THURSDAY, OCTOBER 12, 1876

OUR NATURAL HISTORY COLLECTIONS

THOSE who pass along Cromwell Road, South Kensington, will not fail to observe on the site of the former International Exhibition, a stately building rising from the ground under the superintending genius of Mr. Waterhouse. The contractors have labelled it "The Museum of Natural History," but when the building is completed (which will be the case in November, 1877, according to the Office of Works) it may "surprise" our readers to be told that there will be no "Natural History" to put into it. The Natural History Collections in the British Museum—which are commonly supposed to be national property—belong not to the people of England nor to the "Government," but to fifty "Trustees" who are obliged by statute to keep them in Great Russell Street, and nowhere else. In order to enable these collections to be removed to South Kensington when the new building is ready to receive them, it will be necessary to pass an Act of Parliament discharging the Trustees from their present statutory duties and enacting others applicable to the new site. Now the Royal Commissioners on Science, who have recently terminated their labours, have devoted a good deal of time and attention to this branch of their subject. They have come to the conclusion that the removal of the Natural History Collections to another building will be a good opportunity for effecting a radical change in their administration, which, as it is now conducted, is by no means satisfactory either to men of science or to the public. It must be recollected that the British Museum was originally instituted as a great public library, to which the collections of art and science were considered merely as appendages. The director of the whole institution is still called the "Principal Librarian," and even up to a recent period the whole of the staff, even in the scientific departments, was classified under the fiction that they were "assistants" in the Library. The consequence of this leading idea is that everything in the British Museum, even up to the present time, is sacrificed to the extension and glorification of a single department. The Natural History Collections have, it is true, a nominal head, and a very eminent person he is, but Prof. Owen has nothing to do with the government of the institution, and has not even access to the trustees when they meet in solemn conclave. All he can do, when anything is wanted or something goes wrong in one of the Natural History Departments, is to approach the trustees through the principal librarian, an excellent individual, no doubt, but a gentleman entirely unacquainted with natural science and its requirements. It will be easily imagined, therefore, that under this system everything is sacrificed to the Library. The head-executive officer, naturally enough, thinks that his own branch of the business is of by far the greatest importance, and that everything else should knock under to it. As an illustration of this fact we have only to turn to the Civil Service Estimates for the current year. It will be found that 10,000*l.* is to be spent upon the purchase of printed books for the British Museum although copies of all those published in the United Kingdom are obtained gratis, whereas the miserable pittance of 1,200*l.* is allowed for zoological specimens, 800*l.* for fossils, and 400*l.* for botany! It may be alleged by the trustees that these amounts are sufficient, but the contrary is notoriously the case. The general level of the zoological and botanical collections in the British Museum is undoubtedly far below what it ought to be. The finest specimens in nearly every department of natural history fall into the hands of amateurs because the National Collection is so badly supplied with funds for purchases of this kind. No dealer would think of offering a new butterfly or a new hummingbird to the British Museum. With the former he would go to Mr. Hewitson with the latter to Mr. Gould. Again, the staff of officers in the Natural History Departments is inadequate in point of numbers. Their salaries likewise are much below those of other branches of the Civil Service, and quite insufficient for the duties expected of them. Hence it follows that there is little temptation for young men of ability and education to accept such a career. These deficiencies might have been remedied long ago if the trustees had been content to give up their patronage. But the right of presentation to all places in the British Museum is vested by statute in the three principal trustees, and the Government, naturally enough, declines to increase the value of appointments over which they have no sort of control.

Under these circumstances it is not to be wondered at that the Royal Commissioners on Science have come to the conclusion that, as regards the Natural History Departments shortly to be removed to South Kensington, the irresponsible rule of the fifty trustees should altogether cease, and a more simple form of government come into existence on the new site. Nothing can be more successful than the National Botanical establishment at Kew, governed by a Director immediately responsible to one of the Ministers. The Science Commissioners, with good reason, recommend a similar form of administration for the National Zoological Museum at South Kensington.

In this view, as will be seen by reference to their report, the Commissioners are supported by the best men of science of the day, many of whom have emphatically condemned the present system. One short clause in the Bill which must be brought in to authorise the transfer of the Natural History Collections to South Kensington will be sufficient to discharge the trustees from all future responsibility connected with them, and we trust there will be no hesitation on the part of her Majesty's Government in following the excellent advice tendered to them by the Science Commissioners on this subject.

CENTRAL AFRICA

Naked Truths of Naked People: an Account of Expeditions to the Lake Victoria N'yanza and the Makraka Niam-Niam, West of the Bahr-el-Abiad (White Nile). By Col. C. Chaillé Long, of the Egyptian Staff. (London: Sampson Low and Co., 1876.)

THIS work is more than usually interesting, as the author was an American officer in the Egyptian army attached to the expedition of Col. Gordon, the successor

of Sir Samuel Baker. The descriptions of the country and the various tribes who are the "Naked People" of the title, lead us for the most part over ground that has been already brought to our notice by Speke, Baker, and Schweinfurth, but a peculiar charm is contained in this volume, as it introduces to our notice some of the *Dramatis Personæ* of "Ismailia," and we find ourselves in the presence of many of the principal characters pourtrayed in the last work of Sir S. Baker; among others, the now well-known slave merchant, Abou Saood.

Some persons may not have forgotten that Sir Samuel Baker was accused of having dealt somewhat too harshly with this arch slave-trader, and it is therefore gratifying to receive the testimony of Col. Long who in p. 20 writes on arrival at Khartoum:—

"It may not be foreign to the subject to allude here to the unfavourable impression produced upon government officials and the well-wishers of the expedition on learning that Abou Saood was on his way to join us, that he had been renominated, and would go to Gondokoro in connection with the administration of the Equatorial Provinces; for in Khartoum Abou Saood was looked upon as inimical to the interests of the Government in these regions. Reference to him will be hereafter made and his true connection with the expedition and final fate be fully shown."

On March 22, 1874, after an extremely rapid journey of only twenty days from Suez, Col. Long, in company with Col. Gordon, left Khartoum by steamer for Gondokoro. The terrible difficulties which had impeded the expedition of Sir Samuel Baker had vanished, and the great White Nile was opened to navigation by the removal of the enormous vegetable obstructions. This great work had been accomplished by the energy of Ismail Ayoub Pacha, the governor of Khartoum, who, by the special orders of the Khedive, suggested by Sir S. Baker, had worked with a large force during two following seasons (not for only three weeks as supposed by Col. Long), and the river had resumed its original character. The fleet of seven steamers which Sir S. Baker had sent up from Alexandria to Khartoum had now an uninterrupted channel, and communication between Khartoum and Gondokoro would be effected in twenty days, instead of the weary and pestilential voyage of twelve months, so painfully described in "Ismailia." Under these favourable conditions Col. Long reached Gondokoro on April 17, and he immediately prepared to visit the interior instead of delaying at that unhealthy station.

The Commandant, Raouf Bey, furnished him with two trustworthy soldiers from the faithful "forty thieves" of Sir S. Baker. These men, Saïd Bagāra and Abd-el-Rahman, proved themselves worthy of the high reputation of the corps, by extreme courage and devotion throughout their service with Col. Long. In company with a large party of irregular troops, Col. Long started from Gondokoro to the Victoria N'yanza, on April 23. The company included a personage who becomes famous in the course of the narrative; this is Ba Beker, of whom Col. Long thus writes:—"The presence at Gondokoro of a wily black named Ba Beker, who had made his way through Unyoro, coming from M'tésé, King of Uganda, and bearing letters to Sir Samuel Baker from Lieut. Cameron, announcing the death of Livingstone, at Ujiji, seemed a propitious circumstance"—p. 36.

It is to be regretted that Col. Long appears to have been ignorant of the previous history of certain characters which appear in his narrative. The "wily black," Ba Beker, was formerly the dragoman, or interpreter, belonging to Abou Saood's station at Fabbo, and he had learnt the language of Uganda during a visit to the court of M'tésé. Ba Beker's character for cunning and intrigue was so well known to M'tésé, that, when that potentate formed an alliance with Sir S. Baker, he stipulated that Ba Beker should not be sent to his court as he was untrustworthy and a dangerous schemer. Sir S. Baker therefore sent from Fatiko a soldier named Selim, who had formerly been one of the "faithfuls" with Speke and Grant, and knew the language of Uganda. This man Selim was one of the "forty thieves," and he accompanied the envoys of M'tésé to remain at his court as a representative of the alliance formed with the Egyptian Government. The grand reception which Col. Long received from King M'tésé upon his arrival at his capital, was the satisfactory result of the friendship established with the king by Sir Samuel Baker, who at his instance had already sent two expeditions in search of Livingstone, one of which had reached Lieut. Cameron, and had returned from an enormous distance, bearing letters for Sir Samuel Baker; these were sent down from Uganda to Gondokoro, by the wily Ba Beker, who had, against orders, found his way to the court of M'tésé. Ba Beker will be remarked throughout the narrative as a plotter against the success of Col. Long, whom he attempts to infect with small-pox, by sending a native reeking with that disease to march by his side.

Col. Long commenced his journey during the rainy season, and his people suffered severely from fever and the miseries inseparable from a wet march. At that time the new territory was occupied by several important military stations left by Sir Samuel Baker, including the Fort Fatiko on 3° lat., and Foweera, on 2°, in the country of Unyoro. The latter station had been formed when Sir S. Baker established an indissoluble alliance with Rionga after the attack by Kabba Réga at Masindi, which terminated in the defeat of the natives and the total destruction of their capital; but as the country was bare of provisions, the troops were forced to destroy their own camp, and to join Rionga.

Col. Long started under the favourable conditions that M'tésé, on the equator, was an ally of the Government; Rionga had been declared chief of Unyoro by Sir S. Baker. Two powerful government stations existed along the road; several stations, such as Fabbo and Faloro, were held by the irregular troops established by Sir S. Baker (formerly slave hunters) under the command of Wat-el-Mek, and no enemies were supposed to exist except Kabba Réga, who had apparently somewhat recovered his position after the departure of Sir S. Baker to England.

In speaking of the Baris, the first tribe through which he passed, Col. Long says (p. 47):—"The treacherous and cowardly Bari had at length accepted as a fact the definitive occupation of the country by the government troops, against whom, these people, and in fact every other tribe, had been excited by the Dongolowe faction."

(The Dongolowes are the slave and ivory hunters.) This is important evidence, which coincides with the description of Central African politics in "Ismailia."

On April 28 Col. Long arrived at Moogi, the last of the Bari tribes. As the Bari refused to sell provisions it became necessary to forage. This is the great difficulty of that portion of Africa, the troops must either starve or help themselves; in the latter case it is not surprising that the natives offer resistance, which ends in bloodshed. Three of Col. Long's people were killed by the Moogi, and a general attack commenced. A rapid and skilful disposition of his force enabled Col. Long to disperse his assailants, and charging them at the double, they were put to flight. This was his first experience of the docile negro, who, we are told by philanthropists, is to be gained by conciliation. Col. Long's "Naked Truths" appear to take a more practical and common-sense view of the African savage. On April 30 Col. Long has another skirmish with the Moogites, and it should be remembered that this tribe had never opposed Sir Samuel Baker's march and were treated most kindly by him. The return for this consideration was an attack upon Col. Long, and the subsequent massacre of the unfortunate Linant de Bellefonds, with thirty-six of the gallant "forty thieves" sent to make a reconnaissance by Col. Gordon.

On May 5 Col. Long arrived at Fatiko, near 3° latitude. He thus describes it:—

"Fatiko is a neat little earthwork surrounded by a fosse about ten feet deep, constructed by Sir Samuel Baker, flanked on its western side by a huge rock mountain that serves as well for a look-out. Its position and construction render it almost impregnable, certainly against any African force. From its rocky eminence one might see the Nile, though more than a day's march distant, winding its serpent-like way from the Albert N'yanza."

Speaking of the officer, Adjutant-Major Abdullah, whom Sir Samuel Baker had left in command, Col. Long writes:—"It gives me no little pleasure to refer here to the cleanliness and discipline of his command, and the *esprit de corps* which he had instilled into both officers and men." This is a gratifying result from the labours of a European who first planted these stations in Central Africa to suppress the slave-trade.

At Fatiko Col. Long was introduced to Wat-el-Mek, who commanded the irregulars. This man, conspicuous in "Ismailia" as the chief agent of Abou Saood, who was subsequently pardoned by Sir S. Baker and appointed to his present command, determined to escort Col. Long to Foweera, and together with Selim, already described, and the wily Ba Beker, they started, May 12, towards Foweera, about seventy miles distant. On May 17 they reached the camp, garrisoned by 270 men, and described by Col. Long as a "model of neatness and order." After a rest of some days at the station of Foweera, during which Col. Long was much impressed with the noble appearance and character of Rionga (the chief with whom Sir S. Baker had formed an alliance by exchanging blood), he at length started for the capital of M'tésé in company with Selim (Sir S. Baker's representative) and the wily Ba Beker, who was extremely jealous of the co-interpreter. After a terrible journey of rain, slush, and numerous deep marshes, which induced distressing attacks of fever, Col. Long and his party arrived at the capital of the great King M'tésé.

It is absolutely necessary to refer all readers of African travels to the work itself, as "Naked Truths" will yield a rich harvest of horrors, which would intrude too largely upon the space accorded to a review. The reception given by the great King M'tésé commenced by the cold-blooded massacre of thirty people in Col. Long's presence! This is the monarch whose praises Mr. Stanley sings! It is indeed necessary that "Naked Truths" should be impressed upon the public. Col. Long's description of M'tésé is perfectly truthful, agreeing with that given by Capt. Speke. There can be no doubt that in spite of his savage customs he is far more enlightened than most African monarchs, and much can be done with his assistance in opening Central Africa to commerce. We can only hope that his country will not be annexed to Egypt, in which case we should lose the confidence of a man who has already rendered most important assistance as an independent potentate. If the simple traveller shall be known in Africa as the forerunner of an invading army, and the return for a gracious reception shall be the loss of a kingdom, future explorers will be regarded in Central Africa with well-merited suspicion, and the ordinary dangers of the country will be enhanced.

Col. Long visits a small portion of the Victoria Lake, which conveys an impression since proved to be erroneous. He then proceeds in two canoes with his faithful Saïd Bagāra and Abd-el-Rahman, together with a few followers, down the river from Urondogani to Rionga's Island. He is dreadfully ill, and the wretchedness and misery he describes will show that nothing has been overstrained in the accounts of those regions previously published. When opposite M'rooli, lat. 1° 38′, where the Nile is more than a thousand yards wide, he is attacked by a fleet of forty canoes by the people of Kabba Réga. The fight which ensued is one of the liveliest scenes of the book, and the cool and accurate shooting of Col. Long and his two ex-"forty thieves," with Snider rifles and a large supply of ammunition, win the day, and save the little party from destruction.

In a state of great physical prostration from hunger and continual sickness, our gallant explorer and his little party reached the military station at Foweera (Rionga's). At this place he made an important discovery, that on the same day that he was attacked by Kabba Réga's fleet of canoes at M'rooli, Sulieman, the ex-slave-hunter, but present officer of the Egyptian Government, was actually residing with Kabba Réga at his palace! Col. Long needed no further proof of treachery; it was a repetition of the conduct pursued towards Sir S. Baker, and as Col. Long writes "in acting against me, he was but proving his hostility to the Egyptian Government and his sympathy with Kabba Réga, the old ally of Abou Saood." In fact, the irregulars formed of the disbanded slave-hunters of Abou Saood knew that their occupation was gone, and they still clung to the hope that some fortuitous circumstance might lead to the withdrawal of the Government from the new territory, and the return of the good old times of slavery.

Col. Long had hoped to visit the Albert N'yanza, but

finding it quite impossible, he at length returned to Fatiko. His final report of the Fatiko natives is as follows :—

"The Fatiki of all the negro tribes I had seen are the most moral and the most honest. They were very numerous, and their well-filled corn-bins attested their frugality and their industry in the cultivation of 'dourah,' the sole product of the soil."

It will be remembered by readers of "Ismailia" that Sir S. Baker delivered these good people from the yoke of Abou Saood's slave-hunters, and they have ever since shown their gratitude by cultivating corn sufficient for the support of the garrison. In p. 205 Col. Long writes :—

"The garrison of Fatiko, composed of 200 men, was sheltered from any attack not alone from its position in a military point of view, but because of the entire sympathy of the natives, who were most friendly to the government troops and acknowledged their authority with pride at being considered as belonging to 'Meri.'" . . .

Nothing can be more satisfactory to the true well-wisher of the negro than such a picture, neither could any more convincing proof be desired of the grand reform effected in these districts by the Khedive's expeditions to suppress the slave trade.

On October 18 Col. Long returned to Gondokoro, where he heard with sorrow that most of the Europeans had died during his absence. He speaks with honest pride of the congratulations that he received from the Governor-General (Col. Gordon) upon the results of his arduous journey. He was also visited by Abou Saood, of whom he writes :—

"Abou Saood came to see me and to welcome me back. From the very great dignity with which he had been invested on his arrival, he had now fallen into disgrace."

Col. Long now returned by steamer to Khartoum to recruit his health by change of air, and having remained at the Soudan capital for sufficient time, he once more returned to the White Nile regions with reinforcements. On his voyage to Lado, a new station which Col. Gordon had established fourteen miles north of Gondokoro, he was tempted to explore the important river Saubat, which is the largest affluent of the White Nile. In a powerful steamer he passed up the stream of the Saubat for about 300 miles, and arrived at an ivory station of the Arabs far beyond the highest point reached by Europeans. The Saubat was reported navigable for an unknown distance, but circumstances compelled his return, and Col. Long, after a rapid passage, once more joined Col. Gordon at Lado.

A short rest at this station prepared him for an expedition into the Niam-Niam, or cannibal countries west of the Nile. During this journey Col. Long lost a considerable number of men from sickness, and, as usual, was attacked by the natives, who succeeded in killing one of his soldiers. With the assistance of the irregular troops from the Niam-Niam stations, and those warlike tribes of cannibals, he defeated the enemy, and his allies ate them as refreshment after the battle. Col. Long subsequently returned to Lado, and after a short but brilliant career in Central Africa he returned to Egypt, to take the command of an expedition sent by the Khedive to the Juba river on the east coast of Africa.

In concluding a notice of this volume we must express a regret that Col. Long gives us no astronomical observations; therefore no practical addition has been made to our geographical knowledge. There are also some instances of careless description, as he speaks of "deer," whereas no species of deer exist, and he must mean "antelopes." He tells us of a boa constrictor 30 feet long, with a thickness equal to the body of a child. This is a careless picture of an enormous snake that deserved to be accurately measured as a curiosity in natural history.

There are no pretensions to literary style in this book, but the charm exists in the evident truthfulness and absence of prejudice which pervade it throughout. Col. Long is far too honest and straightforward to condescend to stratagem to win the applause of the public ; he does not believe in the good qualities commonly attributed to the negro.

The impression left on the mind after carefully reading Col. Long's "Naked Truths," is that such men as he undoubtedly is, are the true stamp for the improvement of Central Africa—a character which combines courage, energy, love of liberty, and fair play, and sound common sense with patience, must effect good, and such a man will always be respected by the negro equally with more enlightened races.

OUR BOOK SHELF

Electro-Telegraphy. By Frederick S. Beechy, Telegraph Engineer. (E. and F. N. Spon, 1876.)

WHY Mr. Beechy should wish to depart from ordinary usage and call his book electro-telegraphy rather than electric telegraphy, we have no idea. The assumption of an eccentric title for a scientific book naturally gives rise to a feeling of prejudice against it. Nevertheless, we find in this little book a very fair and clear account of the practical part of electric telegraphy. It would be impossible, in 125 pages, to deal fully with this great subject. Mr. Beechy has, however, managed to compress into that short space an account of the principles and methods both of sea and land telegraphy, sufficient to give an intelligent reader a very good notion of how telegraphy is carried on. He has wisely avoided all detail regarding telegraph instruments. In his diagrams he generally gives a skeleton illustrating a principle without attempting to display details that would only complicate the figure. His descriptions are generally clear and simple.

It is surprising, however, that he has not taken the trouble to explain the elementary principles of electric science more thoroughly. We are far from satisfied with the preliminary chapters on this part of the subject, and we have noticed some very extraordinary mistakes. In the chapter devoted to "testing" we read as follows: "The *metre*, or French standard of length, is a certain sub-multiple of the diameter of the earth. The standard of time, or the second, is derived from observation of the earth's revolution. The standard measures, such as the yard measure or the pound weight, may be lost or destroyed, and the only security for always obtaining reliable standards is the permanence of the great natural laws of our globe." This is very astonishing. To say nothing about the "diameter," which may be a misprint, we thought that though the writings of Balfour Stewart, Maxwell, Thomson, and the celebrated B.A. Unit Committee, every one knew better than to trust to permanence of the earth's dimensions for replacing the metre were it lost.

The next paragraph defines the Ohm. "The *Ohm* is obtained by observing what effect is produced by a current of electricity on a certain conductor in a given time. As a certain metal rod represents the yard, so a wire of a

certain resistance represents the *Ohm*. The *Ohm* is a small coil of German silver wire representing the resistance overcome by a current in a certain time." What kind of conception can Mr. Beechy have of current and of resistance?

Still, as we have already said, we are much pleased with Mr. Beechy's little book. The author can readily make the necessary improvements in a future edition.

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.*]

Action of Light on Ebonite

It is well known to electricians that the insulating power of ebonite gradually diminishes in consequence of the formation of a conducting layer of sulphuric acid on the surface (produced by the oxidation of the sulphur used in vulcanising). It is perhaps not so well known that exposure to light facilitates this change, if indeed it is not an essential condition.

In order to put this to the test, a plate of ebonite polished on both sides was cut into four pieces, each about 52 mm. long, 22 mm. wide, and 8·5 mm. thick, exposing therefore a surface of about 3,500 square millimetres (the edges were not polished), and one half of each piece was varnished with an alcoholic solution of shellac. Two pieces were placed in wide test tubes plugged with cotton wool, and the other two were sealed hermetically in similar tubes. One of the sealed tubes and one plugged with cotton wool were placed in a dark drawer, and the other pair exposed to light in the laboratory, and during the latter part of the experiment to direct sunlight. The experiment was commenced on December 26, 1874, and after some time minute drops of liquid were perceived on the ebonite exposed to light and air, the remaining three pieces retaining their original appearance. Between September 1 and 21 of this year the sealed tube exposed to light was accidentally broken, so that for a period of less than three weeks the ebonite in it was exposed to both light and air. On September 21 the tubes were opened, the ebonite washed with water, and the amount of acid determined by standard solution of caustic soda. No trace of acid could be detected on either of the pieces of ebonite which had been kept in the dark; on the one which had been exposed to light in the closed tube, ·343 milligrammes of sulphuric acid were found, and on that exposed to light and air, 2·646 milligrammes.

By a mistake it was not ascertained whether the part of the ebonite which had been varnished had become acid, but during the time of exposure small drops were also perceptible on this portion of the surface. When the pieces were exposed to direct sunlight another change became visible, the drops being replaced by what appeared to be small particles of a yellowish white solid. This may have been due to the heating of the black material by the sun and consequent action of the strong acid on the solid.

I was led to try this experiment by noticing that an ebonite plate electric machine which had been kept in a light room had changed in colour except on those portions which had been protected from light by the rubbers. The exposed surface acquired a brown colour and the machine acted very badly. On cleaning the plate with a hot solution of caustic soda, large quantities of ammonia were evolved and the brown surface became softened, so that it could be easily scraped off.

I had an opportunity of noticing a remarkable instance of this action a short time since in the laboratory of my friend, Mr. Warren De la Rue. An apparatus with an ebonite base, with three adjusting screws, was standing at some distance from a window. The surface of the plate was covered with a fine dew of an acid liquid, except at the parts where the shadows of the heads of the screws fell. The surface at these places completely retained its original polish.

The interest of this matter must be my excuse for communicating the results of an incomplete experiment.

Royal Indian Engineering College, Cooper's Hill, October 2 — Herbert McLeod

Visual Phenomena

The following quotation was written, and a stereo-slide to which it was appended was sketched by myself in January last, and shown at the *soirée* of the Manchester Mechanical and Scientific Society then held:—

"In looking through comparative darkness at any bright light, the writer, who is near-sighted, sees in place of such light or any number of such lights, a bright disc or discs each like the stereoscopic combination of the figures here shown.

"Are such figures seen by other myopic subjects, and do they consist of the middle portions of the crystalline lenses as seen *from within*?

"In order to develop the figures the source of light must be sufficiently distant to subtend an angle of about one-twelfth of a degree; the discs have an apparent diameter of about 1° or more, being like the pupils which seem to define their outline, persistently variable in size (*i.e.*, always *on the move*). The disc-patterns are constant in markings and position, and their brighter lines irradiate the darkness (of the vitreous humour) as though by refraction from the (?) denser portions of the lens."

The discs above mentioned differ a little in each eye, but the groundwork in both cases is a somewhat irregularly five-armed star; each arm has a shaded axis with bright margins, and they radiate from a luminous ring inclosing a darker central spot. The whole figure is well illuminated, its details being defined rather by variations of light than by dark markings, and their comparative brightness *inter se* being not unlike that shown by the various parts of the lunar surface at the full. The intervals or *sectors* of the figures are filled with a mottled pattern not easy to sketch; one space contains a figure like a Y with the stem outwards; another a V point inwards. Some dark spots, inside bright rings, as they are exposed or excluded by the margin of the figure, curiously define the varying size of the pupil as one approaches or recedes from the light; at about 12 yards from (say) a street lamp the disc is suddenly supplanted by the true form of the gas flame.

I see these appearances with the unassisted eyes; a concave lens at once snuffs them out. About sixteen years ago I tried some experiments with *convex* lenses, and found that on holding the lens farther from the eye than its (the lens's) focal distance, the star figure suddenly became a NEGATIVE—its cardinal points reversed, its lights shadows, and *vice versâ*; the arms bright, with shaded borders, and the dark spots bright, with shaded rings.

On coming from darkness into a gas-lighted street, the star discs appear large for about a second, then suddenly contract, but retain a slight oscillation, corresponding with the slight but incessant movements of the iris. The conjunction of lightning and street-lamps has a curious effect; *after* each flash the hundred or more of discs, one at each light, suddenly contract and more leisurely expand, the contraction taking about one second and the readjustment about four.

In place of Mr. Mallock's Fig. 2 (p. 350), I get a sort of very acute St. Andrew's cross, its arms consisting of *parallel* rays crossed by numberless very fine striations.

Fig. 3 I only see as a tangled confusion, owing to the hairs not being so neatly arranged as in Fig. 4; yet their foreshortened crookedness seems, by way of amends, to be responsible for the following:—

In looking towards, but a little below, the sun, which should be at about its winter meridian altitude, the upper field of view is crossed by a sort of variegated aurora of rainbow colours, which have almost a polariscope brightness, and are lined and ringed, as it were, upon a sort of chain pattern foundation.

It was in November or December last that I first found that the before-named star figures were not necessarily extinguished by a light sufficiently strong to allow of my sketching them; the occasion being a highly successful Manchester copy of a London fog. A lucid interval and a lowered gas-jet in a large room accidentally gave the requisite conditions.

If considered of sufficient interest, I would send copies of the discs which are sketched nearly two inches in diameter. The disc of a gas-lamp at 100 yards distance has an apparent diameter of nearly 3 feet, and a lighted up cotton-mill is all light, no wall.

Sale, Manchester — H. B. Biden

If Mr. T. W. Backhouse (Nature, vol. xiv., p. 474) is right in interpreting the phenomenon of radiance described by Mr. A.

Mallock, as due (in Mr. Mallock's case) to *under*-refraction of rays (as in my case it certainly is due to *over*-refraction), his own experience furnishes a good connecting-link between the "two different, though allied, phenomena." It would be well, however, in order to avoid all uncertainty, that we should know the result, in Mr. Mallock's case, of experiments with an obstacle advanced in front of the eye from a given direction. The experiment with concave or convex spectacles is not quite satisfactory, because it involves a breach of continuity in the observation of the phenomenon.

In concluding that I am "evidently short-sighted," Mr. Backhouse attributes to the whole lens a fault which really belongs only to certain radial portions of the marginal region of the lens. In daylight I see distant objects sharply defined, and that without excessive contraction of the pupil. It is at night, when the pupil is largely dilated and the *marginal* part of the lens becomes exposed to incident rays, that I see radiance around a distant lamp.

These phenomena being necessarily personal to each observer, not admitting of observation by one person for another, and evidently presenting wide differences, it would be interesting to collect and tabulate the facts as described by a number of competent observers. I would suggest that the initiator of this correspondence (Mr. A. Mallock), or some other person, with the approval of the editor of NATURE, should receive and tabulate such facts as may be communicated on this subject, with a view to the publication of the results in a future number of NATURE.

HUBERT AIRY

Blackheath, October 3

An Intra-Mercurial Planet

IF the phenomenon seen by the Hon. F. A. R. Russell was really a transit of this planet, Hofrath Schwabe must have very narrowly escaped witnessing it, for on turning to his MSS. I found the following observation for the date in question :—

"1860, Jan. 29, 9m. (8.11 A.M., G.M.T.).

"Nur die Hauptflecken von 10 deutlich dem Austritte nahe, 11 undeutlich, 12 u. 13 nicht wesentlich verändert."

The numbers refer to the drawing of sun-spots made on the preceding day, indicating also the order in which the spots have appeared since the commencement of the year. No. 10 is a group of spots near the limb, No. 11 a group of very small spots also close to the limb, whilst 12 and 13 are clusters of large spots both of sufficient magnitude to be visible to the naked eye through a fog.

Unfortunately the Photoheliograph was not at work on that day, nor did Carrington make any observations, the sky being cloudy.

G. M. WHIPPLE

Kew Observatory, October 7

Inequality of the Semi-Diurnal Oscillations of Barometric Pressure

WILL you oblige me by publishing the following corrections of certain of the formulæ in my paper on the Inequality of the Semi-Diurnal Oscillations of Barometric Pressure, in NATURE, vol. xiv. p. 316? I regret that the distance of my place of residence has prevented my sending you an earlier notice of the errors.

Formula (2) should stand thus—

$$\tau = V\rho \frac{P}{\mathsf{P}} \frac{T}{T_0} tc,$$

"wherein ρ is the density of air at standard pressure P and temperature T_0, &c."

The same symbol P should be substituted for P in the next formula, and the explanation should run—

"where s is the hypothetical density of water vapour at P and T_0, and λ its latent heat at temperature T. Substituting for s its approximate equivalent $\frac{5}{8}\rho$,

$$\tau = V\tfrac{5}{8}\rho \frac{p'}{\mathsf{P}} \frac{T}{T_0}\lambda."$$

HENRY F. BLANFORD

Meteorological Office, Calcutta, September 5

Miniature Physical Geology

THE occurrence of miniature earth-pillars (vol. xiv. p. 423) is by no means unusual even in our own country.

I noticed some excellent examples some years ago in the neighbourhood of Halifax. From a steep exposure of alternating strata of sandstone and shales, the sandstone stood out in broad ledges which received on their upper surface the *débris* from the weathering shale, consisting of mud and plate-like fragments of the shale itself. Under the action of the rain this *débris* had been carved out into perfect pillars, each capped with its plate of shale, and with a numerous progeny of smaller pillars clustering round it, each also with its protecting roof of jutting shale.

Near the Mumbles (Swansea) I visited a limestone quarry at the foot of which lay a talus of soft earth embedding a number of fragments of limestone. Here not only were large earth-pillars from two to four inches high, and in every detail of form resembling those of the Tyrol, to be seen sculptured from the talus, but a heavy shower of rain falling at the time was actually at work producing fresh columns and enlarging the old ones. I had with me at the time, by good fortune, a party of some forty students, and was pleased beyond measure to be able to point out to them these beautiful pillars and the process of their growth. So perfect were they that one gentleman more enterprising than the rest wished to transport one fine group to the safe keeping of a glass case.

But the most striking examples of earth-pillars I have seen anywhere occur in this neighbourhood. The trias, which here frequently consists of a breccia of hard sub-angular fragments of various kinds of rocks embedded in a red sandy marl, is in many localities cut through by the roads, and thus exposed in almost vertical faces of considerable length on the side of the roadway. These faces have very generally been carved out into earth-pillars, which, whilst resembling in all else the Botzen pillars, differ from them in remaining attached vertically to the parent rock by one face, and thus are free on three sides only. This ornamentation of the rock-faces in high relief may be seen continuously for many yards, I should think for hundreds, and it is permanent from year to year. No one walking from Dawlish to Little Haldon can fail to be struck with its singular appearance, and it is especially well exhibited on the right hand bank of the road skirting the north-east side of Luscombe grounds. The ordinary earth-pillars, free on all sides, may also be occasionally noticed in great perfection. After last year's heavy rains I saw several measuring 3 inches high and 2 inches broad at the summit: in one case the capping was not of stone, but a piece of growing moss, which had become detached from a mossy bank by a landslip on a small scale.

W. J. SOLLAS

Dawlish, Devons

The Claywater and Meno Meteorites

THE analyses of these remarkable bodies by Dr. J. Lawrence Smith, as given in the *American Journal of Science* for September, 1876, suggest a new and interesting inquiry in astro-meteorology. These analyses gave the following results :—

	Claywater.	Meno.
Stony matter	78·33	77·76
Metallic particles	17·07	18·00
Troilite	4·60	4·24
	100·00	100·00
Stony part, soluble	47·20	48·70
Stony part, insoluble	52·80	51·30
	100·00	100·00
Stony part, analysed as a whole.		
Silica	44·98	44·70
Protoxide of iron and aluminia	21·95	22·26
Magnesia	29·30	28·97
Lime	1·80	1·85
Soda	1·32	1·20
	99·35	98·98
Metallic particles.		
Iron	92·15	91·86
Nickel	7·37	7·53
Cobalt	·28	·13
Copper and phosphorus	Traces of both.	
Specific gravity	3·66	3·65

"In regarding the above comparative statement of the composition of these meteorites," says Dr. Smith, "it will be seen that the compositions of the two as made out by me do not

differ more than those of two fragments of the same meteorite, while they both differ in their *physical aspects* from the ordinary type of meteorites, and, in fact, they have few or no parallels in the collections of these bodies."

Are the above coincidences to be regarded as accidental, or do they indicate an original connection between the two bodies? The former alternative is seen at once to be almost infinitely improbable. But the Meno stone fell in Mecklenburg at noon, October 1, 1861, and the Claywater meteorite, in Wisconsin, at 9 A.M., March 25, 1865, the interval being nearly three years and a half. How, then, could the bodies have been originally connected? It will be observed that the two points of orbital intersection are almost diametrically opposite, and may therefore be regarded as the ascending and descending nodes of the same meteoric group. The possibility of an original intimate connection of the two meteorites becomes thus sufficiently obvious. The nodal points correspond approximately to those of the comet of 1264.

It may here be remarked that a similarity of composition was also found in the aërolites of May 22, 1827, and June 2, 1843, both analysed by Baumhauer. DANIEL KIRKWOOD

Bloomington, Indiana, U.S.A., September 5

Comatula rosacea

IN NATURE, vol. viii., p. 469, is a report of an excursion by the Birmingham Natural History and Microscopical Society to Teignmouth, and of the results of its dredging operations in that neighbourhood, in which the following passage occurs:—"By far the most noteworthy capture was *Comatula rosacea*, the Feather-star, two individuals of which were taken in the larval pedunculate condition attached near the base of a frond of Laminaria, which was torn off by the dredge. The specimen measured about one-third of an inch in length. Five young Comatulas in a free condition, the largest about an inch across, were also taken. A subsequent haul on the following day brought up from the same locality three adults." A foot-note states that this was in the vicinity of Torbay, at a depth of 12 fathoms, on a limestone bottom.

It may perhaps be interesting to the above Society, and to the readers of NATURE generally, to know that during the last month Mr. Hunt and myself, in his handy little sailing-vessel, dredging in Torbay, have taken Comatulæ, not by twos and threes, but in the greatest abundance. In one haul off Berry Head there were certainly more than a hundred adults. On this occasion the dredge was brought on board cramfull of the commoner genus, *Ophiocoma rosula*, of which there must have been many thousands, the Comatulas forming only a small percentage. This haul was in about 12 fathoms, on a very rocky bottom. We met with pretty similar results close to the Thatched Rock. It is evident that the habitat of Comatula is strictly defined, viz., in comparatively deep water and amongst rocks. We have never taken a single specimen from sandy or shelly bottoms.

On examining the few pieces of sea-weed and zoophytes brought up at the same time, they were found to be covered with the young stalked state of the Feather-stars, which were principally attached to *Bugula flabellata* and *Salicornaria farciminoides*. As I write, I have before me a small bottle of spirit and water, in which is a little spray of the latter zoophyte about 2 inches in height, and to which are attached at least seventy specimens in every stage of growth, from the calcareous bud, with its zoophyte-like tentacles, to the perfect, but stalked, form of the Feather-star, with its five bifurcated arms; and on a single microscopical glass side and cell I have mounted as many as a dozen specimens, all growing on the same small piece of weed.

It is generally stated that both Comatula and Ophiocoma, on leaving their native element, break themselves into pieces. My experience does not bear this out. It is true that, as they crawled about the deck in their own peculiar fashion, the Ophiocoma especially left an occasional arm behind, but as a rule I could take either of them up in the palm of my hand without their exhibiting any suicidal propensities. Presuming on this fact, I put about a hundred of the two sorts into a sponge bag, but this was asking too much of them, for on reaching home and emptying them out, I found that both Feather-stars and Brittle-stars had converted themselves into a mass of mincemeat! It would have been difficult to find a single portion of an arm a quarter of an inch long.

The microscopic study of the structure of the various genera and their organs of locomotion is most interesting, but is beyond the scope of this communication, which is merely intended to show that *Comatula rosacea* and its young stalked state is not so uncommon as is generally supposed, but can be obtained in considerable numbers, especially if one is so fortunate as to have as a companion such an experienced dredger as my friend, Mr. Hunt. FRED. H. LANG

Influence of Islands on Colour of Animals

THE September number of *Blackwood's Magazine* contains a narrative by Mrs. Frances Wordsworth and her son, Mr. C. F. Wordsworth, of six months and twenty-two days spent by the survivors of the unfortunate *Strathmore* upon one of the rocks of the Twelve Apostles, an island in the Crozet group.

If I venture to draw attention to the following extracts from their story, it is because they seem to illustrate in a rather remarkable manner some observations upon the influence of islands in determining paleness of colour in animals, which occur in Mr. A. R. Wallace's opening address to the Biological Section of the British Association at Glasgow.

The *Strathmore* was wrecked on July 1, 1875, and speaking of a period four months later, when penguin's eggs had begun to furnish the castaways with ample food, Mr. Wordsworth says: "The eggs did everyone a great deal of good; those who had been haggard and miserable got quite plump and fresh; some of them ate about thirty at a meal, and we now saw each other with clean faces, for we used the eggs as soap; while a most remarkable thing was that every one had fair skins and light hair, dark faces and hair being quite changed, black hair turning brown or red, and fairer people quite flaxen. As for myself my complexion was pink and white, like a girl's" (this after four months' constant exposure to the weather) "with white eyebrows, yellow hair and moustache."

The survivors were rescued on Jan. 21, 1876, and on Feb. 18, Mrs. Wordsworth writes, "Charlie looks well and firm now; his hair had got quite flaxen, which did not suit him at all, but now it has nearly recovered its original colour."

With regard to animal life on the rock, Mr. Wordsworth says: "I had almost forgotten to mention the real owners of the soil. The only unwebbed footed birds on the island, and constant residents, were what we called 'little white thieves,' 'white pigeons,' or 'white crows.' They possessed many of the qualities of our jackdaw, being very inquisitive, mischievous, and hardy, and not to be daunted by trifles." D. PIDGEON

Holmwood, Putney Hill, September 27

ARE WE DRYING UP?

SUCH is the title of a paper in the September number of the *American Naturalist*, by Prof. J. D. Whitney, the object of which is to bring together some of the more striking facts in regard to the desiccation of the earth's surface—or at least of a considerable portion of it—which has taken place in the most recent geological period, and to suggest the inquiry whether we have any proof that this desiccation has been and is continued into the historical period: in short, Are we drying up?

There is a prevailing popular impression that the countries around the Mediterranean are drier than they were two or three thousand years ago, and that this change is due in part, if not wholly, to the cutting down of the forests which are assumed to have once existed there. Yet, when this matter comes to be investigated, it would appear that there is little if any evidence either that there has been any such wholesale stripping of the wooded lands, or that there has been any considerable change in the climate of that region. It appears to be true, at all events, that exact observations with the rain-gauge have not yet anywhere been kept up for a sufficient time to enable us to speak with certainty with regard to the existence of any secular change in the amount of rain falling at any one place.

We have, however, abundant evidence of a great change over at least a considerable part of the earth's surface in the amount of water distributed in the lakes or running in the rivers, and it can be shown, beyond a doubt, that this change has been taking place within a very recent period, speaking geologically. Some important evidence can also be adduced to the effect that this change has been continued in the historical epoch,

although not yet capable of demonstration by the recorded observations of the rain-gauge.

There are two regions especially where the facts already collected show most clearly not only a diminution in the amount of water existing on the surface, but a most striking one. In Central Asia and in Western North America, the observations of numerous observers all point unmistakably in this direction. The observations of the Schlagintweits in Thibet and Turkistan are referred to. In all portions of High Asia, south and north of the main water-shed, in Thibet, throughout the entire longitudinal depression between the chain of the Himalaya and the main water-shed of the Karakorum, there are numerous places where the former existence of mountain lakes may be recognised. In Western Thibet the evaporation exceeds the supply of water, so that the prevailing condition is at the present time one of gradual diminution in the area covered by water. There seems to be here, in combining all the results of the Messrs. Schlagintweits' observations, abundant evidence of a marked change of climate in the most recent geological period—resulting in the almost entire disappearance of extensive lakes—and also that this desiccation is still going on.

The observations of Mr. Drew in his elaborate work on the Jummoo and Kashmir territories, fully corroborates the often previously expressed opinion, that the Valley of Kashmir was, in later geological times, completely occupied by a lake. But no evidence has, as yet, been discovered to prove that this desiccation took place during the historical period, although the traditions of the natives point in that direction. There is, however, abundant proof of diminution in the area covered by water in the basin of the Aral and Caspian Seas, not only during the latest geological epoch, but also within a comparatively recent period. Those who wish to investigate the matter will find the material in a paper by Major Wood, published in the *Journal* of the Royal Geographical Society for 1875, and we may state in his recent work on "The Shores of Lake Aral," and in the articles contributed by him to NATURE. There is no doubt of the former vastly greater extension of the Caspian and Aral Seas; it seems beyond dispute that a gradual desiccation of the region has been in progress, and that it is still going on. That there once existed here a vast Asiatic Mediterranean which was connected by navigable waters with the Northern Ocean is very generally admitted.

Similar facts in regard to the diminished quantity of water in Arabia are cited by various travellers in that country. In Africa the existence of extensive ruins in the Great Libyan Desert, in a region quite destitute of water, and which is now entirely uninhabited, may be taken as a strong indication of great changes since the historic period. Dr. Livingstone, in his travels in Southern Central Africa, was again and again much impressed with the proofs presented to him of a rapid and extensive diminution within recent times of the amount of water in the lakes and rivers of that region.

Prof. Whitney adduces much evidence to show that a similar state of things exists in America, especially in the region west of the Rocky Mountains, and above all in the "Great Basin." For example, the terraces surrounding Great Salt Lake are so conspicuous, that no traveller passing through that region on the railroad could fail to notice them. It is certain that the sharp and well-defined character of the terraces in some parts of the western region indicates very clearly that the diminution of the volume of the water must have been an extremely recent phenomenon. It is doubtful whether this desiccation has any connection with the former glaciation of the regions in question; so far as the problem under discussion is concerned, it is of no consequence.

It is certain that both in Asia and North America the phenomena of desiccation are on too grand a scale by far to be supposed to have anything to do with cutting down of forests. The drying up has been commenced before man interfered with nature, and has been continued without reference to his puny operations.

Evidence is adduced to prove that within the historical period, the volume of several of the European rivers has considerably decreased. In this connection the investigations of Berghaus on the Rhine, the Elbe, and the Oder are referred to. Berghaus shows that each of these rivers had decreased in volume during the past hundred years, and that there was reason to fear that they would eventually have to disappear from the list of the navigable streams of Germany. Gustav Wex came to the same conclusion with regard to the Danube.

The general impression, both of Mr. Wex and a committee of the Vienna Academy, seems to be that the cutting down of the forests is the essential cause of the desiccation. But the number of facts which can be given in support of this hypothesis is quite small. That a positive diminution in the average quantity of water carried down in the streams would necessarily ensue on removing a portion of the forests in any region, Prof. Whitney does not consider to have been proved as yet.

In regard to one question, this commission of the Vienna Academy is quite unanimous, and this is that great pains should be taken by the different Governments of the enlightened States throughout the world to obtain more light and additional data bearing on this subject. If desirable for Europe, Prof. Whitney thinks it is still more so in America. They need much more numerous and more accurate observations of rainfall. If it can be shown that the removal of the forests seriously diminishes the quantity of water running in the streams, then there is yet time to stay the hand of the wood-cutter ere the mischief be consummated.

That there has been a very marked decrease in the amount of water on the earth within the most recent geological period is beyond a doubt; and that there is considerable reason to believe that the desiccation is still going on has, we think with Prof. Whitney, been made evident by the facts he adduces. He promises on another occasion to discuss the connection of the so-called "glacial epoch" with the present one of desiccation.

The subject is one of great interest and of prime importance, both from a scientific and an economical point of view. The New York *Nation*, in referring to Prof. Whitney's paper, tries to account for the phenomenon as follows:—

Setting speculative causes aside, such as the possible variation in the central heat beneath the earth's crust, there is one well-known cause which, we think, can scarcely be demonstrated to be incapable of producing the desiccation. The sun's heat is notoriously the source of all climates, and changes in the amount of heat radiated from the sun are now regarded as causing the changes in terrestrial weather. It is therefore reasonable to ascribe our drying-up, since it requires ages for its completion, to a change in the solar cause requiring also a long cycle for its fulfilment, provided that astronomy gives us proof of any such change. And astronomy does tell us of two such cycles: one in the obliquity of the ecliptic, and one in the perihelion distance of the earth from the sun, both cycles being results of planetary perturbations of the earth's orbit. The effect of the second of these cycles is too abstruse to explain here; the first is simpler. As the angle between the plane of the earth's equator and that of her orbit diminishes, the limits of the torrid zone also diminish, inasmuch as that zone is bounded by the tropics which are determined by the angle in question. The region, then, over which the sun is occasionally vertical is being narrowed. An obvious result of this narrowing would seem to be an intensification of the equatorial phenomena of trade-winds, heat, and rainfall within the torrid zone, and a corresponding loss of heat and of precipitation in the extra-tropical zones.

PRINCIPLES OF TIME-MEASURING APPARATUS[1]

I.

WE cannot measure time in that sense in which we measure other things. Time has been very happily defined as the great independent variable of all change; and it is by watching matter in motion, which is the simplest form of change with which we are acquainted, that we estimate its progress. Thus, the motion of the earth around its axis furnishes us with that well-defined interval, the day; and the motion of pendulums (which swing against the earth's attraction) and of watch balances (which swing against the attraction of the particles of matter of which their springs are composed) furnish us with its subdivisions. I mention this at starting, because during our discussion, I want you perpetually to bear in mind that pendulums and watch balances are not mere appendages or terminations to the mechanism of time-measuring apparatus, but are themselves the true time-measurers; and in general, the question of accurately constructing such apparatus resolves itself into the problem of obtaining an uniform impulse—just such an impulse, neither more nor less, which shall exactly restore to the pendulum or watch balance that amount of motion, of which it has, during its preceding swing, been deprived, by the friction of its connections, and the resistance of the atmosphere.

Our natural time-measures, the sidereal and solar days, are determined respectively by the passage of a star or the sun across the plane of the meridian. The solar day is three minutes fifty-six seconds longer than the sidereal day, the reason of which will be obvious from the accompanying diagram (see Fig. 1). During the

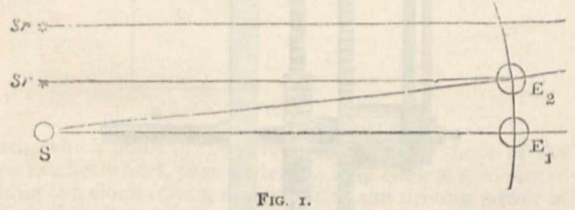

FIG. 1.

time of rotation, the earth, E, has advanced a little distance upon its annual journey round the sun, S. Therefore, any place upon its surface will have to proceed just a little further (through the angular space S E$_2$ S) in order to get the sun opposite to it, than it would have had to have done, had the earth been stationary. The sidereal day is practically the time of one exact rotation of the earth upon its axis; the distance of the stars being so indefinitely great, that their rays throughout the width of the earth's orbit may be considered to continue parallel.

The measure employed in our ordinary every-day reckoning of time is mean solar time, which we derive in this way. Through sundry astronomical causes, the time of the earth's rotation with respect to the sun is not exactly uniform, solar days differing at certain periods of the year by as much as half an hour. In order to avoid the practical inconvenience which it would occasion by having days, hours, and minutes of different lengths, at different seasons, we add the time of all the days of the year together, and dividing by their number (which is fractional) we obtain the average length or mean of the days, and we refer to this and its sub-divisions as days, hours, minutes, of mean time.

Hour-glasses, candles, and water-glasses, were the instruments used by the ancients to indicate the passage of time. It was not till a comparatively recent date that apparatus consisting of a moving body, impelled through the medium of a combination of wheels (which also served to register the body's progress) was introduced for the purpose. We have a very good illustration of such early mechanism in the clock from Dover Castle (see Fig. 2).

A rope supporting at its extremity a weight, W, is wrapped around a cylinder or barrel, B, and by its means

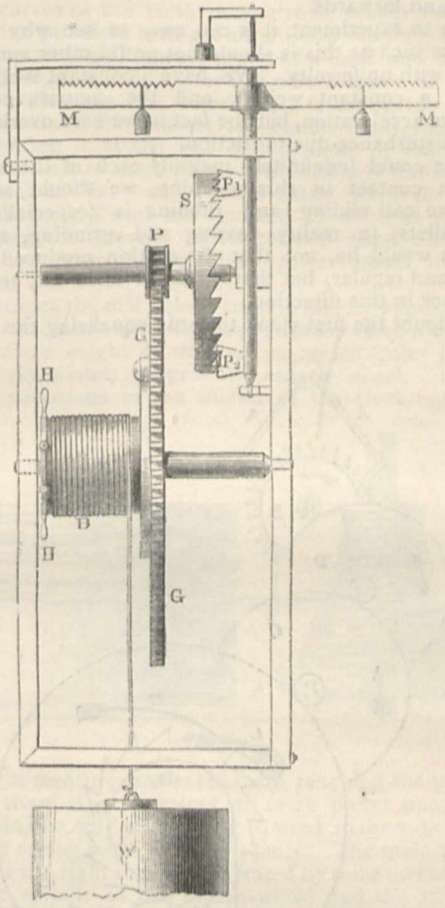

FIG. 2.

drives the wheel G G. This wheel is engaged with a pinion, P, and through it impels the escape-wheel S. The teeth of the escape-wheel operate upon two tongues or pallets, P$_1$ P$_2$, set at an angle to each other upon the stem carrying the moving body or time-measurer, M M. The

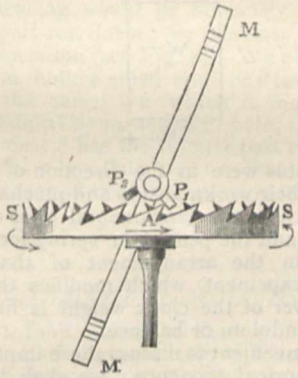

FIG. 3.

action of the wheel upon the pallets is exceedingly simple; the tooth A (see Fig. 3[1]) is now pushing the pallet P$_1$ to the right. It will presently have pushed it out of the way

[1] Lecture by Mr. H. Dent Gardner, a the Loan Collection, South Kensington.

[1] For comparison with Fig. 2, imagine the wheel to be moving in the reverse direction, and the letters P$_1$ P$_2$ interchanged.

altogether, and then the tooth beyond upon the opposite side of the wheel will fall upon the other pallet, and a process similar will take place. By this arrangement the moving body, or balance, will alternately be driven backwards and forwards.

Prior to experiment, it is not easy to see why a contrivance such as this is should not go (in other words run down) with uniformity. We have a constant weight impelling a constant weight, and the contrivance itself destroys acceleration, but the fact is, we here overlook the great disturbance due to friction.

If we could indefinitely magnify each of the surfaces now in contact in this machine, we should see that what we call sliding and rubbing is (especially upon the pallets) in reality tearing and grinding, and the wonder would be, not that the motion produced is not equal and regular, but that it should have any tendency whatever in this direction.

No doubt the first steps towards equalising the motion

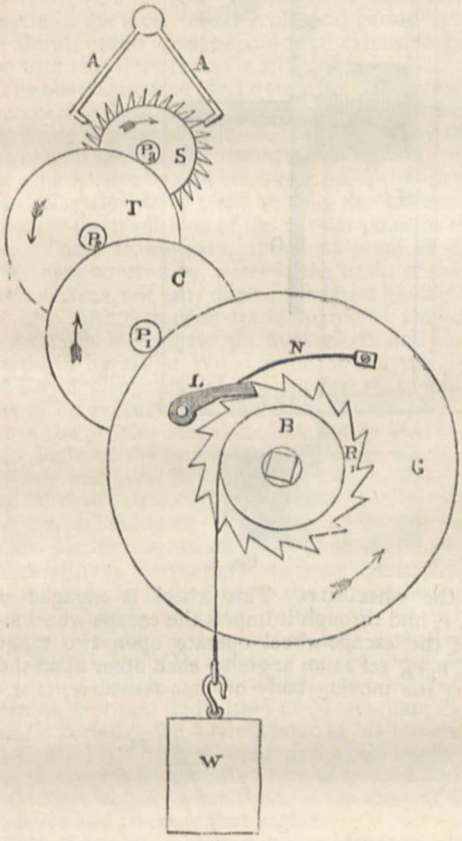

FIG. 4.

of such apparatus were in the direction of a general improvement in their workmanship and mechanical arrangement. Then came the fundamental ones of the pendulum for clocks and the pendulum spring for watches, and lastly, those in the arrangement of that mechanism (called the escapement) which modifies the manner in which the power of the clock weight is finally administered to the pendulum or balance.

It will be convenient to discuss these improvements not strictly in historical sequence: we shall begin with the machinery itself, or clock-train.

Trains.

Fig. 4 shows the general arrangement of a modern clock-train. G is the "great wheel" connected with the "barrel" B, around which the line carrying the weight W is wrapped. This great wheel drives a pinion, P_1, fastened upon the spindle of the centre-wheel C, and the centre-wheel in turn drives another pinion, fastened to the spindle of the third wheel T, and the third wheel again another upon the spindle of the escape-wheel S. The escape-wheel operates upon two arms or "pallets," A A, and by their means passes on impulse to the pendulum. For a clock with a seconds' pendulum there are generally thirty teeth in the escape-wheel, and as one tooth passes either pallet at every other vibration of the pendulum, you will see that it turns once in a minute, and its spindle carries the seconds' hand. The numbers of teeth in the escape-pinion, third wheel, third pinion, and centre wheel are so arranged that the centre-wheel turns once for every sixty turns of the escape-wheel, that is, once in an hour. The great wheel which engages the centre pinion turns once in twelve hours, and for an eight-day clock there are, of course, sixteen turns of the line upon the barrel.

Fig. 5 shows the apparatus for obtaining the relative motions of the hour and minute-hands. Upon the spindle S S of the centre-wheel (which you recollect turns once in an hour) is placed, friction-tight (that is, so stiff that it clings to the spindle, and yet loose enough to be movable by

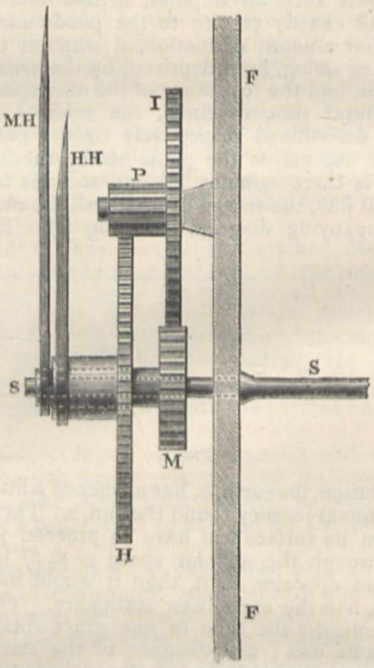

FIG 5.

hand), the wheel M, with a long socket reaching through to the left which carries the minute-hand M H at its extremity. This wheel gears with another, I, which it moves round in twice its time, *i.e.*, in two hours. Connected with this second wheel is a pinion, P, and the wheel H (which rolls upon the socket of the wheel M), gears into it. This wheel is arranged to move round six times as slowly as the pinion P, that is to say, in twelve hours, and it carries a socket to which the hour-hand H H is attached. The socket-wheel, M, being on the spindle of the centre-wheel, only friction-tight, you can, of course, shift the combination without disturbing the clock-train.

The barrel, B, is connected with the great wheel by means of a ratchet-wheel and click (see Fig. 4). The ratchet-wheel, R_1, is fastened to the barrel, and when you wind up the weight by turning the barrel, its teeth being pointed backwards, pass under the click L. When you cease winding, the square face of the tooth meets the click, and communicates pressure through it to the great wheel.

But when you wind the clock, you relieve the great wheel from the strain of the weight, and the clock would stop if you did not introduce mechanism to prevent it. Fig. 6 represents such mechanism.

In this case the click L is fastened not upon the great wheel G G but upon an additional ratchet-wheel, $R_2 R_2$, which rides loosely upon the axis of the great wheel. Its

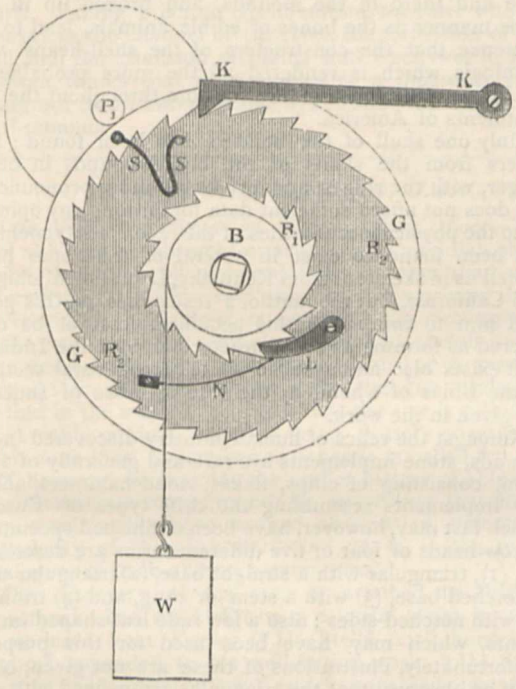

FIG. 6.

teeth, which point in the reverse direction to those of the first ratchet-wheel, pass under the long click K K mounted within the clock frame, and so far as the driving power of the clock weight is concerned, its action may be neglected altogether.

This ratchet-wheel is connected with the great wheel only by the spring S S, one end of the spring being fastened to the great wheel and the other to the ratchet-wheel. The strain of the clock weight keeps this spring closed and is transmitted to the great wheel through it.

Let us see what will happen when we try to wind. The spring S S is relieved from the strain of the weight and essays to open by thrusting back the ratchet $R_2 R_2$, but this it cannot do, for the long click K K prevents it, and banking against this the thrust of the spring is transferred to the clock-train.

Other mechanism is also employed for the purpose,

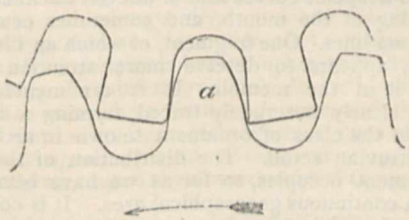

FIG. 7.

One very favourite plan (a very old one, which has been once or twice re-invented lately) places the fulcrum of the lever (in other words, the spindle of the wheel) through which the barrel is wound, upon the great wheel itself.

Great care has to be taken both in shaping and sizeing the various wheels and pinions. It is an advantage to have high numbered pinions, because in this case you do not get so oblique an action of the wheel teeth upon the teeth of the pinions: the action is more across the line of centres.

The curves of the teeth must also be properly formed. The broad principle is to get an uniform running, that is, that the pinion shall always move at a fixed and definite rate with regard to wheel, for if it moves faster or slower it is quite clear that the wheel tooth is acting too far up or too low down the flank of the pinion tooth, that is to say, working it at the end of too short or too long a lever; and less or more power is accordingly transmitted. If you look at Fig. 7 you will see easily that if the top of the wheel tooth *a* were not rounded off quite so much it (supposing the present curve correct) must drive the pinion too fast, and too little power would then be delivered.

Sometimes the main clock-train is merely employed to wind up at certain short intervals (usually twice a minute) a subsidiary weight or mainspring, which latter is that which immediately propels the escape wheel. In this manner variations in the friction of the clock-train can

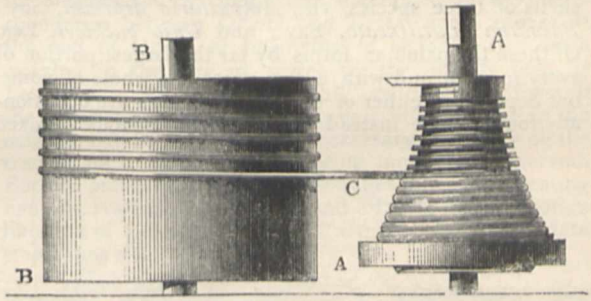

FIG. 8.

be in great measure prevented from reaching the pendulum, if there is a little less or more power upon the clock-train, the only effect being to wind up the subsidiary weight or spring more or less rapidly. The main clock-train is at the right moment liberated by some mechanism upon the spindle of the escape-wheel and the minute-hand being connected with it moves by jumps whenever the weight or spring is wound up.

The general arrangement of the train of watches and chronometers differs little from that of clocks, but the power is delivered by means of a coiled spring, which necessitates the following arrangement.

The spring pulls harder the further you wind it, and its force at commencing would be obviously greater than when it has in part run down; we therefore introduce the following compensation (see Fig. 8). We place the great wheel upon that hollow-sided cone or "fusee" A A, and connect it with the barrel B B (which is impelled by the main spring inside it) by means of a chain, C. When the spring pulls hardest it has the thinner part of the fusee to act upon, it works a lever of shorter radius, and the force at the circumference of the great wheel is in this manner equalised.

(*To be continued.*)

FLORIDA SHELL MOUNDS[1]

THE river St. John drains the eastern portion of the northern half of the peninsula of Florida, running northward over a flat country for a distance of about 300 miles. In the lower part of its course it opens out into large sheets of water two to three miles in width, and as might be expected from the nature of the country, it frequently shifts its bed, and is liable to annual inun-

[1] Fresh-water Shell Mounds of the St. John's River, Florida. By Prof. Jeffries Wyman. In the Memoirs of the Peabody Academy of Science. Vol. I. No. 4.

dations which place large tracts of the surrounding country under water; indeed it is said that a depression of ten feet would cover the whole of this part of Florida by the sea.

It is not until the river begins to narrow its channel near Palatka that the shell mounds which form the subject of this memoir begin to appear, and they then continue at intervals along the banks of the river as far south as Salt Lake. They always are, or have been at one time, on the river bank, although the latter has in some places removed from them, and in others encroached so as to totally destroy or cut deeply into their sides, and as is frequently found to be the case with prehistoric fishing habitations elsewhere, the junction of the river with the lagoons was often selected as a place of residence. Most of the mounds are in the form of ridges parallel to the shore, fifteen, twenty, or twenty-five feet in height, flat-topped, and some of them covering several acres of ground; others are circular; and others again form shell-fields having their materials more evenly distributed, and not more than two to three feet in thickness.

They are composed almost entirely of fresh-water shells of three species, viz., *Ampullaria depressa*, Say; *Paludina multilineata*, Say; and *Unio buckleyi*, Lea. Of these the paludina forms by far the largest portion of every mound, and with a few unios the whole of some, but deposits of either of the above species are occasionally found alone instead of being promiscuously mixed

with the others, showing that probably at certain times they had been used exclusively for food. All three species are now found inhabiting the rivers and creeks, and more particularly the lagoons, the bottoms of which are sometimes covered with them, and yet they are not now found in such abundance as to suffice for the creation of such large mounds, from which it must be inferred either that the construction of the mounds must have been spread over a long period of time, or what is equally probable from the known habits of shell-fish, that they must have existed in greater abundance formerly. It was also noticed that the *ampullariæ* and *paludinæ* in some of the shell mounds were much larger than their living representatives. These observations remind us of similar changes which have been noticed as having place in the size and distribution of the shell-fish found in the kitchen middens of Denmark.

The mounds consist solely of refuse heaps of food, and were not thrown up for any other purpose, which is proved by finding hearth-stones with charcoal, and the remains of the bones of animals used for food at different levels throughout the mass. The animal remains consist of the following species, viz.:—bear, raccoon, hare, deer, otter, opossum, turkey, alligator, hard and soft-shelled turtle, box-turtle, gopher, catfish, gar-pike, whiting, and other birds and fish not determinal. No trace of domesticated animals has been discovered, nor does the dog anywhere appear in the shell mounds, and there is no evidence that agriculture had been introduced. A few bones of mastodon, horse, ox, and other animals now extinct in this region have been found, but their condition has led the author to think it certain that they do not belong to the age of the mounds, and may perhaps have been scooped up from the bottoms of the creeks with the shells taken for food. Fragments of human bones found scattered here and there in the mounds, and broken up in the same manner as the bones of edible animals, lead to the inference that the constructors of the shell-heaps were cannibals, which is rendered all the more probable by the known prevalence of this custom throughout the two continents of America.

Only one skull of the builders has been found; this differs from the skulls of the burial-mounds in being longer, with the ridges and processes more pronounced, but does not afford sufficient data for forming any opinion as to the physical peculiarities of the race. Platycnemism has been found to exist in several of the bones here, as well as in skeletons from Kentucky, Labrador, Michigan, and California, but the author's researches on this point lead him to think that this peculiarity cannot be considered as forming a race-character amongst the Indians, as it exists also amongst the white race, several sections of the tibias of whom, by the side of those of Indians, are given in the work.

Amongst the relics of human industry discovered in the mounds, stone implements are rare and generally of rude form, consisting of chips, flakes, stone hammers, and a few implements resembling the drift types of Europe, which last may, however, have been unfinished specimens. Arrow-heads of four or five different forms are described, viz. (1), triangular with a straight base, (2) triangular with a notched base, (3) with a stem or tang, and (4) triangular with notched sides; also a few rude leaf-shaped implements, which may have been used for this purpose. Unfortunately, illustrations of these are not given, but it may be observed that the triangular arrow-head with side notches is a form which is almost exclusively confined to America, being common throughout the United States and in Patagonia. The bone tools consist chiefly of awls, the ulna of the deer being a favourite bone for this purpose; fragments of stag's horn are also found cut round the outside and broken off, and also with longitudinal incisions for the purpose of detaching long pieces suitable for making pins.

The shell tools are made exclusively of marine species, viz., the *Strombus gigas*, and two species of *Busycon*, found abundantly on the Atlantic and Gulf coasts, and known to have been used in prehistoric trade as far north as the great lakes. They appear to have been held in the hand, and are spoken of by Le Moyne and Cabeza de Vaca as implements employed by the Indians for cutting wood.

Pottery is found only in the later mounds in small fragments and is composed of clay mixed with a vegetable fibre; the vessels were all hand-made, and appear to have been formed in irregular curves and of uneven thickness, generally flaring at the mouth, and sometimes ornamented with incised lines. One fragment, of which an illustration is given, appears to deserve more attention than is given to it in the memoir. It is ornamented with a loop-coil clearly but rudely traced, forming a fragment perhaps of the class of ornament known in architecture as the Vitruvian scroll. The distribution of the use of this ornament occupies, so far as we have been able to trace it, a continuous geographical area. It is common in Peru, Mexico, Colorado, Arizona, and amongst some of the tribes of the northern part of South America, and its occurrence here is of interest, as affording perhaps the most reliable evidence of connection with the arts of the races to the south and westward.

Like the kitchen middens of Denmark, these shell-heaps were, for many years after their discovery, con-

sidered to be of natural origin. Little or no notice of their contents appears to have been taken until the examination of them by Prof. Wyman, in 1860 and 1867. They are now for the most part covered by a thick forest-growth, the chief trees being oaks and palmettoes, with many shrubs and vines. The age of some of the oaks growing upon the mounds has been estimated by their annual rings at 400 years, and one, a gigantic one, at 666 years. Taking this into consideration, together with the changes in the channel of the river, the formation of new land, and the extension of plants and trees over it, Prof. Wyman thinks that an antiquity of a thousand years would not be an unreasonable age to allow for the earliest shell-mounds.

OUR ASTRONOMICAL COLUMN

THE VARIABLE STAR 34 CYGNI, NOVA 1600.—This star, although an object of pretty frequent meridian observation, has probably received less attention than most others from those observers who especially occupy themselves with the variable stars, owing to the circumstance of the estimates of magnitude recorded at transit having been remarkably accordant for upwards of a century. Indeed since the year 1750, on examining the catalogues, we find in the majority of cases that the star is estimated 5½, the only marked exception being Bessel's observation in his zone 1825, September 14, when it is called 6·7.

If, however, we examine the earlier history of this star, we see there are some grounds for suspecting that one or more maxima may have escaped observation, unless the irregularity of variation attributed to it, in the recent catalogues of such objects be very great.

The discovery of the star is ascribed to William Janson, who had marked it on a celestial globe in 1600, as we learn from Kepler ("De Stellâ tertii honoris in Cygno," appended to his well-known work, "De Stellâ novâ in pede Serpentarii," which appeared in 1606). Kepler himself was not aware of its existence till May, 1602, and he enters into an explanation which is, to an extent, apologetical, for his not having previously remarked it. At the same time he calls it a *new* star, and in proof of its being so, adduces, in addition to Janson, the authority of Justin Byrgius and Bayer, who, by the way, has attached the letter P to the star in his "Uranometria," and is followed by Prof. Schönfeld. By observations in August, 1602, he fixed its position in R.A. 300° 46′, Decl. 36° 52′, which agrees closely with the modern catalogues. He calls it a third magnitude in 1602, and states that it continued of the same brightness during the nineteen years over which his observations extended; it was not quite so bright as γ Cygni, but was brighter than β in the same constellation.

According to Liceti it appeared again in 1621, afterwards diminishing, until lost altogether. In 1655 it was observed again by Dominique Cassini, and gradually brightened during five years, until it attained the third magnitude, and subsequently diminished. Hevelius states that it reappeared in November, 1655; it was still very small in 1666, afterwards becoming brighter, though without reaching the third magnitude. In 1677, 1682, and in 1715 it was estimated a sixth magnitude, and there is no further record of its increase to the maximum of 1602.

Pigott assigned a period of eighteen years, which but imperfectly represents the observations of the seventeenth century.

Schönfeld remarks that it is doubtful whether the star had its actual brightness before the year 1600, or was invisible; perhaps the former condition will be considered the more probable, notwithstanding Kepler's account of its having escaped his observation from the year 1591, when he commenced the study of the heavens under Mæstlin, and noted but one conspicuous star in the breast of the Swan.

Probably a systematic observation of 34 Cygni may lead to the record of another maximum. The star is of a deep yellow colour, and its position for the beginning of 1877 is in R.A. 20h. 13m. 15s., N.P.D. 52° 21′.

Its neighbour χ (Bayer) Cygni, deserves special attention at present, the fluctuations of brightness for some years past having been quite exceptional. Its position is in R.A. 19h. 45m. 50s., N.P.D. 57° 23′ for 1877·0.

THE INTRA-MERCURIAL PLANET QUESTION.—M. Leverrier made a further communication to the Paris Academy, on the 2nd inst., with reference to this subject. Having collected in his previous communications, chiefly from the original authorities, such observations as could be supposed to bear upon it in any way, he finally selects for discussion those only which, in addition to the roundness and blackness of the spots, have distinct mention of sensible change of position upon the sun's disk on the day of observation. There are ten cases under this head in the months of January, February, March, May, and June, or possibly beginning of July, and October. M. Leverrier remarks it is inadmissible that a body projected upon the sun on February 12, which is the date of the observation by Steinheibel mentioned in the correspondence between Olbers and Bessel, could repass at the end of March or beginning of October, *i.e.*, when arriving in the line of nodes of the objects seen by Lescarbault and Lummis. This could only happen if the first body moved in an orbit very little inclined to the ecliptic, but in this case the necessary frequency of the transits must have led to its being more often observed. For the present, therefore, he confines himself to treating five observations in October and March, where motion like that of a planet in transit are recorded. His data stand thus:—

Decuppis,	1839, Oct.	2·0	... ...	Helioc. long.,	8°·60
Fritsch,	1802, Oct.	10·0	... ...	,,	16·46
Sidebotham,	1849, March	12·18	... ...	,,	172·01
Lummis,	1862, March	19·87	... ...	,,	179·86
Lescarbault,	1859, March	26·22	... ...	,,	186·60

And it is found that these five longitudes are represented with all the precision permitted by the nature of the observations by the formula (ν = helioc. longitude)—

$$\nu = 121^{\circ}{\cdot}49 + 10^{\circ}{\cdot}9017834\, j - 0^{\circ}{\cdot}52 \cos.\ \nu,$$

j being reckoned in days from 1750·0.

The differences between calculation and observation are:—

1839	...	+ 3°·6	1849	...	+ 3°·5
1802	...	− 3·6	1862	...	+ 0·8
			1859	...	− 4·6

None of the residuals exceeding a half-day's motion, M. Leverrier thinks it permissible to infer that the five observations appertain to the transits of the same body.

With the above motion the period of revolution is 33·0225 days, and the semi-axis major 0·201.

The existence of an intra-Mercurial body announced by theory, being, according to M. Leverrier, beyond doubt; to use his own words, "nous voilà desormais en possession de données permettant dès à present de constituer une première théorie qui conduira à retrouver la planète avec facilité et à la faire rentrer dans le système régulier des corps célestes." In conclusion he states that he is now occupied in determining the epochs of the next following transits over the sun's disk.

NOTE ON THE SUN-SPOT OF APRIL 4, 1876

(Communicated by the Astronomer Royal)

ON the publication of Herr Weber's observation of a round spot seen on the sun on April 4, reference was made to the photographs taken at the Royal Observatory, Greenwich, on the morning of that day, and it was remarked at once that there was a small round spot

in a group of faculæ near the north-east limb in the place indicated by Herr Weber's observation. The position of the spot has now been measured on the two photographs, which were taken at 21h. 46m. 35s. and 22h. 1m. 4s. Greenwich mean time respectively, and the following are the means of the two sets of results which agree very closely :—

1876, April 3d, 21h. 54m.

Distance from sun's centre along arc of parallel	788″
Diff. of R.A. (Spot − ⊙)	+ 52ˢ·3
Diff. of N.P.D. (Spot − ⊙)	− 218″·5
Distance from sun's centre	817″
Distance from N.E. limb	145″
Diameter of spot	4″

As Herr Weber's observation was made at 4h. 25m. Berlin mean time, or 3h. 31m. Greenwich mean time, the sun's rotation in the interval—5h. 37m.—would have carried the spot to a distance of about 163″ from the limb, as appears from a rough computation, and thus the position would agree tolerably well with that given by Herr Weber. There can be no question that the spot on the Greenwich photographs, which is the same as that observed by M. Ventosa, is an ordinary sun-spot without penumbra, and not an intra-mercurial planet.

Royal Observatory, Greenwich, October 4

CAUTIONS AS TO INTRA-MERCURIAL OBSERVATIONS

AT the Paris Academy on the 2nd instant, Dr. Janssen read a paper containing some very timely cautions as to the observation of the transit of intra-Mercurial bodies across the sun. He maintains that we have the means of investigating the problem which at present is interesting astronomers of a most satisfactory kind and leading to a certain and rational result. The first of these means is the knowledge we now possess of the solar envelope, and the second is photography. A criterion of a true transit is that the spot be well rounded against the solar disc, that it have a rapid displacement on the surface of the disc, a motion quite different from the apparent motion of solar spots. These requirements would eliminate a great number of doubtful observations, and even then the transit might not be a real one. Many solar spots are distinctly rounded, but then error is apt to creep in in the observation of the proper movement, especially when the observation is made with a telescope having no equatorial mounting, the diurnal motion making the spot appear to be constantly changing place. The rapid disappearance of a spot is no proof that it is outside the sun ; at the minimum period spots have a tendency to dissolve rapidly. It follows that the isolated observations made by persons who have no thorough knowledge, or who have not suitable instruments, are comparatively valueless. While giving the highest place to photography, Dr. Janssen thinks telescopic observations of so great importance that he gives some hints for the guidance of observers.

There are circumstances connected with the constitution of the photosphere which may afford guidance even in fugitive observations. Briefly, as a solar spot is a phenomenon of the photosphere, a disturbing phenomenon at the highest point of the region where it is produced, it follows that the ordinary aspect of the photosphere is modified all round it. Moreover, if the spot is sufficiently distant from the centre of the disc, it ought to present the perspective effects of an object placed upon the vanishing surface of a globe. Finally the region of the sun where the spot appears ought to be attended to, to discover its solar latitude, since we know that the spots are located in two main regions, to the north and to the south of the sun's equator. More valuable still is the following test. It is evident that a moving body interposed between our eye and the solar surface ought to produce a succession of eclipses of the granulations covering that surface ; to cover successively those towards which it moves and uncover those on the opposite side. This phenomenon of emersion and immersion is the most decisive of all tests of the value of a brief observation ; it requires, however, a good instrument of considerable power. Dr. Janssen advises moreover that the regions around the sun's disc to three or four minutes angular distance should be explored with the greatest care ; as at that distance the coronal atmosphere is bright enough for a body of a fraction of a minute in diameter to give a visible eclipse. A trustworthy observation of a body seen either entering or leaving the sun's disc under such circumstances, is of the very highest value ; moreover the field of observation is thus greatly increased. But eye observations of the sun must at best be but isolated, and photography furnishes the only sure method of unerring, precise, authentic observation, surpassing in value that of the ablest astronomer.

The question of intra-Mercurial bodies shows once more the immense importance of obtaining uninterrupted international observation of the sun's face. Hence the value of a mechanical photographic revolver that would, every hour, say, photograph the sun, without requiring the interference of any one. A number of these distributed over the globe would, in a few years, give us such a knowledge of the sun's surface as it would be impossible to obtain under any other circumstances.

RUSSIAN EXPLORATION IN ASIA DURING THE PAST SUMMER

THE following information as to the different scientific expeditions sent during the past summer by the Russian learned societies for the exploration of various parts of Russia and of the adjacent territories will probably be of interest. We begin with Central Asia, leaving for another paper the report upon the proceedings of the expeditions to the Obi and Jenissei.

M. Prshevalsky has left Omsk, and we have already given some account of the scientific staff of the expedition and the route he proposes to follow.

M. Severtsoff, as reported by the *Turkestanskija Vedomosti*, was to begin his travels in the Fergana district and in the adjoining hilly tracts during this autumn. He will be accompanied by M. Sharz, astronomer, M. Mushketoff, mining engineer, M. Smirnoff, botanist, M. Skvortsoff, zoologist, one topographer, and six Cossacks. During next summer he proposes to explore the Alai and the mountains south of Kokan, and to penetrate about the autumn into the Pamir, reaching here the route followed by the members of Mr. Forsyth's expedition.

M. Potanin, as reported by the *Sibir*, reached Omsk on June 27. The object of his expedition is the geographical, ethnographical, and economical exploration of North-western Mongolia, for which purpose 9,400 roubles were allowed by the Geographical Society and by the Government. He will be accompanied by his wife, M. Posdnéeff, linguist, M. Raphailoff, topographer, M. Beresoffsky, volunteer, and M. Kolomiitseff, zoologist, sent by M. Severtsoff. Starting from the Zaisansky post on the Irtish, M. Potanin will follow the steppe-valley of the Black Irtish and proceed to Urumga, Khobdo, the Oobsa-nor. For winter-quarters he will then go south, through Oolassootai to the eastern parts of the Tian Shan. During the following summer, taking a northern course, the expedition proposes to reach the sources of the Jenissei and the Kossogol lake, returning south again for the winter to the eastern foot of the Shangai-alin and to the expansion of the Onguiin river. During his stay in Omsk, M. Posdnéeff has assiduously visited the town's archives, and has found some very interesting documents ; for instance, letters from the Telengoot chiefs written in Kalmuck with Mongolian alphabet, whilst now the Telengoots do not use any written language.

M. Poliakoff, who was sent by the St. Petersburg Academy for the exploration of the fauna of the Lower Obi, which fauna has not been explored since the times of Pallas's companion Zooeff, has already collected many interesting zoological materials. He found, also, vestiges of the stone age. Having received some pecuniary help from the municipal councils of Tiumen and Tobolsk, he proposed to extend his travels to the mouth of the Obi, and to reach, if possible, the Tasofskaia Gooba.

M. Chersky, of the Siberian Branch of the Geographical Society, explored the lower parts of the Irkoot river, where it enters its deep cañon below the Toonka settlement. This cañon has been traversed but once, in 1855, by M. Bakshevitch. It is reported, by the *Sibir*, that M. Chersky, as might be expected, has collected many materials for the settling of the much-debated question on the origin of the Toonka valley, and of the trough of the Baikal.

M. Regel (son of the botanist), having accepted the position of surgeon in the Kooldsha district, is exploring the country and preparing large collections for the St. Petersburg Academy and Botanical Gardens; and Capt. Larionoff with three preparators for natural history collections, continues his investigation of the hilly tracts of the same district.

Prof. Wagner, zoologist, has just returned from his excursion to the White Sea. He stayed more than a month on the Solovetzky islands, engaged in the collection of materials for his biologico-morphological studies; and his companions, Prof. Grigorieff, and the students Andréeff and Mereshkofsky, have traversed the shores of the White Sea, and returned with large collections of the sea-fauna.

The zoologist, M. Grimm, sent for the exploration of the Caspian fauna, gives ampler information as to his proceedings, in letters published in the *Golos*. Having at his disposition the steamer *Persianin*, he cruised the sea in various directions. On the cruise between Bakoo and Fort Alexandrofsk he dredged at various depths between six and 300 fathoms, bringing up immense quantities of animal forms. The most interesting were: molluscs, *Adæna vitrea*, enormous *Cardium crassum*, and an undetermined species of *Cardium;* among the sponges, the *Reniera flava;* a new species of *Isopoda*, some new species of *Gammaridæ*, a new *Mysis*, the *Idotea entomon*, &c. Among the fishes deserve to be mentioned some small ones from a depth of 70–90 fathoms, as transparent as glass, and a black marine species of *Luciaperea*, more common at Fort Alexandrofsk than the common *Luciaperea sandra*.[1] Further dredgings on the cruise to Krasnovodsk, made during a dead calm, at depths from 6 to 130 fathoms, produced similar large quantities of animals, many of them found for the first time in the Caspian, or totally new. The more interesting were: living *Adæna vitrea*, *Cardium*, many *Gasteropoda*, a new species of *Neritina*, and a living *Planorbis micromphalus* (discovered in 1874), from a beautiful rose-colour. The *Crustaceæ* and *Vermes* were also numerous. But the most beautiful of the collection found are sponges collected near the Kara-boogas gulf at depths of 40–48 fathoms. Marked by the most vivid colours, from pale-yellow to a bright red, they cover nearly, without interruption, the stones, assuming the forms of flat thick carpets, and half-spherical, totally spherical, or egg-shaped masses, reaching the size of a child's fist. Altogether, the two cruises in the northern parts of the Caspian gave a very interesting, varied, and rich collection of animal forms, and proved that the northern part of the sea has a richer fauna than the south, which, at first, seemed improbable. It is well to remark, also, that on the eastern shores, where the water reached as high a temperature as 31° Cels., the animals occupy deeper zones than on the western shores where the temperature of the water is lower. Having made some excursions in the neighbourhood of Krasnovodsk, M. Grimm proceeded to Bakoo, but the weather was very stormy and the dredgings were made at small depths (sixteen fathoms), producing only already known forms. From Bakoo M. Grimm proceeded northwards, proposing to explore the greatest depths of the northern parts of the sea.

[1] The whole number of species of fishes in the Caspian M. Grimm estimates to be about eighty, ten of which are new species, discovered by the explorer in 1874.

NOTES

AT the recent meeting of the Association of German Naturalists and Physicians at Hamburg, a proposal for the establishment of zoologico-botanical stations on the German coast was reported on and discussed. The high importance of such establishments to German science was recognised. While all praise was accorded to the Naples establishment, considerations of distance, expense, and climate, render it desirable that similar stations should be established within easier reach of German students and biological investigators. The report of the Committee appointed to consider the matter discussed the suitability of various places for such establishments, and concludes by strongly recommending Kiel on the Baltic and Heligoland in the North Sea. The Committee are of opinion that the establishments should be established on the broadest bases for the investigation not only of the botany and zoology of the seas referred to, but also for their physics, their chemistry, and for meteorology. In the discussion which followed it was suggested that the Heligoland station might be conducted in connection with English men of science. The Association finally decided as follows:—1. The erection of stations for zoologico-botanical research at Kiel and in Heligoland is necessary for the development of German science. 2. The Association approves of the drawing up of a memorandum and petition, to be sent to the Imperial Chancellor, the Bundersrath, and the Governments of the several States of the Empire, with the additional request to the Prussian Government that it would take the initiative in the matter. 3. The Association to appoint a commission to draw up and distribute the memorandum. 4. The memorandum to be circulated among all eminent German scientific men, in order to obtain as many signatures as possible. The following Commission was appointed to draw up the memorandum:—Professors Alex. Braun, Ernst Haeckel, Rud. Leuckart, Dr. H. Ad. Meyer, Alex. Pagenstecher, Pringsheim, and Julius Sachs, with power to add to their number. It is not necessary to say one word in commendation of this admirable scheme; we cannot doubt that it will be successfully carried out.

DR. JANSSEN is devising the construction of an automatic photographic revolver, which will take a photograph of the sun every hour each day of the year, from sunrise to sunset. The photographs which will be taken under cloudy conditions, will be useless so far as sunspots are concerned, but they might be utilised for meteorological purposes. The others will be kept and tabulated. The advantage of this plan is that it will dispense with any observer, and will obtain a mechanical regularity. A communication will be made very shortly to the Academy of Sciences on the invention which was suggested by the discussion on the transit of "Vulcan." It will be set to work in the physical observatory of Dr. Janssen.

AT the inaugural meeting of the third session of the Yorkshire College of Science, held on Friday last, Lord Frederick Cavendish, M.P., the President of the College, drew attention to a report drawn up by Mr. Beaumont, the Instructor in the Textile Industry Department, in conjunction with Mr. Watts Maclaren, on the Weaving Schools of the Continent. It appears that there are no less than twenty-five separate schools of instruction in connection with textile industries, in addition to seven belonging to Polytechnic Institutions, scattered throughout France, Belgium, and Germany, and in spite of the fact that the majority

of these schools are unaided by the State and have to rely mainly upon the fees of the students, supplemented by subscriptions from the manufacturers, they can vie with some of the best equipped scientific laboratories of the Continent in the character of their organisation and in the completeness and extent of their arrangements. An effort is about to be made to secure a portion of the surplus in the hands of the Commissioners of 1851, with a view to the further extension and development of the College. They had established a number of chairs more or less connected with the necessities of the manufacturers of the district, but they required extension in the direction of other subjects, many of which doubtless lay nearer to the basis of sound education. Their buildings were rapidly getting inadequate to their requirements, and they wanted additional lecture-rooms, and a good library. Prof. Rücker, speaking for himself and his colleagues, believed that the greatest want of the institution was not so much that a large sum of money should be devoted to further scientific objects, but that a portion of the money should be spent in the furtherance of other objects of education besides those which were scientific. They found practically that they were hampered in their work by the fact that they were unable to offer to the students that came to the college a complete preparation for the curriculum which they would have to go through at the universities. The Council of the College had found themselves in a position to add to the scientific chairs which they had already founded, and he trusted that they would soon be able to create chairs for classics, modern languages, and literature.

A KIND of supplement is about to be issued regularly along with *Poggendorff's Annalen*, under the title of *Beiblätter zu der Annalen der Physik und Chemie*, the object being chiefly to give a *résumé* of physical science in foreign countries.

FROM a letter received from Prof. Mohn, we learn that hourly meteorological observations of all the elements have been made by the Norwegian Scientific Expedition during the whole cruise. In the hands of this distinguished meteorologist the invaluable data thus acquired will doubtless be made to tell us something regarding the daily periods of the meteorological elements, including the surface temperature and density of the northern portion of the Atlantic, and the part they play in the meteorology of North-Western Europe.

THE unusually high temperature which prevailed over the British Islands during the latter part of last week deserves a passing notice. The mean temperature from October 4 to 7 was 62° in London, and 59° in East Lothian, being 8° and 9° respectively above the average of the season. The Weather Maps of the *Bulletin International* of Paris and of the *Deutsche Seewarte* of Hamburg, show for these days a high atmospheric pressure over all Europe southwards and eastwards, whilst a pressure continually getting lower was met with on advancing westwards over the British Islands. These are interesting as the meteorological conditions which are the immediate cause of unusually mild warm weather at this season of the year, seeing they necessarily result in an extensive southerly atmospheric current, bearing northwards with it the high temperature and moisture of southern latitudes.

THE fourth number of the *Isvestia* (Bulletin) of the Russian Geographical Society, just appeared, contains a sketch of the Guissar region and of the Koolab-beckdom, by M. Maïeff; letters of the governor of the Semipalatinsk province, by General Poltaratzky; on the German expedition of Dr. Finsch, Dr. Brehm, and Count Waldburg-Zeil; and two letters from Dr. Miclucho Maclay written on board the schooner *Sea-Bird*, and dated February 29 and April 12. Desirous of obtaining further information as to the races of South-eastern Asia, the East Indian Archipelago, and of the Pacific Islands, Dr. Maclay wished especially to visit the islands of Western Micronesia and the group of little-known islands lying between New Guinea, New Ireland, and New Britain, these islands being, it is supposed by certain ethnologists, near to the route taken by the Malayo-Polynesian race before spreading over the islands of the Pacific. The *Sea-Bird*, at the time the letters were written, was going to the western islands of the Caroline Archipelago, stopping from time to time at the more interesting localities lying near to her course; and after having discharged her cargo she will be for some time at the disposal of Dr. Maclay, for his proposed journey.

THE members of the scientific expedition sent for a further exploration of the former bed of the Amu-arya, left the Krasnovodsky post on August 22, with a reconnoitring military party proceeding to the Steppes under General Lomakin.

WE are glad to learn from the Mauritius *Commercial Gazette* that Mr. John Horne, F.L.S., who for a long time has most successfully fulfilled the duties of director of the Mauritius Botanical Gardens, has been confirmed in the appointment. This promotion we believe to have been thoroughly well earned.

VISCOUNT WALDEN, President of the Zoological Society, has, by the death of his father, succeeded to the Marquisate of Tweeddale.

THE death is announced of the Chevalier Pertz, for many years librarian to the Royal Library, Berlin, and editor of the *Monumenta Germanica*. He was brother-in-law to the late Sir Charles Lyell.

THE *Reports of the Meteorological, Magnetic, and other Observatories of the Dominion of Canada, for* 1875, appear in a thick volume of 541 pages, giving full details of the tri-daily observations and monthly extremes and means for the year at various stations, now amounting to 108. The report gives evidence throughout of increasing energy and efficiency in this valuable system, the object of which is the collection of meteorological statistics suited for the discussion of physical questions, and the deduction therefrom of the climatic character of the several districts, and the application of the facts and principles thus acquired to questions of practical utility, especially the prognostication of the weather. The new features of this report are a table of the latitudes, longitudes, and heights of the stations, and tables of the maxima and minima of temperature at the more important stations in the dominion for each day of the year. Among the interesting facts noted is the low temperature of −49°·5, which occurred in January at York Factory, on Hudson Bay, the mean for the month at the same place being −25°·5, and for February following, −24°·6.

MR. CHARLES TODL has issued in a separate form his paper "On the Observatory and Climate of South Australia," originally published in the "Handbook of South Australia." Perhaps no other of our English colonies could be named whose climate has been more ably and, so far as the materials hitherto collected admit of it, more exhaustively treated than that of South Australia in this tractate. The rainfall of the colony is now being investigated at upwards of seventy observing stations extending over the whole breadth of Australia, as is also the annual southerly march of the north-west monsoon which prevails on the north coast from about the middle of November to March, and occasionally extends its influence in heavy thunderstorms right across the continent. Among the many interesting relations subsisting between the meteorology of South Australia and that of surrounding regions may be noted the progressive changes of the barometer which, roughly speaking, advance from west to east at such rates as to occupy from two to four days in passing from Western Australia to Adelaide, after which they reach Melbourne in from twelve to twenty-four hours, and

Sydney and Brisbane in about twenty-four to forty hours. The importance of this in a system of weather warnings for Australia need scarcely be pointed out.

A LINNEAN Society was recently established in New South Wales, and now numbers, in addition to a president (Mr. W. Macleay), vice-president, secretary, treasurer, and council, about 120 members. Its first meeting was held on January 25, 1875, and it now publishes the first part of its first volume of *Proceedings*. Among the papers are contributions to the Malacology of Australia and the Solomon Islands, by Mr. Brazier; to our knowledge of the stone implements of Australia and the South Sea Islands, by Dr. Cox; description of a new genus and species of rat-kangaroo (*Hypsiprymnodon moschatus*), by Mr. E. P. Ramsay; and, by the same author, of a new genus and species of Passerine bird (*Vitia ruficapilla*), from the Fiji Islands; notes on zoological collections made in Torres Straits and New Guinea during the cruise of the *Chevert*, &c. The botany of the colony appears at present to have furnished nothing to the Society, to which we wish a prosperous career.

MR. W. J. BEAL reprints in one cover three papers read before the American Association for the Advancement of Science at the Detroit meeting:—Carnivorous plants, Inequilateral leaves, and the Venation of a few odd leaves. Mr. Beal includes *Martynia* in the list of true carnivorous plants.

THE fourth annual edition has appeared of Prof. E. Morren's extremely useful "Correspondance botanique," a list of all the botanic gardens in the world, with the officers connected with them, and the various other establishments for instruction in botany.

THE following curious experiment has recently been described by M. Spring to the Belgian Academy:—A sheet of vulcanised caoutchouc two-tenths of a millimetre thick is stretched till its surface becomes six or seven times greater, then rubbed with a cloth. This friction electrifies the sheet so that it will readily attract light bodies. If now the mechanical tension of the sheet be gradually diminished, the quantity of electricity diminishes along with it, until when the band has recovered its original length, all trace of electricity disappears (provided the original charge have not passed a certain limit). M. Spring concludes that the variations of electric state of the band are intimately connected with molecular changes experienced interiorly according to the degree of tension. The experiment is one which deserves the attention of physicists.

THE recent number of the *Schriften der naturforschenden Gesellschaft in Dantzig* contains several excellent photographs of the skeleton of a whale (*Fterobalæna laticeps*, Gray), stranded in Dantzic Bay in 1874; a description of the spiders of Prussia; a lecture by M. Ohlert on Laplace's hypothesis, and an account of acoustical studies on the piano, by M. Kayser.

M. SKALWEIT, of Memel, relates in the publication just named that in summer he observed a wasp flying about a writing desk near an open window. There were some steel pen-holders on the desk, and the wasp went into one of the tubes. This must have appeared convenient to it, for it soon began to bring in small caterpillars, building each in with earthy paste, till the tube was full. In each cell an egg was also deposited. M. Skalweit took away this holder, and put another in its place. This was similarly filled by the wasp, though in rainy weather and at night the window was closed. Four holders were thu filled. Opening the holders in the end of August, M. Skalweit found the larvæ grown and the caterpillars consumed. The wasp in question was the *Odynerus parietum*, which generally constructs its cells in old fence-posts, hollow plant-stems, old walls, &c.

AN improved catalogue of variable stars is published by Prof. Schönfeld in the thirty-ninth and fortieth *Jahresbericht des Mannheimer Vereins für Naturkunde* (Mannheim, 1876). It is largely based on his own observations.

THE extraordinary divisibility of matter is well illustrated by a lecture experiment recently described to the Berlin Chemical Society by M. Annaheim. He employs the strong colouring power of fuchsin and cyanin. To form an idea what quantities of colouring matter were still perceptible by the eye, he dissolved 0·0007 gramme of fuchsin (a particle about 0·5 mm. diameter) in spirit of wine, and diluted the solution to the extent of 1,000 cubic centimetres. Thus in each centimetre there was still 0·0000007 gramme colouring matter. If this liquid be put in a burette of about 1 cm. diameter, it appears strongly coloured on a white ground, and the colour can be distinctly seen from a distance. If a drop from the burette (there are thirty-five of them in a cub. ctm.) be now let fall into a small dry test-tube of about 0·8 cm. diameter, the red colour is still evident if the tube be held obliquely on white paper, and looked at parallel to the paper, while a second tube with pure spirit of wine is held near for comparison. It follows from this, that with the naked eye one can still perceive 0·00000002 gramme fuchsin. Assuming that one drop of the solution only contains one molecule of colouring matter (and so much must in all circumstances be present), the absolute weight of an atom of hydrogen is inferred to have the astonishingly small value of 0·000000000059 gramme (viz. 0·00000002 : 337·5; molecular weight = 337·5). M. Annahein makes a similar experiment with cyanin, and infers the absolute weight of an atom of hydrogen to be 0·000000000054 gramme, which closely agrees with the former estimate. From these experiments, then, it is mathematically certain, that the absolute weight of an atom of hydrogen cannot be greater than 0·00000000005 gramme.

THE number of visitors to the Loan Collection of Scientific apparatus during the week ending October 7 was as follows:—Monday, 2,186; Tuesday, 1,767; Wednesday, 239; Thursday, 252; Friday, 200; Saturday, 2,439. Total, 7,083.

THE Catholic University of Lille has been at last organised, but the governors of the Sainte-Eugénie Hospital having refused to establish a ward for their use, there can be no Faculty of Medicine. Consequently the University authorities, it is said, are to prosecute the governors before the Council of State in order to obtain the requisite number of patients.

A CORRESPONDENT of *Land and Water* shows that some of our most recent inventions were foreshadowed, if not actually accomplished, upwards of 300 years ago. In a work, "Vegellii Renoti (Flavii) viri illustris de re militari libri quatuor, etc. Parisiis subscuto Basiliensi ex officina Christiani Wecheli, M.D.XXXV.," are figures of a number of military engines, which we work very hard at reinventing. Amongst others there is a revolving gun, revolving turrets for monitors, water-beds for the wounded, &c. The first plate of Book III. shows a warrior habited in a "Boyton dress," completely immersed in water, but without apparent means of breathing. In the second plate is a diver with a reservoir of air, and tube communicating with the surface. There are several representations of these "tube and reservoir" apparatus, and diving dresses. An engraving not only shows the submarine explorer of more than 300 years ago at work, but also gives the diagram of a diving-bell, according to the notion of some engineer of the early part of the sixteenth century.

THE Session of the Watford Natural History Society and Hertfordshire Field Club commences this evening with a lecture "On the Polarisation of Light," by Mr. James U. Harford.

THE storm of the end of September raged with such terrific force at Dijon (Côte d'Or) on the 30th at 2 o'clock in the afternoon, that two turrets on the cathedral were thrown down.

M. KRANTZ intends to imitate on a smaller scale the great Hell Gate explosion by opening in a similar manner the ground of the Champ de Mars, and thus expediting the excavations for the erection of the basement of the Exhibition building.

THE French papers give some figures with reference to the iron framework of the building now constructing. The weight required for the machine gallery will be 17,000 tons, and for other galleries 10,000 tons. To these 27,000 tons of iron or cast-iron may be added 700 tons of sheet iron for covering the building. The superficial extent of carpenter work for battening the roof will be 90,000 square yards covered with zinc. The quantity of the wood necessary is about 2,000 cubic yards. The number of rivets used for bolting the metallic frame will be 11,000,000, and the number of holes to be perforated a little more than double, viz., 23,000,000.

AMONG the lectures to be given at the Nottingham Literary and Philosophical Society during the coming winter, are one by Dr. Ball, F.R.S., November 9, "A Night at Lord Rosse's Telescope," and another on December 7, by Dr. M. Foster, F.R.S., "On Nerves."

THE following are some of the scientific works to be published during the coming season :—The second series of Mr. George Henry Lewes' "Problems of Life and Mind," entitled "The Physical Basis of Mind," is in the press, and will be published by Messrs. Trübner. The same publishers are preparing for publication in December, "Theoretical Mechanics," a Manual of the Mechanics of Engineering and of the Construction of Machines, with an Introduction to the Calculus; designed as a text-book for technical schools and colleges, and for the use of engineers, architects, &c., by Julius Weisbach, Ph.D., Professor at the Royal Mining Academy at Freiberg. It is translated from the fourth augmented and improved German edition by Eckley B. Coxe, A.M., Mining Engineer. With woodcuts.—Messrs. Bentley and Son have in the press a narrative of travel in Norway and Lapland, by Mr. S. H. Eden, to be called "Within the Arctic Circle."—We are glad to notice that Messrs. Chatto and Windus are preparing a new edition of "Wilson's American Ornithology; or, Natural History of the Birds of the United States;" with the continuation by Prince Charles Lucien Bonaparte; completed by the insertion of above one hundred birds omitted in the original work, and illustrated by notes and a life of the author by Sir William Jardine.—Among Messrs. H. S. King and Co.'s announcements we observe :—"The Large and Small Game of Bengal and the North-Western Provinces of India," by Capt. J. H. Baldwin, F.Z.S., Bengal Staff Corps, with numerous Illustrations. "Studies in Spectrum Analysis," by J. Norman Lockyer, F.R.S., "The Races of Man and their Geographical Distribution," from the German of Oscar Peschel. This last-named book is ready.—Prof. Tyndall's "Lessons in Electricity at the Royal Institution," will be published by Messrs. Longmans at the end of this month.

THE additions to the Zoological Society's Gardens during the past week include two Silky Marmosets (*Hapale chrysoleucus*) from S.E. Brazil, presented by Master T. A. Brassey; a Green Monkey (*Cercopithecus callitrichus*) from W. Africa, presented by Mr. Chas. L. N. Ingram; an Entellus Monkey (*Semnopithecus entellus*) from India, presented by Mr. Edwin Penn; two Coatis (*Nasua nasica*) from S. America, presented by Mr. J. A. Watson; a Vulpine Phalanger (*Phalangista vulpina*) from Australia, presented by Mr. Graham M. Sutton; four European Terrapins (*Clemmys europea*), European, presented by Mr. Edward W. Bonham; two Tora Antelopes (*Alcelaphus tora*) from S. Africa, purchased; two Sœmmerring's Antelopes (*Gazella sœmmerringi*) from S. Africa, deposited; a Crested Pigeon (*Ocyphaps lophotes*), bred in the Gardens.

SCIENTIFIC SERIALS

Poggendorff's Annalen der Physik und Chemie, No. 8, 1876.—This interesting number commences with a paper by M. Zöllner, investigating a class of electrical phenomena that do not appear to have been previously studied. When two different bodies, an insulator and a half-conducting rubbing instrument are rubbed together, electrical currents occur in the rubber, as follows :—If the rubbed insulator be positively electric, the currents at the surface of contact or in the interior of the rubber are parallel, but opposite to the relative motion of the insulator; if the latter be negative, the currents of the rubber are parallel, and in the same direction as the insulator's motion. These currents were measured, and shown to be often very considerable, and they could be intensified by multiplying the rubbers and connecting their corresponding parts with wires. They lessen the useful effect of an electric machine, and an advantage is had by uniting the electricity at the positive end of the rubber with the positive electricity of the conductor. M. Zöllner is led to study a variety of related experiments, *e.g.* the currents generated in flow of water through a thin tube. He arrives at this general result : Diaphragm-currents and their modifications are due to the occurrence of new electromotive forces, such that the electric current they generate in the moved liquid, so long as it is in contact with the canals of the diaphragm or the capillary tube, are always opposite to an electric current which would force the liquid in the same direction through the diaphragm as the mechanical pressure.—From experiments made with caoutchouc, carbonic acid, and hydrogen, on the diffusion of gases through absorbing substances, M. Wroblewski concludes that the velocity with which a given quantity of gas diffuses through a caoutchouc membrane is proportional to the pressure of the diffusing gas on the membrane.—A paper on the radiometer is contributed by M. Finkener; the object of the experiments was to show the influence of change of gas, pressure, and radiant heat on the instrument. He finds (1) that with rarefaction not carried too far, and with equal heating, a given motion takes place at a greater pressure in a specifically lighter gas than in a heavier one; (2) the turning force excited by the flame increases at first (other circumstances the same) with the rarefaction of the gas, but with further rarefaction decreases; (3) this maximum occurs at a greater pressure with hydrogen than with air and carbonic acid. M. Finkener offers an explanation of the motion, deduced from these phenomena.—The law of colour-mixture may be studied by superposing different parts of two spectra, or looking at a glass plate from which a surface of one colour is reflected while another colour is seen through it, or by means of the persistence of impressions from a disc with variously coloured sectors or rings set in rapid rotation. M. Bezold here gives another and still more convenient method. You look through a prism of Iceland spar set in a tube blackened interiorly, which is closed below by a disc with four squares cut out of it. The prism gives double images of the squares, and in a certain position two of the eight are brought to coincide with other two in the middle. Surfaces of different colours being brought under the two squares occupying (say) the upper row, their composite colour is obtained in the middle image, and then may be found what colour must be put under the lower two squares to obtain a colour in the middle corresponding to the one above.—Dr. Berthold collects some interesting early indications of a knowledge of the phenomenon of fluorescence as shown by an infusion of nephritic wood. It is remarkable that though Priestley, Fischer, and Wilde referred at some length to the observations made by Kircher, Boyle, Newton, Wolff, and Wunsch, on fluorescence, the facts should have been almost entirely forgotten till our time.—Studying the influence of temperature on the galvanic conductivity of tellurium, M. Exner finds that the seemingly quite irregular resistances of the metal after repeated heatings stand in direct relation to the time of heating and of cooling, a circumstance which must be connected with the crystalline structure of tellurium at low temperatures.—Among the remaining papers we note accounts of an apparatus for combination of vibrations at right angles to each other (Stöhrer), a new hydrometer (Sedlaczek), and an improved poison syphon (Antolik).

Sitzungsberichte der naturwissenschaftlichen Gesellschaft Isis in Dresden, January to June, 1876.—From this publication we note the following papers of importance :—*Mineralogical and Geological Section.*—Geognostical researches on the Leitmeritz mountains, by Herr Engelhardt.—On the Velino fall near Terni, by C. Bley.—On the silver and gold mines in the neighbourhood

of Nertschinsk, by Herr von Pischke.—On the coal formation in the Plauen district, by Dr. Geinitz.—*Section for Researches on Prehistoric Times.*—On the sepulchral mounds (dolmen) of Denmark, by Herr Jünger.—On some objects found recently in former Lake dwellings, by Herr Geinitz.—On the burying-places of Auvernier on the Neufchatel lake, by Prof. Desor.—On the composition of some mortars and face powders of the ancients, by Dr. Landerer.—On some tablets with interesting inscriptions recently found at Pompeii, by Sig. Fiorelli.—On the occurrence of artificially pointed sticks of wood in a layer of argillaceous coal in Switzerland, by Prof. Ecker.—Report of the last meeting of the German Anthropological Society at Munich, and remarks on the same, by Major Schuster.—*Zoological Section.*—On the season dimorphism of certain day lepidoptera, by Herr von Kiesenwetter.—On anthropoid monkeys, by Dr. A. B. Meyer.—On the metamorphosis of the Mexican axolotl, by Dr. B. Vetter.—*Physical and Chemical Section.*—On an improved influence electrical machine, by Carl Dathe.—On a new galvanometer, by Schadewell in Dresden, and on a new Geisler radiometer, by Prof. Neubert.—On the action of chloride of lime upon carbon compounds.—*Mathematical Section.*—On ray-complexes of the second degree, by Dr. Burmester.—On methods of projection, by the same.—On the problem to determine two curves, by Dr. Heger.—On the mechanical conception of chemical processes, by Dr. Hoffmann.—On Riemann's planes, by Dr. Koenigsberger.—On the composition of forces in space, by Herr Mohr.—*Botanical Section.*—On cotton at Pompeii and on some Italian botanical gardens, by Carl Bley.—On some new garden and house plants, by G. A. Petzold.—*General Meetings.*—On excavations and discoveries near Halle, by Dr. Caro.—On the Colorado beetle, by Herr von Kiesenwetter.—On the intellectual life of insects, by the same.—On the axioms of mathematics, by Dr. Koenigsberger.—On researches made in the Caucasus Mountains on earth wax, petroleum, and mud volcanoes, by Dr. Schneider.

Zeitschrift für Wissenschaftliche Zoologie, vol. xxvii. Part 1.—R. Wiedersheim, of Würzburg, devotes a long paper to an account of the structure, disposition, and secretion of the cephalic skin-glands in the tailed amphibia. They appear to possess very generalised characters, and the author regards them as representing the more specialised Meibomian, Harderian, and other glands of higher animals. He claims to have demonstrated the connection of many of his gland-cells with nerve-fibrils, and with branches of ganglion-cells.—August Weissmann has an elaborate contribution on the Daphnidæ, dealing with the formation of the winter eggs in *Leptodora hyalina*. He describes at length the origin of the winter egg, which at first contains several large nutritive cells destined to have all their contents absorbed by one cell to form the nutritive mass for the young germ. Many interesting details are given; but if everything were written at such length, only Germans would survive.—Dr. William Marshall, of Weimar, who has published valuable researches on the Hexactinellid Sponges, has an article on their classification and relationships. His systematic revision of the genera and species will be very useful. He considers the sponges with four-rayed spicules to have been derived from the Hexactinellids, and finds no sharp distinction between the latter and the Ventriculitidæ.—Franz Vejdovsky, of Prague gives an account of the anatomy of *Tubifex umbellifer* (Ray Lankester), for which he creates a new genus, Psammoryctes. This interesting fresh-water oligochætous annelid has been found in Lake Onega, in Victoria Docks, in the Paris Jardin des Plantes, and in Bohemian lakes.

THE sixth part of Reichert and Du Bois Reymond's *Archiv* for 1875 (issued as late as May last) opens with the conclusion of Du Bois Reymond's second memoir on the negative variation of the muscle-current during contraction; it must necessarily be read by all students of this abstruse subject.—R. Hartmann continues his lengthy contributions to our knowledge of the anthropoid apes, by describing several skulls of chimpanzees.—The remaining papers do not call for notice in these columns.—Part 1 for 1876 contains an interesting account, by F. Kurtz, of the minute anatomy of the leaf of *Dionæa muscipula*, accompanied by two plates.—A very long paper by Hermann Munk follows, in this and the following part, on the electrical and motor phenomena of the leaf of *Dionæa muscipula*. The views of Dr. Burdon Sanderson and Prof. Hermann are controverted in many respects; it being contended that the resemblance between the contraction of muscle and that of the leaf is far less complete than the former observer has asserted.—Parts 1 and 2 contain further contributions by Du Bois Reymond on the negative variation of the muscle-current.—Prof. W. Krause maintains his account of the allantois in the human embryo against Kölliker's denial of its existence in his recent work on Development.—Dr. Grüber gives some more notes of minor anatomical variations in the second part, and Dr. Adamkiewicz commences a further contribution on animal heat, which promises to be of great interest.

No. 32 of the *Journal* of the Quekett Club contains the following papers:—On the principle of illumination in connection with Polarisation, by Mr. W. K. Bridgman; On a new method of mounting microscopical objects, by Prof. H. L. Smith; On a new process of histological staining, by Dr. Francis E. Hoggan; On *Tubicolaria Najas*, by Mr. J. Fullagar; the address of the President, Dr. Matthews, and the Eleventh Annual Report.

SOCIETIES AND ACADEMIES

LONDON

Royal Microscopical Society, October 4.—Mr. H. C. Sorby, president, in the chair.—A paper was read by Mr. Thos. Palmer on a new method of measuring and recording bands in spectra, consisting of a photographed micrometer scale shown in contact with the spectra in the field of view and so arranged as to be capable of adjustment as required. The values indicated by the micrometer were by means of a chart and tables engraved and prepared by the author, easily converted into wave-length measurements.—A paper on the microscopical structure of amber, by Mr. H. C. Sorby and Mr. P. J. Butler, was read by the president.—A paper by Dr. Hinds on a curious effect in connection with the cells in the leaves of *Hypericum Androsæmum* was (owing to the lateness of the hour) taken as read.

PARIS

Academy of Sciences, Sept. 25.—Vice-Admiral Paris in the chair. The following papers were read:—Examination of observations presented at various epochs regarding the transits of an intra-Mercurial planet (continued), by M. Leverrier. He notices fourteen observations from 1820 to the present.—Probable consequences of the mechanical theory of heat, by Gen. Favé. The heat from the sun may have a repellent action on the stars. The phenomena of latent heat may probably be explained by supposing that a liquid contains a greater quantity of interposed ether than a solid, and a gas more than a liquid. Tempered steel probably owes its elastic property to an increase of ether. Ozone and oxygen, sulphur and phosphorus, in their different states, perhaps obey the same law. Opaque solid bodies, as well as transparent bodies, have a certain quantity of constituent ether which increases with the temperature.—On the contact of a curve with a system of curves doubly infinite, by Mr. Spottiswoode.—Photomicrographic researches on the effects of reduction of salts of silver in photographic negatives, by M. Girard. Examining with high power a negative developed indistinctly with sulphate of iron or pyrogallic acid, there are found in the clear unimpressed parts, crystals of reduced iodide of silver uniformly distributed; these constitute the *veil*, a cause of frequent insuccess.—The carburetted schists of Côtes-du-Nord, by M. Hena.—On the destruction of phylloxera by intercalary cultivation of red maize, by M. Gachez. The insect abandons the vine to attack the roots of the maize.—On the use of bobbins of very small resistance in employment of telegraph lines for meteorological announcements in stormy weather, by M. Germain.—On the number of branches of curves of a system (μ, ν), which cut a given algebraic curve at an angle of given magnitude, or the bisectrices of which have a given direction, by M. Fouret.—New process of extraction of gallium, by M. Lecoq de Boisbaudran. The gelatinous precipitate given by zinc in the acid solution of the natural mineral is dissolved in hydrochloric acid and treated with sulphuretted hydrogen. Carbonate of soda added in portions to the filtered liquid, enables the oxides with which the gallium is associated to be isolated. These transformed into sulphates, leave in hot water the sub-salt of gallium when the oxide of this metal is precipitated by a prolonged current of carbonic acid. It has then only to be purified.

October 2.—Vice-Admiral Paris in the chair. The following papers were read:—Rectification of an error which mars theorems on systems of two or three segments, making a constant product, by M. Chasles.—Intra-Mercurial planets (continued), by M. Leverrier. He analyses the observations given. We possess data for a first theory which will make it possible to find the planet easily,

and bring it into the regular planetary system. There will not be a transit in September and October for several years.—Note on the transits of hypothetical intra-Mercurial bodies over the sun, by M. Janssen [See separate article].—Industrial application of solar heat, by M. Mouchot. He presented a small solar alembic, with mirror 58 cm. diameter. The boiler contains one litre of wine which boils after half an hour in the sun. The vapour passes in a tube through the bottom of the mirror to the worm where it is condensed. With water in the boiler, and a receptacle for odoriferous leaves or flowers interposed between it and the worm, various essences may be distilled; or the steam may be used to cook vegetables.—Note on Phylloxera, by M. Lichtenstein.—On the theory of solar spots and the constitution of the sun, by M. Gazan. The spots he explains by continuous cooling of the sun, which changes the inferior layers of vapour of its atmosphere into liquid layers. The sun is a large earth, with nucleus in fusion, vapour and gases in a solid envelope, surmounted by a luminous liquid layer, and supporting an atmosphere of vapour and gas.—Discovery of the planet 168; telegram on September 28, by Mr. Joseph Henry, of Washington, to M. Leverrier. Discovered by Mr. Watson at Ann-Arbor.—Discovery of the planet 169 by M. Prosper Henry, by M. Leverrier.—Elements and ephemerides of the planet 164 Eva, by M. Bossert.—Influence of temperature on magnetisation, by M. Gaugain. If a steel bar, with one end in contact with a magnet, be several times heated and cooled between temperatures T and t, the corresponding magnetisms M and m assume variable values. The ratio $\frac{M-m}{m}$ expresses the value of this *temporary variation*. This coefficient increases considerably the further you go from the point of contact. The ratio $\frac{M-M_0}{M_0}$ expresses the value of the *permanent variation*; M_0 being the magnetisation at ordinary temperature at a given point, before heating, and M that obtained after a series of heatings. This coefficient also increases with distance from the point of contact, and more rapidly. The coefficient of temporary variation is independent (within certain limits) of the intensity of the magnetising force, that of permanent variation increases as the force diminishes.—Chemical reactions of gallium, by M. Lecoq de Boisbaudran.—On a skeleton of Hemiphractus, by M. Brocchi.—On the nature of the phenomena of cell division, by M. Fol. These are studied in Heteropoda, Sea Urchins, and Sagitta. They are occasioned by a fusion between the protoplasm and the nucleus, beginning at the two opposite poles of the nucleus. When reproduction commences the nucleus ceases to be the centre of the system, and the points of fusion become places of convergence for the currents of sarcode which run on all sides towards these new masses. The new nuclei result from partial liquefaction of these masses. They are then composed of a mixture of the substance of the old nucleus and the protoplasm of the cell.—Siphonation and migration of gases, by M. Bellamy. He describes several phenomena that may be distinguished from osmose proper (through a septum), in which there are conductors of large surface and length almost *nil*, while here the conductor has a narrow surface and a relatively great length.

GENEVA

Society of Physics and Natural History, August 3.—Prof. J. L. Soret gave an account of the results of a new series of researches in which he is engaged along with M. Edward Sarasin, on the rotatory polarisation of quartz, principally for the ultra-violet rays, to which these measurements have not been before extended. By means of Broch's method and by employing for this purpose the spectroscope with fluorescent eye-piece devised by M. Soret, a prism of spar and quartz lenses, they have carried their measurements as far as the line R. They have repeated, besides, a great number of determinations for the different lines of Fraunhofer in the visible part of the spectrum. Their results agree in a satisfactory manner for that part with those of the physicists who have preceded them. Moreover, they have found a striking agreement between their results as a whole from A to R and those which result from the formula given by M. Boltzmann for connecting the rotatory power with the wave-length.

VIENNA

Imperial Academy of Sciences, July 20.—The following, among other papers, were read:—Annual period of the insect fauna of Austria and Hungary; II., the beetles (*Coleoptera*), by M. Fritsch. This is in two parts, the first treating of times of appearance (observation of 5,025 species at sixty-five stations from 1852 to 1874); the second, of annual distribution.—On the vessel-nerves of the Ischiodon, by M. Stricker.—A contribution on the action of the heart, by M. Rokitansky. This refers to the action of richly-oxygenated so-called apnœic blood in the arteries and veins on the heart.—Microscopic studies on growth and change of hair, by M. Ebner. He shows that the inner root sheath is essential for hair formation, and though broken through by the hair, it grows during the whole hair-vegetation, in the lower part of the follicle with even greater rapidity than the hair. He defends Langer's view that the new hairs are formed in the old follicle and on the old papilla, and describes fully the mechanism of the process.—Researches on the influence of light and radiant heat on the transpiration of plants, by M. Wiesner. Both luminous rays and dark heat rays strengthen transpiration. Ultraviolet rays have probably little action of this kind. With a gas flame, the influence of the dark heat on transpiration is relatively more prominent than with sunlight (in the one case, *e.g.*, 57 per cent. of the action was due to the dark heat rays; in the other, 21 per cent.). The increase of transpiration of green plants through light is due to absorption of the light by the chlorophyll, and transformation of it into heat, whereby the tension of water vapour in the gas-spaces of the plant is increased, and so the relative moisture, and there is an escape of aqueous vapour into the atmosphere. Other colouring substances, such as etiolin, favour transpiration like chlorophyll by their power of changing light into heat, but in less degree.—Contributions to anatomy and morphology of the bud coverings of dicotyledonous woody plants, by M. Wiesner.—On the consequences of action of temperature on germination and germinating power of the seeds of *Pinus picea*, Du Roi, by M. Velten. The percentage and rapidity of germination warrants no sure inference as to germinating power of seeds. Heating of seeds may have a favourable or an unfavourable influence on the germinating power, according to the physiological state in which the seed is. The duration of the heating has an important influence on development of seeds, inasmuch as long heating at low temperatures can produce the same effect as short heating at high temperatures.—On the theory of waterspouts, by M. Boué. He opposes Faye's view that these are always formed from below downwards. He has witnessed some formed the other way.—M. Viktor v. Lang described an improvement on M. Broch's method of determining the rotation of the plane of polarisation by quartz.—On barometric measurement of heights, by M. Hann. This refers chiefly to influence of moisture on the results of such measurement, and shows how to take exact account of it where measurements of moisture are wanting, at the two stations whose difference of level is to be ascertained. He calculates from the observed air-temperature and an estimated *relative* moisture.—On the velocity of propagation of sound-waves from explosions, by MM. Mach and Sommer. The experiments show that this velocity rapidly increases with the violence and suddenness of the explosion.

CONTENTS

ERRATUM.—Vol. xiv. p. 506, col. 1, line 17 from top, for *applied, a coast*, read *applied to a coast*.