematicians of Scandinavia, Germany, and France.

LAST week the Crystal Palace Company inaugurated an Exhibition of Electricity and Gas which gives even greater promise of success than that in which electricity was the sole object of attraction. Gas at present occupies the largest display. Exhibitors demonstrate the utilisation of gas, and there are many practical illustrations going on. The South Nave contains a great collection of all the best systems of improved gas lighting, Sugg's stand being distinguished by an immense standard lamp of 1000 candle power and a series of suspended lanterns of tasteful pattern of 600-candle power. There are similar great gas lights by Bray, Siemens, and others, which are submitted as competitors against the electric arc lights. In the North Nave there are numerous stands of electric apparatus and material.

THE annual meeting for the distribution of prizes and certificates in connection with the Institute for the Advancement of Technical Education was held on Thursday night in the hall of the Goldsmiths' Company, Foster Lane. After the presentation of the prizes, Dr. Siemens said that Sir Frederick Bramwell had prevailed upon him to present the prizes on this occasion, and had urged that he was a fit person to do so. The distinction made between ordinary and honour prizes, marking the addition of some scientific knowledge to proficiency in applied science, was worth the attention of all students. It was not sufficient for after-life to be efficient in a craft or calling. Unless the workman also mastered entirely the scientific principles underlying that calling, he might, in consequence of some invention changing the *modus operandi* in an occupation, be left high and dry, whereas with a knowledge of fundamental principles he could adapt himself to changed circumstances. With regard to the school in Cowper Street, he might say, having recently visited it, that the lecture rooms and the laboratory for physical science and chemistry were the most perfect he had seen, and he contrasted them with those in which he had himself received scientific instruction. He remarked upon a deficiency he had noticed in the Finsbury School—the indifferent accommodation and provision for the study of drawing, both artistic and mechanical. He hoped that art and literature would not be neglected in this scheme of education. Dr. Siemens said he hoped that through the dissemination of pure and practical science a higher spirit would take possession of the artisan, and that he would work with the object of attaining higher results and higher ends instead of discussing with his employer questions of hours and wages.

THE American papers have been devoting considerable space to Prof. Henry Draper, whose comparatively early death is regarded as a great loss to American Science. The *Tribune* has a long and interesting biographical article.

MR. A. E. GARROD has published, through Parker and Co., his able and elaborate paper, re-written, on "Nebulæ," which gained the Johnson Memorial Prize (Oxford) in 1879.

ONE of the largest avalanches ever known in Western Switzerland fell a few days ago near Ormons Dessus in Canton Vaud. It carried away several houses, piled up a mass of ice and snow 200 feet thick, and covered three square kilometres of ground. Some of the ice blocks were 18 feet long. The inmates of the houses struck were got out safely.

NEAR Tabiana (Italy) the remains of a fossil elephant have been discovered. Two enormous tusks, two teeth, and several bones from the skull were found. The objects found were submitted to scientific investigation by Prof. Strobel and Dr. Mariotti of Parma. They declared them to belong to *Elephas* (*Loxodon*) *meridionalis*, Falconer. The tusks measure 3·2 metres in length, and 0·28 metres in diameter at the thickest part. The skull bones were so much decayed that they could not be removed. It was resolved, therefore, to cover up the remains with earth until next summer, when it is hoped that warmer weather will be more favourable to further excavations.

DURING a stay near the Suez Canal last winter, Prof. Keller of Zurich made a study of the animal migrations due to the opening of this means of communication. These are very positive, though certain causes quite stop some species, or at least retard their movements, especially (1) the too sandy nature of the ground; (2) the large lakes; (3) the currents; (4) the passage of ships, which derange the ova and larvæ; (5) the too great saltness of the canal water. From the Mediterranean to Suez have passed since 1870, *Solen vulgaris*, *Umbrina cirrhosa*, *Labrax lupus*, *Balanus miser*, *Ascidia intestinalis*. Some Mediterranean species are now on their way through (*Solea vagina*, *Cardium edule*, *Sphæroma*), several fishes (*Pristipona stridens*, *Crenidens Forskali*, &c.), and some molluscs (*Cerithium scabridum*, *Mactra olorina*, *Mytilus variabilis*) have passed from the Red Sea to the Mediterranean, while quite a numerous "caravan" is now resting in the basins of the great Bitter Lakes. The fauna of the canal is still too poor for large carnivorous species to find a living in it; hence rays, cuttlefishes, &c., do not migrate. Red Sea corals also have not passed into the canal.

THE *Overland China Mail* gives an account, taken from the Manila papers, of the typhoon which visited the Philippine Islands on October 20. The typhoon began at eight o'clock in the morning, and continued with unabated fury until about two o'clock in the afternoon. Not a house in Manila escaped injury. During the storm it was utterly impossible to walk in the streets, owing to the force of the wind, which was rolling carriages along like playthings, and keeping sheets of iron roofing floating in the air like pieces of paper. It is said that during the typhoon several shocks of earthquake were felt. No such destructive typhoon has visited the islands since 1831. The record taken at the Observatory says that the greatest velocity attained by the anemometers reached 144·4 English miles per hour; nothing could resist this force of wind. The vortex was touched at 11·40 a.m., when the minimum barometer reached 727·60 millimetres. The greatest violence of the hurricane could not be indicated, because all the anemometers were rendered useless before the severest gusts came.

THE eleventh annual *soirée* and exhibition of the Lambeth Field Club and Scientific Society will take place on Monday evening, January 1, 1883, at St. Philip's Schools, Kennington Road, S.E.

PROF. GUSTAV VON HAYEK, an eminent Vienna naturalist, is editing a large Atlas of Natural History. Five parts have appeared, and the work will be complete in fifteen. Each part contains eight plates folio size. Moritz Perles, of Vienna and Leipzig, is the publisher.

"MYTHOLOGIE und Civilisation der Nordamerikanischen Indianer" is the title of a little work just completed by Herr Karl Knortz, and published by Paul Frohberg of Leipzig.

A VIOLENT shock of earthquake was felt at Siders (Canton Valais) on December 5 at 3.40 p.m.; the direction of the shock was from east to west.

THE French Lower House has adopted the project of subterranean telegraphic lines, which had elicited some criticism.

ON the 2nd inst. Dr. Finsch, who recently returned to Berlin, after an absence of over three and a half years, reported upon his travels before the Geographical Society of Berlin. He first proceeded to Micronesia in order to study the ethnology of the rapidly disappearing natives of those groups of islands. From Honolulu he proceeded to Oahu, where he visited the old burial-grounds. At Maui he succeeded in obtaining a specimen of a bird that is very nearly extinct, and from the scarlet feathers of which formerly the royal mantles were made. In March 1880 he accompanied the German Consul, Herr Hernheim, to the Caroline group, and saw the ruins of the celebrated colossal edifices there. In July Dr. Finsch proceeded to New Britain. He stayed there for eight months, and then went to visit the Maoris in New Zealand. At the beginning of 1882 he proceeded to New Guinea, in August he left for Batavia and then for Europe, having travelled over 30,000 miles. His collections comprise 4000 ethnological objects from 43 localities, 290 skulls, 200 samples of hair, 200 casts of faces taken from living individuals in 66 different places, 6000 vertebrata, 30,000 invertebrata, 1000 plants, numerous minerals, 400 photographs, and 200 sketches.

THE Russian Geographical Society has addressed to other scientific societies of Russia a proposal to collaborate in the publication of a general description of Siberia. The Geographical Society undertakes for its part the publication of a geographical description and of a general bibliographical index of all works and papers on Siberia.

THE Belgian expedition for the investigation of the Upper Congo has left Antwerp on board the steamer *Harkaway*. The party consists of Dr. van der Heuvel, Herr Schaumann, an Austrian officer, and several mechanics. The expedition takes out large stores of goods, including samples of the seeds of all nutritious vegetables grown in Belgium. They are to proceed as quickly as possible to the furthest of Stanley's stations, and then penetrate further if possible.

THE additions to the Zoological Society's Gardens during the past week include a Chacma Baboon (*Cynocephalus porcarius* ♀) from South Africa, presented by Mr. J. W. Browne; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Lady Sibyl Tollemache; a Smooth-headed Capuchin (*Cebus monachus*) from South-East Brazil, presented by Mr. A. J. McEwen; a Squirrel Monkey (*Chrysothrix sciurea* ♂) from Guiana, presented by Mr. M. Escaré; a Rhesus Monkey (*Macacus erythræus* ♂) from India, presented by Mr. G. V. Sawyer; two Leadbeater's Cockatoos (*Cacatua leadbeateri*) from Australia, presented by Mr. C. J. Harvey; a Common Barn Owl (*Strix flammea*), British, presented by the Rev. A. Reece; a Ring-hals Snake (*Sepedon hæmachetes*), a Rhomb-marked Snake (*Psammophylax rhombeatus*) from South Africa, presented by Mr. H. Pillans; a Lesser White-nosed Monkey (*Cercopithecus petaurista* ♂) from West Africa, deposited; a Long-eared Owl (*Asio otus*), British, a Marbled Cat (*Felis marmorata*) from Assam, purchased; a Red Kangaroo (*Macropus rufus* ♂) born in the Gardens.

OUR ASTRONOMICAL COLUMN

MEASURES OF DOUBLE STARS.—We receive at about the same time several important series of measures of double stars.

(1) "Results of double star measures made at the Sydney Observatory, N.S.W., 1871 to 1881," under the direction of Mr. H. C. Russell, Government Astronomer for New South Wales. From 1871 to 1874 the instrument employed was a very fine 7¼-inch refractor by Merz; after 1874 the 11½-inch refractor by Schröder was substituted, the same method of observation being followed with both instruments. For the more difficult objects, a power of 330 was applied on the Merz telescope, and one of 800 on the larger refractor. The objects measured include about 746 of Herschel's stars, and it is unnecessary to say more than this, to show the importance and value attaching to the catalogue, no measures of a large number of the stars having been put upon record since the publication of Sir John Herschel's Cape Volume. In addition to these objects, however, Mr. Russell's catalogue includes measures of 350 new double stars detected at Sydney, and he remarks that it would have been easy to double the number if he had adopted the same limit of distance as Sir John Herschel, and without making any very strict examination of the southern heavens, which will be a hint to future workers in this branch of astronomy in the other hemisphere. Some of Herschel's stars, Mr. Russell says, present considerable difficulty, but are probably in motion; thus γ Lupi, an easy double star in 1836, is now single under the highest power on his large equatorial; π Lupi, which Herschel found "excessively difficult," is now quite an easy object with the Sydney refractor; *h* 4854 is another star of the same character; in June, 1872, it was easily divided with power 230; in June, 1874, it could not be divided with any power; and in July, 1880, it presented only a round disc with all powers on the large telescope.

Mr. Russell has made an innovation in the manner of expressing the dates of the separate sets of measures, which appears an unfortunate one: instead of giving them according to the u ual method, as fractions of the different years, he has three columns with "Day of the month," "Month of the year," and "Year in the 19th century," and this inconvenient expression of dates is not remedied without some trouble, by means of the table at p. 68, showing day and fraction of year. The computer of double-star orbits in taking means of sets of measures for an epoch to work upon, will hardly appreciate this innovation.

(2) "Micrometric measurements of double-stars" in vol. xiii. part 1, of "Annals of the Astronomical Observatory of Harvard College." This is a valuable catalogue of measures of about 350 stars in upwards of one thousand sets, made with the 15-inch refractor at Harvard College, chiefly in the years 1866-1872, under the direction of Prof. Winlock, but including a few obtained by the Bonds, and by Mr. Waldo, which have previously appeared in the *Proceedings* of the American Academy of Arts and Sciences, and in the *Astronomische Nachrichten*. The catalogue includes nearly all the more interesting binaries and many difficult objects. In addition, Prof. Pickering publishes a list of 179 double stars discovered at Harvard College Observatory, some of which have been independently detected by Mr. S. W. Burnham; these were found to a considerable extent during an exploration of the southern heavens, occasionally instituted in the intervals of other observations. In the cases of some of the principal revolving doubles as γ Virginis, 70 Ophiuchi, &c., the measures extend to the year 1876.

(3) "Measures of the principal double stars in rapid orbital motion," made in the years 1875-1882, with the Merz refractor of the Observatory of Brera, Milan by Prof. Schiaparelli; an important series of results which will be most welcome to those who are engaged in the investigation of double star orbits, since in most cases, there are measures later than any others available at the present moment. We extract a few of the more recent mean results:—

		Position	Distance
		°	″
ζ Cancri (A:B) ...	1882·247 ...	75·07 ...	0·980
ω Leonis	1882·363 ...	89·99 ...	0·55
ξ Ursæ Majoris ...	1882·386 ...	261·06 ...	1·928
η Coronæ Borealis ...	1882·503 ...	135·37 ...	0·594
μ^2 Bootis	1882·521 ...	120·40 ...	0·795
ζ Herculis	1882·602 ...	101·55 ...	1·473
τ Ophiuchi	1882·600 ...	252·13 ...	1·860
70 Ophiuchi	1882·609 ...	51·83 ...	2·336

No trace of the companion of γ Coronæ Borealis was visible in the years 1875-1881. In 1882 a prominence was once suspected at 120°, but at other times the star was single. In 1875-1879, however, this star was single in the Washington 26-inch refractor.

PHYSICAL NOTES

PROF. W. KOHLRAUSCH gives the following as the results of recent experiments on the electric conductivity of the haloid salts of silver. Chloride, bromide, and iodide of silver at temperatures above their melting-points conduct far better than the best conducting liquids (sulphuric acid, &c.) at ordinary temperatures do. Chloride of silver conducts best, iodide worst of the three. The chloride and the iodide of silver change their resistance very greatly and suddenly on solidifying, the resistance increasing more than a million-fold by cooling through 20°. More remarkable still, iodide of silver undergoes absolutely no change of conductivity at its melting-point (540°), but shows a rapid decrease at the temperature (145°) at which it passes from the amorphous to the crystalline state.

NEW combinations to serve for direct-vision prisms have been suggested recently by several persons. Mr. C. D. Ahrens uses a bisulphide prism cemented between two flint glass prisms, giving a wide dispersion with little loss of light. Herr Fuchs employs a single isosceles glass prism in the position of minimum deviation, a silver-faced mirror being attached to the basal face of the prism to rectify the ray after emergence. Signor A. Ricco has described a similar combination, a total-reflexion prism being substituted for the mirror. He has also constructed the second prism of the combination of a four-sided form, so that it not only rectifies the ray which has been deflected by the first prism, but also augments the dispersion of the first prism by a nearly equal amount.

THE electric resistance of mercury is, according to R. Lenz, affected by pressure. Between the limits of 2 and 60 atmospheres' pressure, the resistance of a quicksilver column 1·2 metres long, inclosed in thermometer tubing, diminished ·02 per cent. for each additional atmosphere.

PROF. MELDE of Marburg proposes to study the force of electric reaction as exhibited in the rotation of Hamilton's well-known "mill," by attaching the "mill" to a torsion fibre, and observing the *torque* produced by the electric reaction. As Tomlinson has shown, the "mill" will work when surrounded by turpentine or other insulating liquid; hence Prof. Melde's suggestion promises to prove of some interest.

DR. H. P. BOWDITCH has recently published in the *Journal of Physiology* a paper on the optical illusions of motion, in which he deals chiefly with the peculiar illusions of rotation, &c., studied a few years ago by Prof. Silvanus P. Thompson. He entirely agrees with the latter experimenter in rejecting the explanation advanced by R. Addams, and more recently by Javal, that these illusions are due to muscular slip, and declares that such an explanation is worthless, being contradicted by the fact that motor after-effects in opposite directions are possible for the same retina at the same time. Dr. Bowditch also thinks that these persistent after-impressions of motion cannot be the product of experience or association, because experience cannot overcome, nor volition control or reverse them. He looks for an explanation in the narrowness of the limits of distinct vision.

M. BERSON has contributed to our knowledge of the magnetic properties of metals by some recent researches on their degree of magnetisation at different temperatures. The experimental method followed consisted in comparing the magnetic moments of different bars by Gauss's method at different temperatures while placed in a magnetic field of constant intensity. The following are the results:—With iron the total and temporary magnetisations both increase up to 260° C., above which the temporary magnetisation falls off rapidly, but the permanent slowly. In steel the total magnetisation is also a maximum at 260° C., but the permanent magnetisation attains its maximum about 240° C. The magnetisation of a steel bar magnetised while cold is diminished by heating, whilst that of a bar magnetised while hot is diminished by cooling. This result appears to be important, as it would follow that a magnet has its permanent maximum power at that temperature at which it was magnetised. With nickel the total magnetisation increases up to 240°, and diminishes above 280° so rapidly as to be zero at 330°. But if magnetised at 280°, the magnetic moment during the subsequent cooling first increases, then diminishes slightly, but still remains greater than at the temperature at which it was magnetised. Cobalt behaves like steel.

M. HESEHUS publishes in the last volume of the *Journal* of the Russian Chemical and Physical Society an interesting paper on his researches on "residual elasticity" (a rather difficult term to translate), the *elastische Nachwirkung* of W. Weber. Without attempting to deal with the immense range of phenomena concerning permanent changes of shape of elastic bodies under the influence of small but continually acting forces, M. Hesehus has studied these changes in a few bodies, especially in lead and caoutchouc, and has made an attempt to bring these changes into connection with other physical phenomena. He comes to the conclusion that residual elasticity depends to a great extent upon the mass of the body, and its surface; that the elastic conductibility depends upon, and increases with, temperature; and that the laws of residual elasticity afford close analogies with those of heating and cooling of solid bodies, as well as with those of phosphorescence and of residual magnetism and electricity.

AT a meeting of the Russian Physical Society, M. Kraevitch made an interesting communication on the results of his researches on the elasticity of air. Rarified air does not obey the Boyle-Mariotte law, that is, in proportion as it becomes more rarified its elasticity diminishes more rapidly than its density, and becomes equal to zero, while the density has still a measurable value. M. Kraevitch observes that it would result from these experiments: (1) that the atmosphere of the earth is limited; and (2) that our weights of gases contain an error, as, however perfect the pneumatic machine, it cannot pump all air from a vessel, if this vessel is lower than the pneumatic machine, or the air is pumped from above. Prof. Mendeleeff, recognising the importance of these researches, advised M. Kraevitch to continue them on heavy gases.

IN a paper relating to recent studies of the Rhone glacier (read at last meeting of the Helvetic Society of Sciences), Prof. Forel formulates these four questions as, in his opinion, the most urgent for a theoretic knowledge of the phenomena of glaciers: (1) How and in what measure does the velocity of flow vary in different layers of the depth of the glacier? (2) How and in what proportion does the surface-velocity vary if the glacier increases or diminishes in thickness? (3) What is the temperature of the internal mass of the glacier? (4) What are the laws of periodic variations of different glaciers? (For this study it is desirable to know, in the case of each glacier, the epochs of commencement ot periods of elongation or shortening).

HERR HERTZ has recently measured with special apparatus, the pressure of saturating vapour of mercury at different temperatures, from 0° to 220° (*Wied. Ann.*, No. 10). His numbers are considerably smaller than those of Regnault; and with Herr Hagen's they agree only between 80° and 100° C., being greater below, and smaller above these limits. Between 0° and 40° he finds the elastic force of the vapour of mercury to vary from 0·00019 mm. to 0·0063 mm. It follows that at ordinary atmospheric temperatures it is less than $\frac{1}{1000}$ mm. This result is important in reference to barometers, machines, and Geissler tubes.

SIGNOR MARTINI has studied the sounds produced by outflow of water through a cylindrical hole in a metal disc at the bottom of a long glass tube filled with the liquid (*Atti del. R. Ist. Veneto*, 5 ser. t. viii. 1882). In such a case one does not hear a series of sounds of decreasing pitch, though the liquid charge continually shortens; but a certain number of distinct sounds. The sound is due, as Savart proved, to the vibrations of the liquid vein; and the author verified Savart's law, that the numbers of these are proportional to the liquid charge and inversely as the diameter of the hole. A pure sound of clear tonality is only got if the sound of the vein is one of those the liquid column can yield. The series of sounds from a liquid column of constant length is that of the harmonics of an open pipe. The air column above the liquid strengthens some of the sounds. The sound is quenched if the tube is kept from vibrating. These experiments afford a means of comparing the velocities of sounds in different liquids. One has only to find what lengths the columns must have to yield a particular sound (all air-bubbles must be expelled). The author has tried alcohol, sulphuric ether, and petroleum, and found numbers agreeing with those by other methods.

IT appears from recent experiments by Herr E. Wiedmann (*Wied. Ann.*, No. 12) that a number of water-containing salts, when heated, undergo chemical transposition even before fusion. He has, in this inquiry, found two new modifications of zinc-sulphate and magnesium-sulphate, and determined the changes of volume attending their formation. The general result, he points out, is of interest with reference (1) to determination of tension, inasmuch as it is necessary, first, to ascertain whether a given salt remains unaltered or not within the range of temperature considered; (2) to researches on heat of solution, &c., of a salt partly deprived of water by heating; it should be exactly determined in what form water and anhydride salt are combined.

CHEMICAL NOTES

A RECENT patent by Mr. Morris, of Uddingston, N.B., claims to have solved a problem which has long baffled the skill of technical chemists. By heating an intimate mixture of alumina and charcoal, in a current of carbon dioxide, Mr. Morris says that metallic aluminium is produced; the metal is purified from carbon and aluminium by fusion.

WHAT may perhaps be called the kinetic theory of chemical actions, the theory, namely, that the direction and the amount of any chemical change is conditioned not only by the affinities, but also by the masses of the reacting substances, by the temperature, pressure, and other physical circumstances—is being gradually accepted, and illustrated by experimental results. Thus Hammond (*Monatsheft für Chimie*, 3, 149) concludes, from experiments on the hydration of salts, that when a saline solution is gradually concentrated various hydrates are formed, but that the crystallisation of any one of these from the liquid depends on the relative quantities of the various hydrates, and on the temperature of the solution. Another example of the establishment of a state of equilibrium between antagonistic chemical systems is furnished by the recent observations of L. de Boisbaudran (*Compt. rend.*, 95, 18) on gallium protochloride. When gallium is dissolved in cold concentrated hydrochloric acid a

stable solution of the protochloride is obtained; but when water is added to the solution hydrogen is evolved and gallium perchloride is produced.

HERR SCHWARZ describes (in *Berichte der Deut. Chem. Ges.*, xv. 2505) three lecture experiments illustrative of the action of zinc on sulphur: 2 parts of fine zinc powder are carefully mixed with 1 part of flowers of sulphur, and the mixture is ignited by an ordinary match; combination occurs with evolution of much light. Vapour of carbon di-sulphide is passed over zinc powder, which is gently heated in a piece of glass tubing; zinc sulphide is produced, and a considerable quantity of carbon is separated. Sulphuretted hydrogen is passed through carbon disulphide, and the mixed gases are then conducted over hot zinc powder; zinc sulphide is produced, and a gas, which is passed through potash and collected in a small gas-holder; this gas burns with a slightly luminous flame, and explodes when mixed with air; it is marsh gas.

NILSON has prepared the rare metal thorium in considerable quantity, and determined its atomic weight to be 232·35, specific gravity about 11, and atomic volume about 21 (*Berichte*, xv. 2519).

M. MIKLUKHO-MACLAY ON NEW GUINEA

AMONG the queries that were submitted to M. Milukho-Maclay before his departure from Europe, was one of Karl von Baer, who advised the traveller to visit the Philippine Islands, and to bring home several skulls of the natives, in order to ascertain whether the primitive inhabitants of these islands are brachiocephalic, or not. During a five days' stay of the clipper *Izumrud* at Manila, M. Maclay visited the Mariveles mountains, and discovered there Negritos who lived in their *pondos*, or small huts made out of palm-tree leaves. Numerous measurements (favoured by the custom of the men shaving the back of the head) proved that they really are brachiocephalic, the index being no less than 87·5 to 90 Their size is altogether small; one woman, mother of two children, measured only 1·30 metre. Their faces proved to be very much like those of the Papuans of New Guinea, while their customs are much akin to those of the inhabitants of many Melanesian islands. For instance, when M. Maclay threw some remains of food in the fire, the Negritos immediately extinguished it, and asked him not to do so again. The same prejudice exists with regard to spitting in the fire (a very widely-spread prejudice, we may observe, as it exists also in Russia and Siberia). Another interesting custom of the Negritos is that everybody, before eating, must loudly shout out several times, an invitation to partake of his food, to all those who may be in proximity. This custom is very rigidly observed, and those who do not comply with it are punished, even by death.

In August, 1874, M. Miklukho-Maclay undertook a journey into the interior of the Malay peninsula, in order to settle the question as to the race of its inhabitants—the Orang-Sokays and the Orang-Semongs—about which question there existed a controversy between Messrs. Logan, Newbold, Crawford, and Waitz. M. Maclay went, therefore, from Singapore to Johore. The Maharajah of Johore received him very kindly, and gave him the necessary men for the journey, as well as orders to his subjects to help him in every way during his journey. In exchange, M. Maclay was bound to prepare a map of the dominions of the Maharajah. The Russian traveller crossed the Johore country twice—from west to east and from north to south. The journey was very difficult, on account of the rainy season; the rivers and streams had inundated the country, even the woods, and the party had to walk in water that reached to the knees, and often to the breasts of the oxen. For seventeen consecutive days they were quite wet, as well as their baggage. Reaching thus the mouth of the Moar river, M. Maclay journeyed up this river in a flat boat, passing by Malayan villages, reached its confluence with the Pallon, and went up the last river. At its sources he discovered in the woods the first hats of the so-called "orang-utangs." This name is given by the Malayans, not to the ape, *Pithecus satyrus*—they never call apes by the name of "orang," but to "forest-men." "Orang" signifies "man," and "utang" a forest. Therefore the Malayans say *orang-bukit* (men of the hills), *orang-ulu* (men at the source of a river), *orang-dalah*, *orang-laut* (men of the interior of the sea-shore), and so on. However, the name *orang-utang* could be applied also to a Malay who stays in the woods, but still it is used to designate a tribe of Malays crossed in various degrees with Papuans, as also with Melanesians.

[1] Continued from p. 138.

Though the different tribes M. Maclay met with during his journeys in Johore differ from one another, still none of them are Melanesians. They forget their primitive language, and adopt that of the Malays. M. Maclay presumes that formerly they had several languages, and were divided into several tribes; some difference still remains in their customs. They are at a very low stage of human culture. They wander in the woods, and only occasionally come to stay in their miserable huts. The Malays distinguish two different tribes of orang-outangs: the orang-outang-dina (or tame, who are in intercourse with them), and the orang-outang-liar, quite nomadic. These last use a weapon, *sumpitan*, which deserves to be mentioned. It consists of a hollow bamboo cylinder, two metres long and two or three centimetres wide, through which they blow against their enemies very light poisoned arrows, as large as knitting-needles. The end of these arrows breaks, and remains in the wound. The Malays say that the slightest scratch of such an arrow kills a man in ten or fifteen minutes. M. Maclay purchased quantities of their poison, which proved always to be made of a condensed infusion of the bark of the Javan tree, *Antiaris toxicoria*, or Upas, to which different tribes add other poisons, such as the poison of snakes, of poisonous kinds of strychnis, &c. A small prick of a poisoned arrow kills a dog or a cat, the death being accompanied by tetanus or not, according to the secondary poisons added to the chief one. The Orang-outangs are rapidly disappearing since they were driven by Chinese and Malayans from the sea-shore to the woods of the interior. Besides, the Chinese and Malays purchase their best-looking and healthier girls, leaving them the feeblest, who leave but a weak progeny. The children from the Malays and Orang-outang girls are far more like the former than the latter.

After having crossed the Johore country from the mouth of the Moar River to the entrance of the Indan into the Chinese Sea, that is, from west to east, M. Maclay crossed the same country from north to south, that is from the Indan to the Selat-tebran Strait, which separates Singapore Island from the mainland. He contracted, of course, a strong fever during this journey, fifty days long, and went to Bangkok. There he happened to receive from the King of Siam a letter to his vassals of the Malay peninsula, enjoining them to help M. Maclay during his further travels on the peninsula. Provided with this recommendation, the Russian traveller undertook a most adventurous journey, namely, to walk from Johore to Siam. It was considered by all his acquaintances as quite impossible, but he accomplished it, as the small rulers of the southern part of the Malay peninsula did not venture to stop him on his way, and preferred, each of them, to despatch him to the next ruler. In this way M. Maclay reached Siam, after a journey that lasted for 176 days.

In the mountains at the sources of the Pakkan River, M. Maclay finally met with undoubtedly pure Melanesians, Orang-Sakays, and made on them a few anthropological measurements. They differ as much from the Malayans, as the Malayans differ from the Papuans, and are like the Negritos of Luzon. The height of the men varies between 1·46 and 1·62 metres, and that of the women from 1·35 to 1·48; the skull is nearly brachiocephalic, that is, the widest is between 74 to 82 for men, 75 to 84 for women, and 74 to 81 for children. The diameter of the curls of the hairs is the same as with the Papuans, that is, from 2 to 4 millimetres. The colour of skin is between the numbers 28 to 42, and 21 to 46 of the table of Broca. The *plica semilunaris*, or the so-called *palabra tertia*, is more developed than with other races; its width reaches sometimes 5 and 5·5 millimetres, instead of the 1·5 to 2 millimetres of the Caucasian race. Finally the Orang-sakays have also a fold of the skin at the interior corner of the eye which is known, when pathologically developed, under the name of *Epicanthus*. Like the Orang-utangs they are disappearing; they nomadize in forests, stopping at a few places to mass collections of camphor and caoutchouc tree, of rotang and elephant bone, which they exchange with Malays for tobacco, salt, iron knives, and various rugs which they use for their dress. The dress of the men consists of a girdle, a part of which covers the *perinacum*: the women have also a girdle of rotang, to which two rugs are adjusted. The women are tattooed by lines and round spots. The Orang-sakays, like other Melanesians, put in the partition of the nose the *hayanmsh*, that is, a long stick of bamboo, or a spike of the *Hystria*.

The Orang-sakays are very kind to their women and daughters, who can even inherit the title of *Pateu*. Their wedding customs contain survival of the custom of stealing brides. On a day agreed to before, the bride, in presence of her parents and friends, runs away to the forests, and the bridegroom, who follows her after some time, must find her during a fixed lapse of time. If she does not wish to marry him she can always conceal herself in the woods so as not to be found. They have maintained also the communal marriage, that is, the wife passes from one man to another for a certain time. They are much afraid of death, and if a member of the community becomes seriously ill, they abandon him in the forest with a supply of food, and leave their huts for ever.

In his fourth lecture, M. Miklukho-Maclay gave an account of his cruise among the islands of the Malayan Archipelago, and the islands of Micronesia and Melanesia, as well as of his work in Australia. The anthropological researches in the Malayan archipelago were far more successful than in Melanesia or New Guinea. He had no longer to deal with wild tribes, and the schools, hospitals, and prisons maintained by the Dutch on these islands gave him many opportunities for anthropological studies. M. Maclay thus made very numerous measurements and photographs of Malayans, which will afford the necessary materials for comparing them with other allied races.

In 1876, when going for a second time to the Maclay coast of New Guinea, the indefatigable traveller had an opportunity of visiting the islands of Western Micronesia. He found there that the Micronesian race is very nearly akin to the Polynesian; but still, he thinks it is most probable that it contains a mixture of Melanesian blood, which appears, especially in the more curly hair; in several instances (on the Pelan Islands), the hairs were purely Melanesian, and the darkness of the skin and several distinctive features of the skull showed unmistakable traces of mixture with Melanesians. On the Lub, or Hermit Islands, M. Maclay found a mixture of Melanesians with Micronesians, and on the next group of islands, Escheker, or Eschikie, he discovered the true border-line of the straight-haired Micronesian race. The most important results of this journey were published in the *Sitzungsberichte der Berliner Gesellschaft für Anthropologie*, &c., meeting of March 3, 1878.

In 1879 M. Maclay left Sydney on board an American schooner for a cruise among the islands of Melanesia. He visited New Caledonia, and journeyed in the interior of it, the Loyalty Islands, and many islands of the New Hebrides, making everywhere anthropological measurements and drawings. Many inhabitants of the New Hebrides proved to be brachiocephalic. Thence he proceeded to the Santa Cruz Islands (where Commodore Goodenough, several sailors, and Bishop Paterson were killed by poisoned arrows), and made measurements of those natives who came on board the schooner. Reaching then the Admiralty Islands, he stayed there for two months, and was enabled to complete to a great extent the observations of the *Challenger* expedition. Visiting further the Lub or Hermit islands, which are said to have been peopled by a few natives landed in a canoe from the Admiralty Islands, and where the Melanesians are continually crossed with Micronesians, as the inhabitants bring every year slaves and women from the Ninigo group—M. Maclay proceeded to the Trobrian group of islands which are very rarely visited by Europeans, and thence to the Solomon and the Luisiadea Islands. The journey lasted for 409 days, out of which 237 were spent on shore. The results were as numerous as important, the chief of them being that brachiocephaly is far more usual in Melanesia than it was before; indexes measuring 81, and even 85, being not rare. Further results of this journey were published in the *Izvestia* of the Russian Geographical Society for 1881, and in a letter to Prof. Virchow, which appeared in the *Sitzungsberichte* of the Berlin Society of Anthropology.

M. Miklukho-Maclay concluded his journey by landing at Somerset, on the northern extremity of Australia, and at several places of the eastern coast, in order to make acquaintance with the black Australian race. It is known that several opinions are current as to the origin of this race. Some anthropologists consider them as Papuans, while others consider them as Polynesians, and Prof. Huxley has made of them an independent race of Astraloids. As far as M. Maclay's observations go, he is inclined to consider them, like Huxley, as a race *sui generis*. But he intends to return again to Australia in order further to study this question.

When staying at Brisbane, M. Maclay undertook an excursion into the interior of the country to see if there really exists an "unhaired" race, of which he was told in Europe. Close by Saint George's Town, on the Ballon River, he discovered a few members of one family who really were representatives of the *Atrychia universalis*; they had only a dozen hairs on their eyelids, and said that they were already a third generation of unhaired people. More details of this occurrence of *atrychia*, together with observations on inherited *hypertrichosis* (hairs covering all the body and face) were given by M. Maclay in a letter to Prof. Virchow which appeared in the *Verhandlungen* of the Berlin Anthropological Society for 1881, as well as several other papers on Australians ("Ueber die Mika Operation in Central Australien; Langbeinigkeit der australischen Frauen," &c.).

At Brisbane M. Maclay had at his disposal very rich anthropological material for the study of the comparative anatomy of the brain of the Australian, Melanesian, Malayan, and Mongolian races, as the authorities had given him all facilities for having fresh brains of representatives of all these races who died in the hospitals of the port, or were executed. The Survey Office of Brisbane offered him the use of its excellent photographs, which rendered him very great services. This rich material, left mostly at Sydney, has not yet been worked out by M. Maclay; but he can already state that the brains of different races afford substantial differences in the development of the *corpus callosum*, the *pons varolii*, and the cerebellum, as well as in the relative development of nerves and in the grouping of the sinuosities of the great brain.

Further interesting studies in comparative anatomy were made by M. Maclay on the brains of Marsupials, as well as of the *Ornithorhynchus*, the *Echidna*, and others. The chief occupation of M. Maclay in Australia being thus comparative anatomy, he proposed to the Linnean Society of New South Wales to open a biological station where everybody could "undisturbed and undisturbing" carry on biological and anatomical studies. The success which has met his proposal our readers already know of. The recently-founded "Australian Biological Association" will take care of the new station.

The Geographical Society not having at its disposal the necessary sums for publishing the scientific work which M. Maclay proposes to publish, the Emperor has allowed the sum of 2200*l.* for covering the expenses of the publication.

THE RECENT AND COMING TOTAL SOLAR ECLIPSES[1]

THE following note has been drawn up in anticipation of the detailed accounts of the work done by me in Egypt on the eclipsed sun of 1882, May 17, which I am preparing to lay before the Royal Society, because as the next total eclipse occurs next May, there is no time to be lost if any attempt is to be made to secure observations, and I am of opinion that such observations are most important.

I have prefaced the statement of the work done by a reference to the considerations which led me to undertake it, and I have added a scheme of observations which, in the present state of our knowledge is, I think, most likely to produce results of value.

1. In order to understand the recent change of front in solar research which has followed the introduction of the view of the possible dissociation of elementary bodies at solar temperatures, and suggested the later laboratory, and especially the later eclipse observations with which we are now chiefly concerned, we must first consider what facts we may expect on the two hypotheses. In this way we can see which hypothesis fits the facts best, and whether there are any inquiries possible during eclipses of a nature to throw light on the question.

2. On the old hypothesis the construction of the solar atmosphere was imaged as follows:—

(1.) We have terrestrial elements in the sun's atmosphere.

(2.) They thin out in the order of vapour density, all being represented in the lower strata, since the solar atmosphere at the lower levels is incompetent to dissociate them.

(3.) In the lower strata we have especially those of higher atomic weight, all together forming a so-called "reversing layer" by which chiefly the Fraunhofer spectrum is produced.

3. The new hypothesis necessitates a radical change in the above views. According to it the three main statements made in paragraph 2 require to be changed as follows:—

[1] Paper read at the Royal Society, Nov. 23, by J. Norman Lockyer, F.R.S

(1.) If the terrestrial elements exist at all in the sun's atmosphere they are in process of ultimate formation in the cooler parts of it.

(2.) The sun's atmosphere is not composed of strata which thin out, all substances being represented at the bottom ; but of true strata like the skins of an onion, each different in composition from the one either above or below. Thus, taking the sun in a state of quiescence and dealing only with a *section*, we shall have as shown in (Fig. 1) C say containing neither D nor B, and B containing neither A nor C.

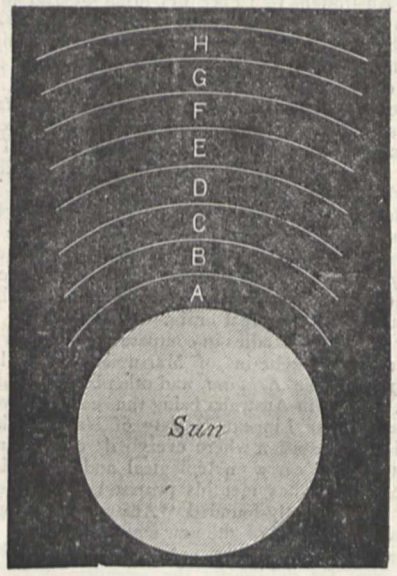


FIG. 1.

(3.) In the lower strata we have not elementary substances of high atomic weight, *but those constituents of all the elementary bodies which can resist the greater heat of these regions.*

4. The conditions under which we observe the phenomena of the sun's atmosphere have not, as a rule, been sufficiently borne in mind, and it is quite possible that the notion of the strata thinning out has, to a certain extent, been based more upon the actual phenomena than upon reasoning upon the phenomena.

5. Take three concentric envelopes of the sun's atmosphere, A, B, C, so that C extends to the base of A, and B also to the base of A, that is, in both cases to the photosphere. Then, whether we deal either with the sphere or a section of it, the lengths of the lines in the spectrum of the strata C, B, A will give the heights to which the strata extend from the sun, and show whether B and A respectively thin out. As the material is by hypothesis continuous down to the sun, the lines will be continuous down to the spectrum of the sun seen below as shown.

6. Now take three concentric envelopes, A, B, C, so that only A rests on the photosphere. The phenomena will *in the main* be the same as in the former case, *i.e.* the line C will still appear to rest on the spectrum of the photosphere, for it will be fed, so to speak, from C′ and C″, though absent along the line C B A at B and A.

7. Thus much having been premised with regard to the observations as conditioned by the fact that we are observing a sphere, we can now proceed to note *how the two hypotheses deal with the facts.*

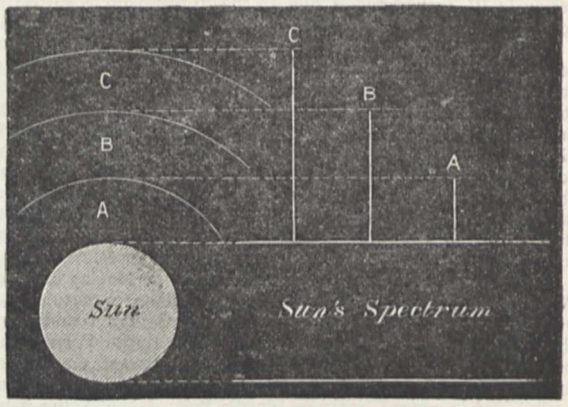


FIG. 2.

Old Hypothesis.	*New Hypothesis.*
1. The spectrum of each element as seen in our laboratories should be exactly represented in the solar spectrum.	The spectra should *not* resemble each other.
FACT.—There is a very wide difference between the spectra.	
2. Motion in the iron vapour, *e.g.* in a spot or a prominence, should be indicated by the contortion of all the iron lines equally.	Motion should be unequally indicated because the lines are due to divers constituents which exist in different strata according as they can resist the higher temperatures of the interior regions.
FACT.—The indications show both rest and motion.	

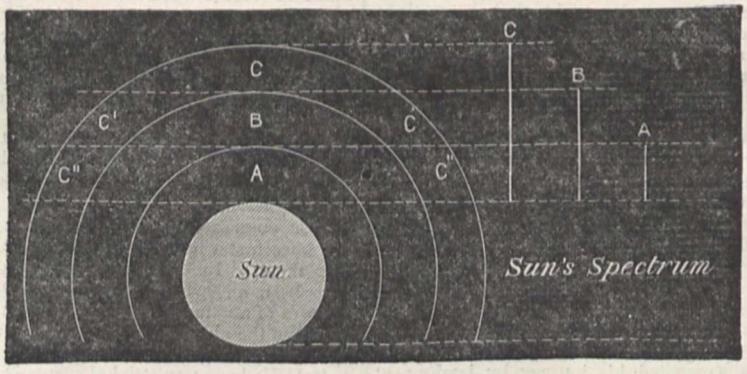


FIG. 3.

3. The spectrum of iron in a prominence should be the same as the spectrum of iron in a sun-spot.	The spectrum of iron in a prominence should be vastly different from the spectrum of iron in a sun-spot, because a spot is cooler than a prominence.
FACT.—The spectra are as dissimilar as those of any two elements.	

Old Hypothesis	*New Hypothesis*
4. The spectra of spots and prominences should not vary with the sun-spot period.	The spectra should vary because the sun is hotter at maximum.
FACT.—They do vary.	
5. The spectrum of the base of the solar atmosphere should most resemble the ordinary Fraunhofer spectrum.	The spectrum of the base should least resemble the Fraunhofer spectrum, because at the base we only get those molecules which can resist the highest temperatures.
FACT.—As a rule the lines seen at the base are either faint Fraunhofer lines, or are entirely absent from the ordinary spectrum of the sun.	
6. *Quâ* the same element the lines widest in spots should always be the same	*Quâ* the same element the lines widest in spots should vary enormously, because the absorbing material is likely to originate in and to be carried to different depths.
FACT.—There is immense variation.	
7. The spectra of prominences should consist of lines familiar to us in our laboratories, because solar and terrestrial elements are the same.	The spectra of prominences should be in most cases unfamiliar, because prominences represent outpourings from a body hot enough to prevent the coming together of the atoms of which our chemical elements are composed.
FACT.—When we leave H, Mg, Ca, and Na, most of the lines are either of unknown origin or are feeble lines in the spectra of known elements.	

8. From the above sketch, hasty though it be, it is, I think, easy to gather that the new view includes the facts much better than the old one, and in truth demands phenomena and simply and sufficiently explains them, which were stumbling blocks and paradoxes on the old one.

This being so, then, it is permissible to consider it further.

9. Let us first suppose, to take the simplest case, that the sun when cold will be a solid mass of one pure element, *i.e.* that the evolution brought about by reduction of temperatures shall be along one line only. Let us take iron as the final product.

(3.) We shall rarely, if ever, see the darkest lines affected in spots and prominences.

(4.) The germs of iron are distributed among the various strata according to their heat-resisting properties, the most complex at L, the least complex at A.

(5.) Whatever process of evolution be imagined, as the temperature runs down from A to L, whether A, 2A, 4A; or A+B, 2[2(A+B)], or X+Y+Z, the formed material or final product is the work of the successive associations rendered possible by the gradually lowering temperature of the successive strata, and can therefore only exist at L.

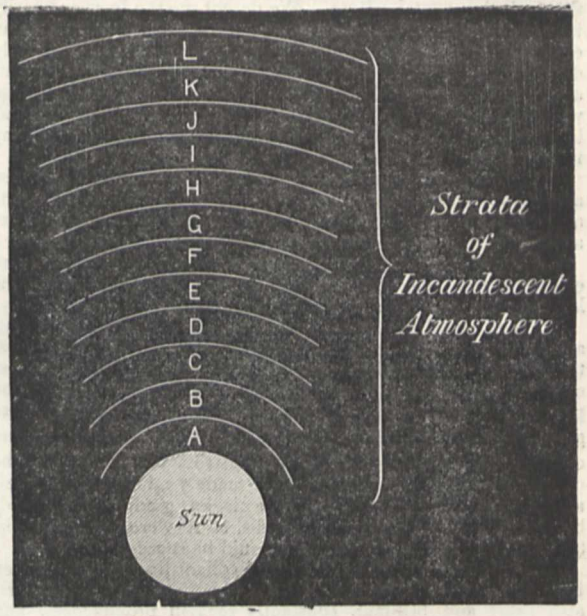


FIG. 4.

10. Now at this point a very important consideration comes in. It was stated (in 6) while discussing the conditions of observation, that whether we were dealing with strata of substances extending down to the sun or limited to certain heights, the spectral lines would always appear to rest on the solar spectrum, and that the phenomena would *in the main* be the same

11. This, however, is true in the main only, there must be a difference, and this supplies us with a test between the rival

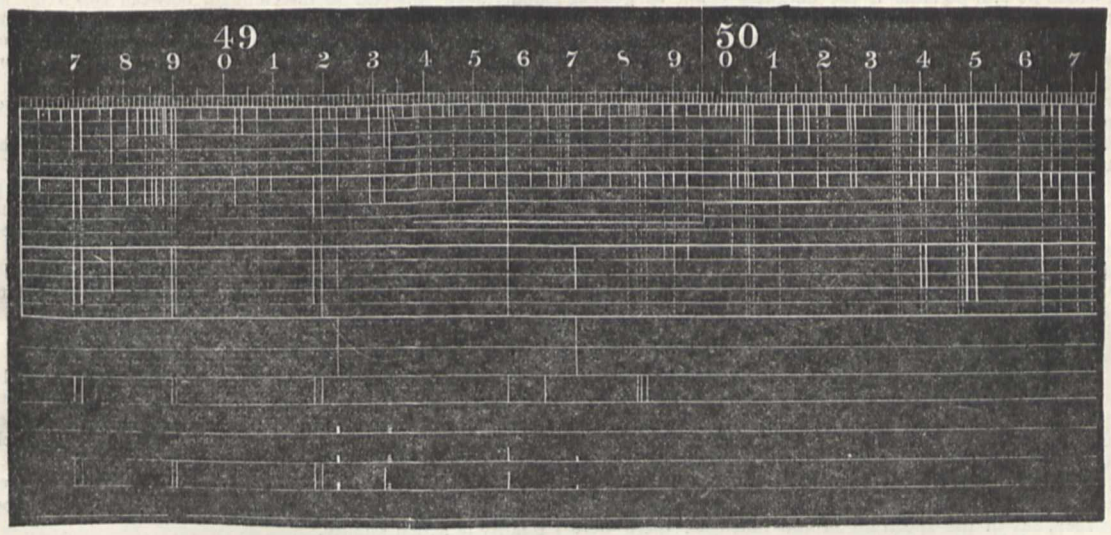


FIG. 5.

Then the sun's atmosphere on the new theory *quâ* this one element may be represented as follows:—

Assume strata A—L. Then—

(1.) The Fraunhofer spectrum will integrate for us the absorption of all strata from A to L.

(2.) The darkest lines of the Fraunhofer spectrum will be those absorbed nearest the outside of the atmosphere.

hypotheses of the greatest stringency. The stratum B, being further removed from the photosphere than the stratum A, will be cooler, its lines therefore will be dimmer, and the lines of C will be dimmer than the lines of B, and so on. So if we could really observe the strata, *the longer a line is, i.e.*, the greater the height at which the stratum which gives rise to it lies, *the dimmer the line will be.*

12. Now our best chance of making such an observation as this is during a total eclipse. We do not see the lines ordinarily in consequence of the illumination of our air. As during an eclipse before totality the intensity of this illumination is rapidly diminishing, the lines first visible should be short and bright, and should remain short while the new lines which become visible as the darkness increases should be of gradually increasing length, so that the spectrum should become richer in the way indicated in Fig. 5.

13. Further, the lines in 1 should be lines seen in prominences, and not in spots, and relatively brighter in the spark than in the arc, while the longer lines added in 2 and 3 should be lines affected in spots, and *not* in prominences.

14. All these phenomena were predicted for the Egyptian eclipse a year before its occurrence, and were verified to the letter for the lines of iron over a purposely limited region.

15. The actual observations of the iron lines made at Sohag are shown in the accompanying map, and these actual observations are contrasted with the lines thickened in spots, the lines observed in the prominences by Tacchini, those intensified on passing from the arc to the spark. The Fraunhofer lines are also given according to Ångström and Vogel, and the iron spectrum of the arc and spark according to Ångström and Thalén. The observations during the eclipse were made 7 minutes, 3 minutes, and 2 minutes before totality as the air was gradually darkened, by which darkening, successive veils, as it were, were lifted so that the more delicate phenomena could be successively seen.

16. We begin with one short and brilliant line constantly seen in prominences, never seen in spots. Next, another line appears, also short and brilliant, constantly seen in prominences, and now, for the first time, a longer and thinner line appears, occasionally noted as widened in spots, while last of all we get very long, very delicate relatively, two lines constantly seen widened in spots, and another line not seen in the spark and never yet recorded as widened in the spots.

17. The procession from the hot to the colder is apparent, and the simplicity of the spectrum as opposed to the Fraunhofer spectrum even yet, is eloquent of the gradual approximation which would be still possible if the darkness could be greater and our attack more complete.

18. It will be noted over what an excessively small range the observations extend. We want similar observations over a wider range during future eclipses, and to do this work properly many observers armed with similar instruments must divide the whole or part of the solar spectrum amongst them, preferably that part between F and D which has been most closely watched in prominences and spots by Tacchini and myself.

19. I next pass to another point on which an observation was made in Egypt.

20. In Fig. 4 we considered the sun's atmosphere, taking the simplest case, that of one element; but evolution and the chemistry of our earth teach us that when the sun cools it will be a very complex mass chemically. If the laws of evolution hold we need not expect that this will largely increase the complexity of the hottest layers A and B, but higher up, say at H—L, the complexity of chemical forms produced by evolution along the fittest lines will be very considerable.

21. These strata H—L may be taken to represent the corona. Its spectrum, therefore, should not be a continuous one, but should consist of an integration of all the radiations and absorptions of these excessively complex layers.

22. The spectrum of the corona, as I saw it in Egypt exactly answered to this description. Instead of the gradual smooth toning seen, say in the spectrum of the limelight, there were maxima and minima producing an appearance of ribbed structure, the lines of hydrogen and 1474 being, of course, over all. This observation, however, requires confirmation, for the look I had at the corona spectrum was instantaneous only.

23. This observation should certainly be repeated during future eclipses with the proper instrumental conditions, *i.e.* small intensely bright image on narrow slit and spectroscope of small dispersion. I believe that, under these conditions, photographs could readily be obtained with the new plates.

24. Now an eclipse occurs next May at a critical time of the sun's activity, for, so far as we can see, we shall be nearly at sun-spot maximum, and I hold that it will be a disgrace to our nineteenth century science, if efficient steps are not taken by those who are regarded as the leaders of science in this and other civilised countries to secure adequate observations.

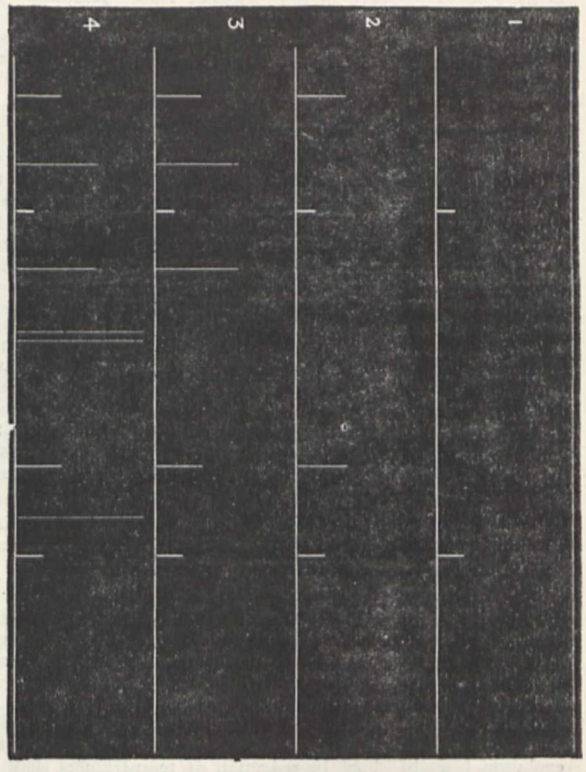


FIG. 6.

25. So far I have only referred to those special observations undertaken this year to discriminate between two rival hypotheses, but both hypotheses may be wrong in many points, so that we must not limit ourselves to such observations, but collect facts over the whole field, as has always been the custom in eclipse expeditions.

26. In my opinion the following scheme shows the observations which, in the present state of our knowledge, it is *most desirable* to secure. The scheme, I am aware, is by no means exhaustive. I give the observations in the order of importance I attach to them, having regard to the present position of solar theory and the conditions of eclipse observations.

(1.) 6-inch equatorial of long focus, perfect clockwork, spectroscope with dispersion of at least five prisms of 60°.

Clamp point of disappearance of sun at base of normal slit, and record phenomena observed from ten minutes before totality to actual totality.

a. Order in which lines appear.

b. Brightness and length when first visible.

The spectrum from λ 4800 to λ 5900 should be distributed among at least nine observers.

Repeat observations after totality on point of reappearance.

(2.) 6-inch photographic lens of 4-feet focus, perfect clock, same dispersion as above.

Clamp point of disappearance of sun on centre of tangential slit and record phenomena observed from ten minutes before totality to actual totality.

a. Order in which lines appear.

b. Brightness and length when first visible.

Repeat observations after totality on point of reappearance. Same part of spectrum, same distribution as in (1).

(3.) 6-inch photographic lens as in (2).

Photographic phenomena before and after totality on slowly ascending or descending or rotating plate, taking care to expose only narrow strip of plate.

(4.) Ditto. Spectroscope of small dispersion, long slit.

Photograph spectrum of corona during totality on both sides of dark moon.

(5.) Prismatic camera. 6-inch photo. lens as in (2), but with grating.

Use first order spectrum on one side and second order on the other.

Commence two minutes before totality. Continue till two minutes after totality on gradually ascending or descending or rotating plate.

(6.) 6-inch photo. lens as in (2), mounted on alt-azimuth. Fine slit. One prism of 60°. To observe spectrum of corona.

(7.) Photographs of corona of short, medium, and very long exposure to determine form and true solar limit of apparent corona due to the illumination of our air, using for the latter purpose the photographic intensity of the image of the moon.

I am aware that because Solar Physics is a new subject, and one so entirely in the domain of pure science, the above scheme may appear ridiculous to many, for if carried out in its completeness its cost would perhaps amount to the sixtieth part of the sum expended on the Transit of Venus in 1874. I have, however, felt myself bound to put it forward as an ideal scheme and one which, if several civilised Governments do each a little, concerted action may help us in part to realise. I am informed that the French and Italian Governments are already making preparations for observations, and my desire is that we may be represented on an occasion which, having regard to the duty which is incumbent upon us to secure observations for the use of those who come after us, is one of high importance.

SCIENTIFIC SERIALS

The American Naturalist, November, 1882, contains:—On the ancient man of Calaveras, by W. O. Ayres.—On the grey rabbit, by S. Lockwood.—On the genus Nebalia and its fossil allies, representing the order Phyllocarida, by A. S. Packard, jun.—American work on recent mollusca, 1881, by W. H. Dall.—Progress of invertebrate palæontology in the United States in 1881, by C. A. White.—On the number of bones at present known in the pectoral and pelvic limbs of birds, by R. W. Shufeldt.—The Editor's table—Recent literature.—General notes.

Zeitschrift fur wissenschaftliche Zoologie, Bd. 37, Heft 3, November 1, 1882, contains:—On the structure and development of *Dinophilus apatris*, by Dr. E. Korschelt (plates 21 and 22). The author would place the forms belonging to this genus in a new family of the Turbellaria.—Studies among the Lampyridæ, by H. Ritter v. Wielowiejski (plates 23 and 24).—On the deposition of bone in the skeleton of bony fishes, by Max Köstler (plate 25).—On the origin and development of the green cells in Hydra, by Dr. Otto Hamann (plate 26); see remarks on this paper by Prof. Lankester, NATURE, vol. xxvii. p. 87.

Bulletin de la Soc. Imp. des Naturalistes de Moscou, 1882, No. 1, contains:—On the geology of the Windimir district, by H. Trautschold.—New lepidoptera of the Amur land, by H. Christoph (conclusion).—On the stone-growth of Sarepta—list of the Staphylinidæ, and on some new plants of Sarepta, by A. Becker.—On the geographical distribution of the hop in ancient times, by Dr. C. O. Cech.—A protest relative to palæontological nomenclature, by H. Trautschold.—Remarks on some anomalies found in the form and colour of the plants in the various countries of the Russian territory, by Dr. A. von Riesenkampff.—Note on an instrument to measure the intensity of gravity, by A. Issel.—On crinoids, addenda and corrigenda, by H. Trautschold.—Materials for a fauna of the Black Sea, fasc. iii. Vermes, by V. Czerniavsky. In Russian, but the diagnoses of new genera and species are in Latin.

Revue internationale des Sciences biologiques, October 15, 1882, contains:—Translation of Prof. Pringsheim's "Researches on Chlorophyll."—M. Roujon, on the faculty of speech in mammals.—Prof. Abel, on the dangerous properties of fine coal dust (translation).—M. Viguier, on orientation and its organs in animals and in man.—*Proceedings* of the Academy of Sciences, Paris.

Rendiconto delle Sessioni dell' Accademia delle Scienze dell' Istituto di Bologna, 1881-82.—We note the following: On the succenturiate spleen of the dog, and on the reproduction of the spleen by pathological processes that have abolished the function of that viscus, by S. Tizzoni.—On adaptation of species to environment; new researches on the genetic history of Trematodes, by S. Ercolani.—On the craniology of lunatics, by S. Peli.—On congenital deviations of the vertebral column in domestic animals, by S. Gotti.—Function of the cœcum and the rest of the large intestine, by S. Vella.—On polydactylia and polymelia in man and vertebrates, by S. Ercolani.—On the variations and the course of the river Po, by S. Predieri.—Meteorology applied to the study of botany, with a description of a new geothermometer, by S. Bertoloni.—On some new electric figures, by S. Villari.—On electric shadows, by S. Righi.—On the minute anatomy of the muscles in insects which move their wings, by S. Ciaccio.—The elevation of the Bolognese Apennines by direct action of gravity and of lateral pressures, by S. Bombieri.—Experimental researches on nerve-stretching, by S. Rossi.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, November 23.—"Monthly Means of the Highest and Lowest Diurnal Temperatures of the Water of the Thames, and Comparison with the corresponding Temperatures of the Air at the Royal Observatory, Greenwich." By Sir George Biddell Airy, K.C.B., F.R.S., late Astronomer Royal.

The observations were instituted at the suggestion of the conductors of the Medical Department in the Office of the Registrar General of Births, Deaths, and Marriages, with the view of supplying some knowledge of an element which may possibly affect the sanitary condition of the metropolis. The plan of observations was arranged at the Royal Observatory of Greenwich; and the instruments were procured and mounted, and repaired when necessary, under the care successively of James Glaisher, Esq., and William Ellis, Esq., superintendents of the Magnetical and Meteorological Department of the Observatory. The self-recording instruments were attached to the hospital ships successively anchored in the Thames, nearly opposite to Greenwich; and their records were read and registered by the medical officers of those ships, and these written registers were transmitted every week to the Royal Observatory.

I have been favoured by Mr. Ellis, who, at my request, has kindly superintended the preparation of the results of observations of thermometers in the water of the Thames, with the following remarks on the nature of the observations and the elements for their reduction.

"The thermometers were inclosed in an upright wooden trunk attached to the side of the ship, its lower portion projecting into the water; the trunk was closed at the bottom; the closing plate, and that portion of the sides which was under water, being perforated with holes, to allow the water easily to flow through. The thermometers were suspended in the trunk, so as to be about two feet below the surface of the water, and one foot above the bottom of the trunk.

"The instruments employed throughout were, one for highest temperature, and one for lowest temperature. For highest temperature two constructions have been successively used: the earlier, in which the mercury, with rising temperature, pushes up a steel index, leaving it detached when the temperature falls; the later, in which the column of mercury becomes divided on fall of temperature, the principal portion of the column being left in the tube. For lowest temperature, a spirit thermometer was employed, its index being contained within the column of spirit. The index-errors of the two thermometers in use were properly determined, and corrections for them were applied when necessary.

"The thermometers were read every morning at 9 a.m.

"The observations of atmospheric temperature at the Royal Observatory were made with the thermometers in ordinary use at the elevation of 4 feet above the ground."

It will be remarked that the indications of the thermometers in the Thames were read only once in each day. I could have wished that a greater number of readings could have been taken, sufficiently numerous to exhibit the dependence of the temperature of the Thames-water upon the phase of the tide. But under the circumstances this was impracticable. To establish a self-registering apparatus was out of question; and if on a few occasions we had gone through the labour of making observations at every hour of day and night, the conclusions deduced from those few instances might have been vitiated by accidents. But I am able to assert positively, as a result from the reductions to be exhibited in the following pages, that nothing has been lost from the restriction of the plan of observation. It will be seen that

the daily change of temperature, produced by the aggregate of strictly diurnal change (depending on the solar hour) and tidal change (depending on the moon's apparent position) is so small that it is impossible to attach with any certainty a sensible value to either of these causes.

I now proceed to describe the principal steps in the reduction of the observations.

In the weekly publication of these observations by the Registrar General, the weekly means of each observed element were also exhibited. In preparation for a detailed publication of the whole, I had the entire series of these weekly means collected, each being accompanied with notes of the principal phases of the moon, the occurrence of remarkable storms, &c., occurring within the week. (This *résumé* exists, and is available for any discussion which might be suggested; I propose to offer it for deposit at the Royal Observatory.) But on general examination of the collected means, I did not perceive that any result could be expected which would justify the labour and expense of printing the whole. For instance, if there were any remarkable dependence on the phase of tide, different values for the "excess of mean temperature of the water above mean temperature of the air" would occur in the weeks which included respectively new moon, first quarter, full moon, third quarter, and these would recur with little alteration for several months. But on general examination, I do not see anything which would justify more technical discussion directed to this point. Finally I decided on exhibiting only the means of deductions as to temperature for each calendar month, and omitting all other phenomena. As the succession of weeks and the succession of entire months do not generally coincide, the rule was established to adopt the first entire week in each calendar month as the first of the weeks to be used, in conjunction with three or four weeks following, to form the monthly mean. Thus, some months contain four weeks, and some contain five weeks. For instance, the month of March, 1846, contains the five weeks, March 1–7, 8–14, 15–21, 21–28, 28–April 4; but the next month contains only the four weeks—April 5–11, 12–18, 19–25, 26–May 2.

By this system, the results, as far as they appear to possess any value, are brought into the compass of five convenient Tables of Double Entry, which, with their columnar and lateral means, appear to give all the information that can be desired. The contents of the several tables are :—

Table I. Monthly Mean Temperature of the Water of the Thames.

Table II. Monthly Mean Atmospheric Temperature at the Royal Observatory.

Table III. Monthly Mean Excess of Thames Temperature above Observatory Atmospheric Temperature.

Table IV. Monthly Mean of Diurnal Range of Temperature of the Water of the Thames.

Table V. Monthly Mean of Diurnal Range of Atmospheric Temperature at the Royal Observatory.

The last line only of each of these tables is given in the present communication to NATURE.

Monthly Means, through a Range of Thirty-five Years, of the Principal Elements of the Temperature of the Water of the Thames

Month.	Temperature of the water of the Thames.	Atmospheric temperature at the Royal Observatory.	Excess of temperature of the Thames above atmospheric temperature.	Diurnal range of temperature of the Thames.	Diurnal range of atmospheric temperature.
	°	°	°	°	°
January	39·4	38·9	+0·5	1·9	9·6
February ...	40·7	40·4	+0·3	2·0	11·5
March	43·6	42·8	+0·8	2·0	15·0
April	50·0	48·7	+1·3	2·3	18·5
May	56·3	54·4	+1·9	2·4	19·9
June	62·6	60·6	+2·0	2·2	20·5
July	65·7	63·9	+1·8	2·1	21·2
August	64·4	62·6	+1·8	2·0	19·6
September ...	59·9	57·9	+2·0	1·9	18·1
October	52·9	50·7	+2·2	2·0	14·3
November ...	44·3	42·3	+2·0	2·1	11·3
December ...	40·4	39·8	+0·6	2·1	9·1

And the following appear to be the legitimate epitomised inferences :—

(1). The mean temperature of the Thames-water is higher than that of the Observatory thermometers by 1°·5. But the locality of the Observatory thermometers is, in hypsometrical elevation, about 160 feet above that of the Thames thermometers. It would seem probable therefore that the mean temperature of the water is higher than the climatic temperature by only a small fraction of a degree.

(2). This difference is not uniform through the year. With some irregularities, the greatest excess of Thames temperature occurs in September, and the least in February. But the autumnal difference exceeds the spring difference by only 1°·6. It seems not improbable that this is the effect of a slight communication with the sea, whose surface-waters have accumulated in autumn the effect of solar radiation through the summer; with contrary effect at the opposite season.

(3). The mean range of temperature through the day is 2°·1. And this expresses the numerical change from the lowest solar temperature, or the lowest temperature in the first tide, or the lowest temperature in the second tide (whichever may be the lowest), to the highest solar temperature, or the highest temperature in the first tide, or the highest temperature in the second tide (whichever may be the highest). It is evident that the change of temperature due to the diurnal change of solar action, and the change of temperature due to each of the tides, must each, individually, be very small.

(4). It appears to me that the fundamental inference must be this: that the material water is very little changed at Greenwich by the tide. Although a vast body of water rushes up at every flow, running with great speed, and sometimes raising the surface by 20 feet, yet nearly the same water runs down at ebb, and is again brought up, with all its contents, at the next flow. These expressions are to be taken as modified by the descent of fresh water from the land; but the amount of that water must be small, in comparison with the mass which it joins in the Thames at London.

(5). I do not imagine that the tidal action has any beneficial effect on the climate of London, except that probably the agitation of the water produces mechanical agitation of the air, and thus destroys injurious stagnation.

Mathematical Society, December 14.—Prof. Henrici, F.R.S., president, in the chair.—Messrs. T. Woodcock, Hugh Fraser, Major Allan Cunningham, R.E., and Capt. P. A. Macmahon, R.A., were elected members.—The chairman announced that in consequence of ill-health Mr. C. W. Merrifield, F.R.S., had been obliged to resign the office of treasurer, and that the council had elected Mr. A. B. Kempe, F.R.S., to undertake the duties of the office. Dr. Hirst spoke in feeling terms of the work Mr. Merrifield had done for the Society, and in accordance with his suggestion a vote of thanks for his services in the past, and of condolence with him on account of the reasons which had led him to sever his official connection with the Society was carried.—The following communications were made :—On the vibrations of a spherical shell, by Prof. H. Lamb.—On the absolutely least periods of the elliptic functions, by Prof. H. Smith, F.R.S.—On certain relations between volumes of loci of connected points, by Mr. E. B. Elliott.—Geometrical proof of Griffiths' extension of Graves' theorem, by Mr. J. J. Walker.—On polygons circumscribed about a tricuspidal quartic, by Mr. R. A. Roberts.—Note on an exceptional case in which the fundamental postulate of Prof. Sylvester's theory of Tamisage fails, by Mr. J. Hammond.—On certain quartic curves, which have a cusp at infinity, whereat the line at infinity is a tangent, by Mr. H. M. Jeffery, F.R.S.

Zoological Society, November 28.—Prof. W. H. Flower, F.R.S., president, in the chair.—Mr. W. B. Tegetmeier exhibited and made remarks upon the skull of a rhinoceros from Borneo; also the horns of a buffalo and deer from the same country.—Mr. J. E. Harting exhibited a specimen of the South African Eagle-Owl (*Bubo maculosus*), said to have been obtained many years ago near Waterford in Ireland.—Mr. R. Bowdler Sharpe exhibited and made remarks on some specimens of Swifts from the Congo. Mr. Sharpe also exhibited a specimen of *Machærhamphus alcinus* which had been obtained in Borneo by Mr. Everett.—A communication was read from Prof. Owen, C.B., on the sternum of *Notornis* and on sternal characters.—A communication was read from Dr. A. B. Meyer, C.M.Z.S., in relation to the adoption by naturalists of an international

colour-scale in describing the colours of natural objects.—A communication was read from Dr. W. Blasius, of Brunswick, containing a description of a small collection of Birds made by Dr. Platen in the island of Ceram. The collection contained 49 specimens referable to 21 different species, one of which was new to the fauna of Ceram.—A communication was read from Mr. E. P. Ramsay containing the description of a new species of *Monarcha* from the Solomon Islands, proposed to be called *Monarcha* (*Piezorhynchus*) *browni*.—Mr. W. Bancroft Espeut read a paper on the acclimatisation of the Indian Mungoos (*Herpestes griseus*) in Jamaica. The author explained that the object in introducing the Mungoos into Jamaica was the destruction of the rats, which had committed serious ravages among the sugar and coffee crops. The first Mungooses were introduced in 1871, and so beneficial was the effect produced, that the saving to the sugar and coffee planters now was estimated at least at 100,000*l*. a year.—Lieut.-Col. Godwin-Austen read a paper describing specimens (male and female) of *Phasianus humiæ*, Hume, which had been obtained by Mr. Ogle on the peak of Shiroifurar in North-East Munipur, upon the Naja Hills.—A communication was read from Mr. A. Thomson containing the results of some observations made by him during the rearing of a species of Stick-insect (*Bacillus patellifer*) in the Society's Insect-house.

Chemical Society, December 7.—Dr. Gilbert, president, in the chair.—The following papers were read:—On the condensation products of oenanthol, by W. H. Perkin, jun. The author has endeavoured to obtain evidence as to the constitution of these bodies. By the action of dilute alcoholic potash on oenanthol, an acid, $C_{14}H_{26}O_2$, was formed, boiling at 270°-298°, and two aldehydes, $C_{14}H_{26}O$, boiling 277°-279°, and $C_{28}H_{50}O$, boiling 330°-340°. Zinc chloride forms with oenanthol principally $C_{14}H_{26}O$; nascent hydrogen converts this last substance first into an alcohol, $C_{14}H_{28}O$, and finally into the alcohol, $C_{14}H_{30}O$. Alcoholic potash converts $C_{14}H_{26}O$ into heptylic acid and an acid, $C_{14}H_{26}O_2$. The author concludes that the substance $C_{14}H_{26}O$ is hexylpentylacrylic aldehyd.—On the condensation products of isobutyl aldehyd, by W. H. Perkin, jun. Fossek has also recently worked on this subject, but has used aqueous potash, the action of which seems to be very different from that of alcoholic potash. Thus the latter forms an acid, $C_{12}H_{22}O_3$, not solidifying at − 10°. Fossek obtained with aqueous potash an acid, $C_8H_{16}O_3$, melting at 75°. The author prepared an aldehyd, $C_{12}H_{22}O_2$, and from this, by nascent hydrogen, an alcohol. By the action of stronger potash upon isobutyl-aldehyde, higher condensation products were obtained.—On a condensation product of phenanthraquinone with ethylic acetoacetate, by F. R. Japp and F. W. Streatfield. This substance has the formula $C_{20}H_{16}O_4$, and crystallises from benzene in white silky needles, fusing at 185°; it is ethylicphenanthroxyleneacetoacetate; by treatment with hydriodic acid it forms ethylicphenanthroxylenisocrotonate, fusing at 124°. A new acid and a new compound, which the authors believe to be the desoxybenzoin of phenanthrene, have also been obtained.—On the constitution of lophin, by Dr. Armstrong. The author considers that the symmetrical formula proposed by Radziszewski is to be preferred to that proposed by Dr. Japp.—On the constitution of basic ferric sulphate, by S. U. Pickering. By the determination of its molecular weight, this salt has the formula $Fe_2(SO_4)_3$, $5Fe_2O_3$.—On the chemistry of Hay and "Ensilage," by F. W. Toms.—On certain brominated carbon compounds obtained in the manufacture of bromine, by S. Dyson. In a bye-product the author has detected carbon tetrabromide, bromoform, and chlorobromoformi—Note on the preparation of diphenylenketone ether, by W. H. Perkin.

Anthropological Institute, November 28.—General Pitt-Rivers, F.R.S., president, in the chair.—Dr. W. G. Parker read a paper on the language and people of Madagascar. The language belongs to the Malayo-Polynesian group, being most nearly allied to the Malay proper. The various dialects, numbering more than sixteen, are essentially only one language. It is soft, musical, phonetic, and easily learned by Europeans. Until the early part of the present century it was a spoken language only, but the English missionaries reduced it to its present form, our own English alphabet being adopted, with the exception of the letters *c*, *q*, *u*, *w*, *x*, which have no equivalent sounds in Malagasy. The vowels are four in number, and the consonants sixteen, pronounced as in English, with the exception of *g*, which is always hard (as in *gate*), and *j*, which has the sound of *dz* (as in *adze*). There are only two real diphthongs. In pronunciation every vowel or diphthong must be clearly sounded, and the accents properly placed, because often the alteration of one vowel, or of the place of the accent, is the only means of distinguishing similar sounding words. The author then gave the six chief rules of syntax, and explained the grammatical structure of the language. In the second part of the paper the peculiar geographical position of Madagascar was first noticed. Its estimated population (from four to four and a half millions), and its chief structural features, with a special notice of the central plateau. There are a great many tribes in Madagascar, but all are divisible into two distinct classes, according to their race-origin, Malay and African. Their forms of government are (1) petty absolute monarchies over the greater part of the island; (2) among the Hovas tribe it is nominally an absolute monarchy, really an oligarchy, the head of which has almost regal power. The office of *Prime Minister* is not peculiar to the Hovas, tribes on the north and west coasts also possessing the same institution; but only among the Hovas is the Prime Minister not only the factotum, but also the "ex-officio husband to the queen." A short sketch of the new code of Hova laws was next given, this being the only tribe which possesses a code of laws. An outline of the history of Madagascar was given, showing the origin of the present form of government among the Hovas, the tribe which seeks to possess the entire island. Lastly, reference was made to the French claims against Madagascar, now being put forward, and their effect upon British interests. These claims are: (1) the demand that French subjects should be allowed to buy, sell, and own land in Madagascar; (2) the claims of private individuals; (3) the establishment of a French Protectorate over a large part of the island. The French are now acting in accordance with a preconcerted (and published) plan for invading and conquering the whole of the island. As affecting the interests of the British Empire, the possession of Madagascar by France will enable that Power, if at war with us, to endanger or even stop our lines of communication with our Indian, Australian, and other colonies, by the Red Sea and the Cape of Good Hope route. In the discussion that followed the Rev. James Sibree, the Rev. W. C. Pickersgill, Prof. Gustav Oppert, Mr. A. H. Keane, and others took part.

BERLIN

Physiological Society, November 24.—Prof. Du Bois-Reymond in the chair.—Dr. A. Fraenkel read a paper upon the further results of experiments which he had made in conjunction with Dr. Geppert to determine the influence of a rarefied atmosphere upon the animal organism. Some of the results of these investigations had been brought before the last meeting of the Society by Dr. Geppert (*antea*, p. 120). Besides the general phenomena and the behaviour of the gases of the blood in animals which breathe in a rarefied atmosphere, investigations were made as to the influence of rarefaction upon blood-pressure. The blood-pressure was read off upon a manometer which was outside the box in which the animal, the subject of experiment, was kept exposed to various degrees of rarefaction. One arm of the manometer communicated through the side of the box with an artery of the animal, while the other arm was in communication with the general cavity of the box. When the atmospheric pressure sank to half the normal amount, the blood-pressure showed no change; when the pressure sank to a third of an atmosphere, a small rise took place in the blood-pressure. This rise, however, passed away during the sleep that occurred under the influence of this amount of rarefaction, and the pressure became normal again. When the air was still further rarefied till the pressure was as low as one quarter of an atmosphere or less, the pulse became weak and small, the blood pressure went down, and then if normal quantities of oxygen were not quickly restored, the heart stopped. The chief aim of the whole investigation was the definite determination of the influence of a rarefied atmosphere upon metastasis (Stoffwechsel), upon which question, up to the present, only few, and even these contradictory, data were existent. The authors agreed in general with M. Paul Bert, in regarding the effect of a rarefied atmosphere as inducing a chemical change which was brought about by a diminished supply of oxygen. The amount of urea secreted in the twenty-four hours was taken as the measure of metastasis. During a lengthened period of observation on those days in which the animals thus experimented on had the same amount of food, the quantity of urea secreted in the twenty-four hours remained constant. Nor was there any alteration in the amount of urea when they were exposed to variations of pressure down to half an atmosphere.

On the diminution of the pressure to one third of an atmosphere, at and under which pressure the amount of oxygen contained in the blood is markedly diminished, and the animal falls into a deep sleep, there was, after this degree of rarefaction had lasted several hours, a very remarkable increase in the amount of urea. This increase did not occur till the next day in the case of animals which had been fed, whereas it occurred on the day of the experiment in the case of those animals which were kept hungry, but it in all cases lasted over a couple of days after the experiment. Dr. Fraenkel's belief is that the rarefaction influences the metastasis by depriving the blood and the tissues of some of their necessary oxygen, and that this want of oxygen entails an excessive destruction of albumen, the constituents of which are in part deposited as fat, and in part are changed into urinary products. Besides the increased elimination of urea, fatty degeneration of tissues (*e.g.* of the heart) is observed when the system is in want of oxygen.

PARIS

Academy of Sciences, December 11.—M. Jamin in the chair.—M. Faye presented the *Connaissance des Temps* for 1883, and noted some improvements.—Observation of the transit of Venus in the Argentine Republic, by M. Mouchez. Good observations were made at the two stations, by MM. Beuf and Perrin.—M. Mouchez stated that the weather prevented observations on the Pic du Midi.—Installation and preliminary operations of the mission for observation of the transit of Venus, at Fort-de-France, by M. Tisserand.—Observations of the transit at Marseilles Observatory, by M. Stephan. There were five observers. The phenomenon was seen through a veil of vapours, and M. Stephan does not think this unfavourable; perhaps, indeed, it is the best condition possible (the solar intensity being weakened), if the observer do not lose his *sang-froid*, through fearing too great obscuration. The black drop was not seen. (Data for the first two contacts are furnished.)—New facts concerning rabies, by M. Pasteur, with MM. Chamberland, Roux and Thuillier. All forms of rabies come from the same virus. Death after inoculation with rabid saliva may be either from a microbe found in the saliva, from formation of much pus, or from rabies. The virus of rabies is found not only in the *medulla oblongata*, but in the brain and spinal cord. Rabies may be produced certainly and quickly, either by trepanation and inoculation, or by intravenous injection. The symptoms are different in the two cases. Animals sometimes recover after the first symptoms of rabies, never after the acute symptosm. The authors have now four dogs which cannot take rabies, however inoculated. Whether this is from having had a mild form of it and recovered, or from being naturally refractory, he cannot at present say.—Separation of gallium, by M. Lecoq de Boisbaudran.—New studies tending to establish the true nature of *glairine* or *barégine*, and the mode of its formation in the thermal and sulphurous waters of the Pyrenees, by M. Joly. The concrete glairine of chemists, found in all those waters, consists essentially of detritus of a host of animals and plants, with some inorganic substances (crystals of sulphur, sulphate of iron, silica, &c.), and very often *Sulphuraria*, a true *Oscillator*.—On the conservation of solar energy; reply to Dr. Siemens, by M. Hirn.—Examples of black seen as orange red, by M. Trécul. A lady's black veil, in full sunlight, seemed orange red at the nodes of the tissue, while the internal parts remained black. The dye in this case was a very dark blue; and the orange-red is complementary.—Effects of lightning on the top of the Puy-de-Dôme, by M. Alluard. The anemometer cups (of red copper) at the top of an iron mast (6 m. high, and having a ladder and stand largely iron; also connected with earth plates), all show traces of fusion in their upper parts, and the fused matter is raised as a cone. (St. Elmo's fire often appears at the salient points of the mast, &c.)—Observations made during the viticolar campaign 1881–82, by M. Boiteau.—Factitious purulent ophthalmia produced by the liquorice Iana, or jequirity, by M. Moura-Brazil.—M. de Lesseps presented a note on M. Wiener's explorations in the regions of the Amazon.—The Secretary read telegrams from Brazil, Washington, Oran, Nice, Bordeaux, &c., regarding the transit of Venus.—Observation of the transit at Châtsandun, by M. Lescarbault. He describes a greyish yellow luminous fringe seen all round the planet when this was three-fourths on the sun; it persisted till entrance was completed.—Observations of the transit at the Roman College, by P. Tacchini. He observed the contacts successfully with the spectroscope applied to a Merz refractor; while Prof. Millosevich observed in the ordinary way. He verified the absorption by the Venus atmosphere, found the planet's diameter 67″·25, &c.—Observations of solar spots and faculæ during the third quarter of 1882, by the same. The spots show a diminution, with well-marked secondary minimum in August. The faculæ had nearly the same extension as in the preceding quarter. While their size diminishes, that of the spots increases.—On the great solar spot of November, 1882, and the magnetic perturbations that accompanied its appearance, by the same. It showed maximum activity at the middle of the disc, and afforded the rare opportunity of distinguishing solar protuberances in the disc as easily as on the limb.—Observations of the great Southern Comet, by M. Jacquet. A sketch is furnished, taken on board the *Niger*, at the mouth of the Rio de la Plata.—On Fourier's series, by M. Halphen.—On solids of equal resistance, by M. Léauté.—On a communication of M. Deprez, relative to the transport of force, by M. Lévy.—Displacements and deformations of sparks by electrostatic actions, by M. Righi.—On the atomic weight of yttrium, by M. Cléve. He obtains 89·02 and 88·9, with different values for O and S.—On a fish at great depths in the Atlantic, the *Eurypharynx pelecanoides*, by M. Vaillant. This was brought up from a depth of 2300 m. off the coast of Morocco, during a cruise of the *Travailleur*. It is about a foot and a half long, quite black, and remarkable for its enormous and disproportionate mouth (like a pelican's). It has no swimming-bladder and few fins, peculiar branchiæ, &c. The genus *Malacosteus* seems the nearest.—On a new fossil insect of the order of Orthoptera, from the coal-mines of Commentry (Allier), by M. Brongniart. It is of remarkable size, and is named *Titanophasma Fayoli*. The author canot say whether it was winged or not.—On the meteorological fauna of the Varangerfjörd, by MM. Pouchet and de Guerne.—The Suctociliates, a new group of Infusoria, intermediate between the Ciliates and the Acinetians, by de Merejkowsky.—Influence of excitability of muscle on its mechanical work, by M. Mendelssohn. For a certain tension the mechanical work of a single contraction of a more excitable muscle is greater than that of a muscle of normal excitability. But the number of successive works the former can do till exhaustion, and their sum total, is less; and the length of time it can perform a series of works with a given load, till exhaustion, is less.—Vegetation of wheat by M. Risler.—Conditions of production of Epinastia in leaves, by M. Mer.

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