THE

EDINBURGH NEW

PHILOSOPHICAL JOURNAL.

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EDINBURGH NEW PHILOSOPHICAL JOURNAL,

EXHIBITING A VIEW OF THE

PROGRESSIVE IMPROVMENTS AND DISCOVERIES

IN THE

SCIENCES AND THE ARTS.

CONDUCTED BY

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Biographical Memoir of the late HENRY KÜHL, M. P. *Doctor of Natural History, &c. &c.* *

HENRY KÜHL was born at Hanau, on the 17th September 1797. His father, John Henry Kühl, was president of the provincial court of judicature, an office which he still continues to discharge. His mother, Maria Judith Walther, who died at an advanced age, was the daughter of Frederick William Walther, who was Councillor of State at Hanover.

Kühl, who was by nature endowed with an excellent genius, was, from his earliest years, so fond of the study of natural history, that he usually devoted to it all his spare hours after the ordinary labours of the school had been performed. He happened to be born at a time and in a country which were particularly favourable to the cultivation of his genius; for no one will deny that the discoveries, by which many parts of natural history have of late years been elucidated, are in no small degree to be attributed to the naturalists on the Mayne.

In the number of these were many friends of his father, such as Leisler, Meyer, Gærtner, and De Leonhard. The two former introduced him to the study of geology, Gærtner to that of botany, while Leonhard taught him that of mineralogy in general. But he was especially indebted to the care of Leisler,

* Prepared from the Memoirs of the Academia Cæsarea of Leopoldino-Carolinæ.

who, being without children himself, and knowing Kühl to be very fond of the study of natural history, and possessed of great talents, took him into his society, which proved of the greatest advantage to him. For Leisler was president of the association which had been formed at Hanau not long before, for the sale and exchange of objects of natural history, and an opportunity was thus afforded him of handling and examining these objects. He himself collected new specimens for the museum in the surrounding country, and transmitted them in a sufficiently finished condition; and besides, freed his friend of much of the labour to which his literary connections subjected him. He met him daily at those hunting excursions which proved of so much benefit to the ornithology of Europe, accompanied him on these expeditions, and, in short, was conducted by him into the only path by which the assiduous investigator of nature can be led to acquire a true knowledge of the objects of his pursuit. The consequence was, that Kühl, while yet a boy, was much better acquainted with these objects than often falls to the lot of people considerably advanced in years. In this manner he obtained a much more complete knowledge of the natural productions of the country of Hanau than could have been expected at his early age; and, at the same time, so improved the natural acumen of his mind, that he afterwards detected, in other parts of the earth, objects which had eluded the observation of many naturalists.

Without allowing their proper weight to these circumstances, it will scarcely be credited that Kühl, when only nineteen years of age, had already gone over the whole range of mineralogy under the instruction of Leonhard, examined a great number of the plants growing in Wetteravia, with the assistance of Gærtner, and acquired a knowledge of all the quadrupeds, birds and fishes, of the middle parts of Europe. Besides, at this age, he published, in the Wetterauen Annalen, vol. iv., a paper on the bats of Germany, in which several species were described for the first time by himself. After Leisler's death, which happened on the 18th November 1813, he undertook the charge of the zoological department of the institution mentioned above, for the sale and exchange of natural curiosities. Nor were his scientific pursuits interrupted by the accession of these new labours; for although he managed nearly the whole business himself, he so assiduously cultivated them as to be taken notice of by the most illustrious naturalists of our time.

After having undergone the usual preparatory exercises in the Latin school of Hanau, he determined to proceed to the University of Heidelberg, with the design of devoting his whole life to the study of natural history, and the resolution of patiently submitting to all the inconveniences which, from the want of sufficient pecuniary resources, he foresaw could not be avoided, in the pursuit of this science. On this occasion he writes in the following manner to his friend Bojes: "What literary profession I shall follow, I do not know. This I know, however, that, without the study of natural history, I cannot live. I therefore wish, with all my heart, that whatever situation I may have in future, it may leave for me a few by-hours, in which I may indulge in those investigations which are of all others the most agreeable to me. I do not seem to have been born for the study of law, which some recommend to me to follow; and so I imagine my best plan will be to study medicine. But I should gladly renounce this also, the moment an opportunity might occur, that I might give myself wholly up to natural history. But if this do not happen, I shall accommodate myself to circumstances, and study medicine, for physicians are required all the world over; and when my studies are finished, I shall endeavour, if possible, to get out to America, or wherever fortune may lead."

He, therefore, in the month of September 1816, had made up his mind to go to Heidelberg, when Theodore Van Swinderen, one of the Groningen professors, becoming acquainted with him, prevailed upon him to follow him to Groningen. This arrangement was fortunate for Kühl; for although his genius and assiduity would have led him to eminence, independently of Swinderen, yet this object could only have been attained by a longer way, and after much time. For with what difficulties would he have had to struggle, and how many sources which Holland disclosed would have been lost to him? But here, under an entirely different sky,—in the midst of other plants and other animals,—in the vicinity of the sea, which he had long wished to behold, and access furnished to the rich collections of Holland,—he daily saw new objects to excite afresh his thirst after knowledge. In short, he there found opportunities of improvement which few other places could better afford.

Difficulties, however, occurred, which presented obstacles to his departure for Holland; but these were removed by the kindness of Swinderen, who felt much interested in him, and, moreover, was influenced by the hope that he would prove an honour to the university of which he himself was a member. At the end of September 1816, Kühl arrived at Groningen, and from this time they pursued their studies together. It happened that Swinderen had then commenced his lectures on Natural History, which being on a larger scale, usually occupied four years in continuance, whereas his ordinary lectures were finished within a year. Kühl, therefore, was admitted into the number of his hearers; nor was he merely a hearer, but also an assistant. This year, although he attended De la Faille and Bakker on natural philosophy and anatomy, he was chiefly occupied in the study of natural history, confining himself to the mammalia, and making choice of a more precise method in treating these different subjects, than is usually followed. With regard to Swinderen's lectures on quadrupeds, this is sufficiently attested by his prize essay, in which he very ingeniously explained the gradual manner in which the animals of this class pass into each other. There needs be little wonder, then, if he gained the gold medal.

Previous to 1816, the year in which he came to Groningen, the zoological knowledge which he had acquired, included only indigenous animals, as he had seen but very few exotic ones. On this account, however accurately he knew indigenous animals, and their mode of living, he yet wanted some general prospectus, without which there can be no order in the study. He, therefore, first of all read Illiger's Prodromus, which Swinderen followed in his lectures on quadrupeds and birds. But he did not confine himself to merely reading it, but at the same time diligently compared each description with the object itself in the museum. In this manner, during the first period of his residence here, he passed five days of the week; but on Saturday he made an excursion to this or that village along the coast, in order to collect fishes or birds. On the winter holidays of this year he made journeys to Amsterdam, Harlem, and Leyden, in which he visited Temminck, as well as the elder Voigtius, who sold him many natural objects, among which were several that he had never seen before. He also met with other learned men, such as Brugmans, the Leyden professor, Van Marum, a medical practitioner at Harlem, and others. He also stayed several days in the town of Lisste, with Temminck, in order to collect the animals of that district, and dissect them.

During the Whitsuntide vacation, he made an excursion to the island of Rottus, where he not only obtained many natural objects, but also made an agreement with the keeper of the island, that he should transmit to him whatever might chance to be cast ashore upon it. The consequence of these journeys was an abundant supply to almost all the collections in Germany of seals and rare marine birds.

When he had returned home during the summer vacation of 1817, he acquired a knowledge of many expensive works in the library of the Society of Wetterau, and, during the same vacation, he made a trip from Hanau to Heidelberg, where he met with Tiedemann, a very accomplished and learned man, who favoured him with useful advice regarding his studies, and presented him with some of his celebrated works. By this time he had acquired so eminent a name in his own country, that he was elected a member of the Natural History Society at Marburg, as well as of that which has been instituted at Hanau, under the name of the Wetterau Society, for promoting the study of every department of Natural History. And, in the end of the following year, on the 20th December 1818, he was made a member of the Academia Cæsarea Leopoldino-Carolinæ, under the name of Johnson.

On the 12th August he passed the Rhine, accompanied with a large party, in which were Leonhard and his family, and returned to Groningen, by Newied, Duisburg, Utrecht, Leyden and Amsterdam. At Newied he was introduced to Prince Maximilian, lately returned from his journey through Brazil, who received him very graciously. In the same manner he was received at Utrecht by Professor Freimer. Passing through Leyden he so gained upon the regard of Brugmans, that after he had taken him through the public museum, and shewn him the collection of natural objects which he possessed, as well as his splendid library, he frankly offered him twice the salary which he had at Groningen, if he would remain at Leyden. What an inducement to a young man, inflamed with the desire of knowledge! The double salary was less an object of importance with him; but how great the difference between the Leyden museum and that at Groningen, between the Leyden apparatus and that which the Groningen University at that time possessed! between Brugman's library and the one at Groningen! How great the conflict between the love of knowledge, and the desire of discharging his duty! But duty prevailed: "I am too much bound to Swinderen," he replied, "to remain with any other than him, during my stay in Holland." So, in the beginning of September, he returned to Swinderen, like a new gift. He received a gold medal from the faculty of Groningen as the reward of his industry, and was admitted by the Physical and Chemical Society into the number of its members.

In the second year which he spent at Groningen, he attended the lectures of Driessen on Chemistry and Botany; of Bakker and Wilkens on vegetable and human anatomy and physiology; of Swinderen on the Natural History of Birds, and in this department, of which he was particularly fond, and which he had already assiduously cultivated, he was frequently not merely a hearer, but also an assistant, as Swinderen himself testifies. Besides, he turned his attention to the history of exotic plants and animals, as well as to comparative anatomy; while at the same time he dissected and diligently described the whole of the indigenous birds and fishes, and defined the coloured figures of birds published by Buffon *. The discoveries which he made in dissecting the various kinds of animals, were afterwards published in the second volume of "Additamenta."

During the long vacation of 1818, he made a journey on foot through Germany with his friend Van Hasselt. They left Groningen on the last of June, and already on the third day after their departure had reached Bremen, thirty-six hours' journey

* Buffonii et Daubentonii Figurarum Avium coloratarum nomina systematica. Groningæ, 1820.

distant from the city of Groningen, where they were kindly received by Albers, Treviranus and Mertens. In the museum of this city, there was a remarkably good zoological collection, and Albers's private cabinet was well stored, particularly in comparative anatomy. Kühl took notes of every thing that he saw. From Bremen they went to Brunswick by Cella, and there they visited the Duke's collection, which is very rich in preparations of amphibia, both anatomical and osteological, while it is at the same time well supplied with birds. From thence they set out without delay for Berlin, where they arrived on the 2d or 3d of July.

Immediately after their arrival, they visited Lichtenstein, whom, having known two years before, they found a very accomplished man, as well as a very learned zoologist. "He treated us," says Kühl, in a letter to Swinderen, "as if we had been his own children; and whenever we visited the Royal Museum, or Lichtenstein's own library, we commonly supped at his house."

In this manner they spent some weeks in Berlin, applying to their studies with the utmost diligence; and the last days of their stay were further improved to them by the arrival of the celebrated Temminck. From thence they proceeded to Halle, where they met Professor Nitzsch, and other naturalists; to Leipsig, Dresden, and into German Switzerland, and, lastly, to Jena, being every where received in a friendly manner.

Kühl also paid a visit to Naumann upon this journey, and the respect which he had before entertained for this celebrated ornithologist, was by no means diminished by his personal acquaintance with him. As the time allotted for their excursion was now drawing to an end, they spent the remainder of the vacation in the house of Kühl's father, making a short journey to Heidelberg, where Tiedemann gave them very useful advice, with regard to the manner in which comparative anatomy should be treated.

From thence they returned to Groningen, on the 21st of September. In this year Swinderen read his fuller lectures on the cold-blooded animals, and the three great divisions of the invertebrata, in which he very ingenuously confesses that he was not less studiously assisted by Kühl in respect to mental than in manual labour. As an example of his industry and proficiency in this department, we may mention that he described the Kobelian Collection of Insects, which was purchased at this time, in such a manner as few collections in Europe have been described.

It is also due to him to state, that he gave excellent definitions of most of the amphibia depicted in Seba's Thesaurus, by which means Swinderen's copy is rendered of the greatest value; and Swinderen further states, that, at the request of several of the most eminent naturalists, he described many things relating to this explanation of Seba's plates, and transmitted them to them; and it would be of advantage to science, as well as creditable to our author, that this work were published, since the Index to Buffon and Daubenton is already before the public. But it is a matter of much regret, that Kühl never completed the plan which he had entered upon, of defining the whole of Seba's work; from doing which, as well as from composing many other excellent works, he was prevented by his journey to India, and ultimately by his premature and much lamented death.

We have thus come to another and very important period of his life, to the time when he prepared for his journey to India; which happened in the following manner.

Having gone, in his accustomed manner, during the short vacation of the Christmas season, to Holland, in order to inspect the specimens of objects, with which he was only acquainted by means of descriptions, on account of the limited nature of the collections at home, he betook himself to Temminck, at Amsterdam, with the view of defining, along with him, the collection of fishes which he had either brought home himself in the preceding summer, or had received, from the Mediterranean. And being requested by this celebrated naturalist to undertake along with him the description of his splendid ornithological collection, he undertook a selection of the Index published by Latham, as a prodromus of his General Synopsis of Ornithology, a work of much labour; by which Kühl, with the guidance of Temminck, and the use of his admirable library, indeed made remarkable progress in the knowledge of exotic species, but which, being deficient in the lately discovered species, has yielded to the

Planches colorées, which are now published by Temminck and Laugier.

While Kühl was thus occupied at Amsterdam, Swinderen received a letter at Groningen, by which intimation was given of his being appointed to undertake a journey at the public expence. A letter was also transmitted to Kühl himself, by the King's minister and counsellor for public institutions of teaching works of art, and the colonies, to the following effect: That his Majesty, from what had been reported to him of his knowledge in the various departments of natural history, his love of science, and the ardent desire which he possessed for the extension of knowledge, had selected him, as a young man, who might be sent with advantage to one or more of the colonies belonging to the state, in order to lay before the learned of his own country, and of Europe in general, the still hidden treasures which nature had so largely bestowed upon them.

Nearly at the same time, the minister, thinking it absolutely necessary, in order to insure the success of the undertaking, that Kühl, before setting out, should be well acquainted with the full progress which science has made in Europe, persuaded the king to order him to proceed to London and Paris, at the public expence. This intelligence produced the most lively emotions in the mind of Kühl, and, in a letter to Swinderen on this occasion, he writes as follows:—"I was so agitated by the message, that I did not know what to do for joy. Much, indeed, am I indebted to you and Temminck, nor shall I ever forget the many good offices which you have performed to me. It was always, indeed, my firm resolution to devote myself entirely to science, but with how many impediments should I have had to struggle, had I not been so fortunate as to become acquainted with you. My residence at Groningen was among the most agreeable periods of my life, and will always remain so; nor shall I ever forget the happy days in which I there commenced my studies."

On the 3d of April, he set out, accompanied by Temminck and Lichtenstein, for London, where he was kindly received by all the learned. Almost all of them presented him with specimens, or at least gave him free access to their collections, that he might have an opportunity of drawing or describing whatever he deemed of importance. He there entered minutely into the study of the mammalia, birds and amphibia of New Holland, the description of the natural history of which, having already collected much with regard to it at Berlin and Amsterdam, he had in view to finish the following winter at Paris. He found a great abundance of these animals in London, as the Linnean Society was in possession of a very extensive collection from New Holland, which had not previously been described. In the course of a few days he described and arranged 200 of these animals. He also found much useful matter for his monographs on the genera Falco and Psittacus (the former of which, however, has not been published); and acquired a knowledge of all the objects which had been brought home by the last polar expedition.—The Banksian Library, which contains an immense collection of books on natural history, being open to all who profess that science, was visited by him between the hours of ten and four; and, among the sketches made by Forster and Sir Joseph Banks himself, he found many things of great importance. In this library he also began the compilation of an Indian Fauna, which he intended to make use of in the colonies which he was about to visit.—Access being given him to Bullock's Museum, which was then proposed for sale, from ten to five, he attended during these hours, to acquire a knowledge of the specimens in that great collection, and describe and name what was new. With regard to mammalia, this museum possessed few that were not previously known; but of birds he described upwards of 100 new species, and corrected the descriptions of a great many more.—He experienced much kindness from Mr Ayton, the manager of the botanical garden of Kew; and also met with Decandolle, who was then consulting the herbaria of Smith and Brown for his great work. In the Banksian Museum he became acquainted with a gentleman, who having commanded the British army in America, had there collected a great store of zoological subjects; and this acquaintance turned out of much importance to him with regard to the object of his journey, for this gentleman was enabled, from his own experience, to furnish our traveller with circumstantial directions in respect to the mode of travelling in hot countries, and was of much assistance to him in procuring the articles necessary for his journey.

Before leaving England, Kuhl made an excursion, along with Laugier and a Breslau student, through the south of England, visiting Oxford, Windsor, Bath, Bristol, Severn, Southampton, the Isle of Wight, and Plymouth. Wherever he came to the sea, he collected natural objects; and many beautiful shells, both terrestrial and aquatic, were given by him to the Groningen Museum, as a memorial of his journey.

During the short time which he spent in Holland, an honour was conferred upon him which is seldom given to students, he having been promoted to the degree of Master of Philosophy and Doctor of Natural History, on the 6th August; as an acknowledgment for which, he presented to the Museum of the University four new genera of birds of the rarest kind, Pozoporus, Melliphaga, Menura and Aptenodytes.

In the beginning of September, accompanied with his friend Cremersius, whose loss we have now also to deplore, and with Van Hasselt, he returned by Brussels, Naumur, (where he met with Professor Galdius), Aix-la-Chapelle and Newied, (where he consulted Prince Maximilian with regard to his intended journey) to Hanau, where he remained with his father for some time, while his friends Cremersius and Van Hasselt made an excursion through Switzerland.

In the beginning of November he left his father and went to Strasburg, in order to meet his friends there according to promise, and continue his journey with them to Paris. The end which he had in view, in undertaking this journey, was to study the invertebrate animals a second time, under the direction of Cuvier and Lamarck; to examine the herbarium made a short time before in Java by Leschenault, and hitherto known to few; but, above all, by making use of the rich collection of amphibia in Paris, to bring more quickly to a conclusion the system of amphibia which he had been busied in for two years back.

Besides, as he had seen all the collections in Berlin and London, he was anxious to inspect those which yet remained in abundance in Paris. For which purpose, Kühl and Van Hasselt having taken lodgings near the museum of Natural History, spent almost the whole day there, in examining all the genera of invertebrate animals which they found. At the same time, they read in the evenings at home the works of Cuvier and Savigny, on the anatomy of these animals, and received various objects for examination from the former; and, besides, Kühl occupied those hours in which Van Hasselt and Cremersius attended the medical lectures and hospital, chiefly in collecting materials for his work on amphibia, birds, and other animals.

The distinguished Cuvier also, had a literary party on the Saturday evenings, to which all the learned men residing in Paris were usually invited, and Kühl and Van Hasselt were constantly invited to attend. These were also allowed free access to Cuvier's library, and were permitted to work in the same apartment with him; while orders were at the same time given to the different keepers of the museum, to open all the cases to them when required.

But, without doubt, among so many illustrious men, he was most disposed to pay the tribute of admiration and esteem to the celebrated Humboldt, a man equally noted for his benevolence, learning and prudence. Humboldt procured for Kühl and his friend free access to the Royal Institute, by which they were allowed to attend the sittings and make use of the library; besides, he very kindly offered Kühl the use of his own library, and did not think him unworthy of being admitted among the number of his particular friends. During his residence at Paris, Kühl completed his monograph on the genus Psittacus, which was printed in the tenth volume of the Transactions of the Leopoldine Society.

Leaving Paris on the 26th February 1820, he returned straight to Hanau, where he laboured with indefatigable diligence in correcting his manuscripts, so as to be able, soon after, to send to the press, his first volume of "Additamenta ad Zoologiam et Anatomiam Comparatam." After reducing all these to order, he took leave of his father and family, and proceeded to Amsterdam, in order to make preparations for his journey; this done, he went to Groningen for the last time, and after staying there one day, bade adieu to his friends. On the 10th July 1820, the ship in which he embarked, commanded by Breukemeyer, sailed from the Texel.

When in the Channel, they examined various species of flexile polypi, and dissected different fishes which do not occur on the coasts of Holland. They noticed a new genus of the family of corallines, and found abundant matter for investigation in the numerous species of flustræ and fuci which occurred. Among other remarkable fishes they dissected the following: Scomber Scomber, Conger Conger, and Raja oxyryncha. In the Bay of Biscay, the weather was so bad that they could not collect any thing. In the Spanish sea they caught the first Salpæ, and among them several new species, as well as a genus allied to these, to which they gave the name of Selenosoma.

On the 18th July they anchored at Madeira; and, although five days only were allowed for their stay on this island, they examined much of its natural history. They were kindly received by the English Governor, and, with his advice and assistance, were enabled not only to examine the shores, but also to penetrate into the interior of the country. This gentleman, whom Kühl happened to meet on his journey, being informed of the object of their voyage, requested him and his companions to come that same day to his seat, two miles and a-half distant from the town, and high above the level of the sea. Having rested here for some hours, they took their departure, and ascended the mountain named *Pico Rufo*, and found its height according to Hasselt's measurement to be 2500 feet. They collected a great many plants in these five days, the number of which they have stated at 224, although this district is not by any means considered as fertile in vegetable productions. They also inquired into the distribution of the plants at different altitudes, and looked after the geological structure of the island. In the animal kingdom, the principal productions that occurred were insects; for this country is very deficient in animals of the higher orders. They found no mammalia, but Kühl discovered a new species of bird, nearly allied to Fringilla cœlebs. Besides, they found a great number of amphibia, but all belonging to two species of lizards, as well as many fishes, but all of six genera; nor did they meet with any fresh-water fishes.

Leaving Madeira on the 3d August 1820, they entered the tropical seas, where so many objects often occurred in a single day, that they were overwhelmed by their multiplicity. There occurred in particular a vast multitude of remarkable and partly new mollusca, echinodermata, and entozoa; and there they made many important observations, with regard to the conformation of various fishes, mollusca, and radiaria.

On the 9th of October they made the Cape of Good Hope, and tarrying there twelve days, explored the mountains or shores from the first dawn to late in the evening. They carried with them the skins of various birds prepared for stuffing, and also preserved a great number entire for the purpose of making skeletons. They also prepared skeletons of the *Viverra genetta* and *Chrysochloris capensis*. Besides, they collected amphibia, fishes, mollusca, crustacea, radiaria, and many species of fuci, in Table Bay and Hout Bay. The number of plants which they collected at the Cape, they had not determined at their departure, but they mentioned it as being very great, they having come there in the proper season. They also prepared some bundles of bulbous roots, and the seeds of about 200 species, for the Botanical Garden at Batavia. But what is particularly worthy of remark is, that they examined with great care the structure and stratification of Table Mountain, and the other hills which surround Table Bay and Hout Bay, concerning which very erroneous ideas had been entertained.

The Great Indian Ocean, not less than the Atlantic, furnished them with ample opportunities of scrutinizing animals hitherto but imperfectly known. They discovered several genera of the family of naked mollusca, annularia, and tunicata of Lamarck. Bad weather at length forced them upon the Cocoa Islands, toward the south of Sumatra,—a group, according to their account, entirely composed of madrepores, and perfectly similar to those flat islands of the Pacific Ocean, whose origin has also by Forster been attributed to madrepores.

On account of the multitude of sharp coral rocks, access can only be had to the bay of these islands in fine weather, and with very small vessels. Their origin from corals shooting up from the bottom of the sea, is plainly demonstrated by their want of mammalia, amphibia, and land-birds, and the scantiness of their flora, which was found to consist of only four species, a new grass, an urtica, the cocoa-nut-tree (*Cocos nucifera*), a wood of which covers the interior of the island, and the *Tournefortia argentea*, which margins the cocoa-wood, with its dark green foliage. Innumerable bands of aquatic birds inhabit these desert shores, and so fearless were they, that many of them were caught by the hands, or killed with sticks. Amid all this profusion, however, there were but very few different species.

They first landed in Java at the Promontory of Banta, and after being a short time on shore, returned to their ships, loaded with corals and mollusca. The labours and inconveniences of their voyage were amply compensated by the kindness with which they were received, and the liberality with which they were treated, by his Excellency the Governor of the Island. He permitted them to live at Buitenzorg, in order to become more readily accustomed to an Indian climate, from the salubrity of the air in that place. The first four months they passed near Buitenzorg without interruption ; for since they daily found an abundant supply of new objects for investigation, it would have been useless to extend their excursions, and seek at a distance what they could obtain at hand. Not a day passed without their naming, describing, and drawing some new species or genera, or even orders. In this manner they prepared a Conspectus of the Flora and Fauna of Java, taking care not to waste their time in delineating what had already been described by Reinwardts. On which account they made out an index of all the drawings which he had made, inspected his Herbarium, and received many of the names which he had imposed. In the course of these four months which they occupied in collecting natural objects, they had done so much, that, by the 10th of August, they were able to write home to the minister, " that their labours regarding some of the objects of investigation in this country were now finished, and that among these might be enumerated the Cheiroptera, Ophidia, Sauria, Birds, Fishes, and Mollusca." At this time they were of opinion, that, with regard to the Buitenzorg Fauna, they were as well acquainted with the animals of this district, as with those of any country in Europe. Having made this foundation, they proposed making a journey to Banta, a less known part of the island, when the cholera made its appearance, and frustrated this design. On which account they set about occupying the following months in ascending the neighbouring mountains, especially the summit of the mountain Salak, 4550 feet in height, situated above Buitenzorg towards the east, one of whose summits had already been ascended by Reinwardt, although a higher one toward the west had been left by him, and had consequently been hitherto unattained. They then came upon a continuous ridge of mountains, extending northwards toward the sea-shore, and among others ascended the ridge of Munar. After this they visited the three hot saline springs, situated between the villages of Rompin and Waru (which are not marked in our common maps), arising from these calcareous hills, which seem to have been themselves produced by the deposition of calcareous matter from the water,—a process which is still daily taking place. An entirely different vegetation was found in the vicinity of these springs, and as it was probable no person had hitherto examined it, they were highly delighted with it. On the 10th August they returned from the mountain Pangerang, 8580 feet in height, forming on one side a continuous ridge with the mountain Gedé, which they had ascended with much labour. These summits, together with that of Salak, situated towards the east, were volcanic. In these pretty elevated and cold regions, they found many retreats of rhinoceroses, and the paths which these animals had made, afforded them considerable facility in ascending the mountains. So great was the profusion of natural productions in these higher regions, that, notwithstanding their unremitted attention and industry, they could not manage to describe the whole. Amidst almost insuperable difficulties, and exhausted with labour, they at length reached the summit. But after they had got to their huts in the evening, a violent rain came on, which continued for three days, and as nothing could resist its impetuosity, they were miserably affected by the cold, and this the more especially, as they had been by this time familiarized to a hot climate.

For the first fourteen days, however, after this excursion, Kühl enjoyed very good health, on which account they supposed that he had escaped the danger, and rather rejoiced that they had been subjected to it, as they imagined the worst was past, and expected to be safe in future from all attacks of the climate. But soon after Kühl became affected by a disease which resisted all treatment, accompanied by inflammation of liver to such a degree that his life was in danger. He saw from the first that the disease would prove mortal, but he waited the approach of death with becoming fortitude. "The tranquillity of mind which he possessed when in good health," writes Van Hasselt, his companion, to Swinderen, "instead of being diminished by sickness, was rather increased. I have been astonished at the calmness with which he spoke of his approaching death. He even gave me some injunctions about things which he wished to be performed before he died. In fact, I am not less an admirer of him, now that he is dead, on account of the fortitude which he displayed, than I was his friend while alive." After having laboured four weeks under his disease, he died on the 14th of September 1821, not yet twenty-four years of age.

Kühl was of an excellent disposition, and the most refined manners. He was quick of comprehension, acute in discriminating, and possessed of a most tenacious memory,—qualities of the utmost importance to the naturalist, especially as the compass of science is now so extended, that, without a proper arrangement of ideas, and a faithful memory, the various objects cannot fail to be confounded. Nor was his manual dexterity less remarkable than the acuteness of his intellect: he could in fact do every thing with his hands that he wished; he stuffed the skins of animals, dissected them with great neatness, and drew not less beautifully than accurately, so as occasionally to supply the place of a painter, on the voyage undertaken to the Island of Java, in delineating anatomical subjects.

To these qualities Kühl added the greatest industry. With him every moment of time was employed: when in his room he was either reading or examining natural objects; when walking, or upon a journey, he was collecting animals, plants, and minerals, and thinking upon their qualities and properties. He deemed it base to enjoy repose longer than was necessary. He often sat up at his studies till midnight; and when Swinderen shewed him his bed-room on his arrival, the first thing he did was to see whether a bell might be hung above his bed, that the watch might waken him every morning at four, by pulling at the door, in such a manner, however, as not to disturb the rest of the family. A man possessed of so much genius and assiduity could not therefore fail to acquire a vast stock of knowledge. Nor was his knowledge confined to natural history alone, but also extended to political history, both ancient and modern. He was also so well versed in geography and all other attainments requisite in a well educated man, that, even at the time when he came to Groningen, the most accomplished student, on hearing him converse on general subjects of literature, acknowledged with one voice, that, in the course of their studies, they had met with no young person equal to him. And to this genius and this industry were added an ardent mind, which prompted him to great undertakings, a constancy which sustained his efforts, and a devotion to science which made him prefer it to all other objects.

It has already been observed, that natural history was his favourite pursuit; and there are none or at least very few examples, in any other department of science, in which so much keen investigation is displayed, so many dangers so fearlessly confronted, and so many privations borne with fortitude, as we see evinced in the character and conduct of the disciples of nature.

All these essential good qualities were combined in Kühl. Besides the other virtues with which he was adorned, he possessed a remarkable moderation in regard to food. On his journeys he required nothing more to allay hunger and thirst than dry bread with water and milk, provided he could attain the object to which all his labours were directed,—the extension of his knowledge. To accomplish this he left his father, his country, and friends; in its pursuit exposing himself to the dangers to which a long sea voyage, change of climate, untrodden paths, savage men and wild animals exposed him; and all these he underwent without the prospect of any great reward, at least without the hope that these labours would be repaid by greater advantages than his accomplishments and celebrity had already acquired for him in Europe. Certain it is, that it was neither by the hope of riches, the most general stimulus to exertion, nor the honourable and truly royal liberality with which he was equipped for his journey, but by the mere love of natural history, that he was actuated,—a truly sublime affection, which made him spare no labour in collecting new objects of investigation.

When he was last at Hanau, anticipating the difficulties which he had to encounter, he thus wrote to Swinderen: "I have determined to make a journey to the eastern countries, and go I shall, if there be no other way, even in the capacity of a barber." Such was the love of Kühl for his profession.

But Kühl had also other properties, which, however becoming in his person, were especially adapted for the department of science on which he had fixed his affections. Besides his other virtues, he was distinguished by an ingenuous mind. Truth, obedience, modesty, and a grateful remembrance of benefits, were among the ornaments of his mind. He willingly accommodated himself to the manners of his friends; but, when persuaded that he was better acquainted with a scientific subject under discussion, he defended his opinion with warmth, although with modesty, nor yielded rashly to the determination of others. His filial piety, and the affection which he bore to his brothers and sisters, were highly exemplary; and it is to be mentioned to his honour, that he would receive nothing from his father, although it would gladly have been given him, lest he should diminish the portions of his brothers and sisters.

Kühl's greatest merit was to have embraced the whole compass of natural history. For when he came to Groningen in 1816, he already knew a great number of minerals, both oryctognostically and geologically, the whole of the plants indigenous to the fertile district of Wetterau, and all the mammalia, birds, and fishes of the middle parts of Europe. He chiefly studied exotic plants in the Botanical Garden at Groningen, as well as in the other gardens which he saw on his journeys; and investigated the foreign vertebrated animals in the Groningen Museum, and in those of Berlin, Paris, London, &c., while he principally studied the invertebrate animals at Paris. "I hope," says he, in a letter to Swinderen while in Java, "that when I return to Europe, I shall not be accused of cultivating one department only of science, as my aim is not merely to treat those parts well of which I was fondest when at home, but I am also bent upon mastering all the other branches.

Another merit of Kühl's was, that, besides the study of natural history in the more limited sense, he paid attention to anatomy also, and to physiology, or rather biology. Although the study of physiology was of all others that which he preferred, he was yet free of a fault into which many naturalists fall, who, on account of the main object of their science, which they take to be the determination of the general laws of nature, despise the aids of less elevated but subsidiary studies; whence it necessarily follows, that they always fall short of their object. But Kühl did better; he set about both kinds of study with equal diligence, and in this respect is the only naturalist who can be compared with Pallas.

Tiedemann, the celebrated anatomist of Heidelberg, when he met with Kühl on his journey to Paris, said, that "a more accomplished naturalist never before travelled;" and Temminck writes thus to one of his friends, "Science, by the death of Kühl, has lost another Linnæus."

But even these were not Kühl's only merits, but rather the beginning and foundation of greater excellence; for he not only knew what others had done, but contributed as long as he lived to the improvement of science. Without insisting much upon his Annotations, not yet published, his Fauna of New Holland and India, or his Monograph on the genus Falco, besides the discoveries which he made in Java, and which, as they have not yet been made public, cannot be judged of, we shall confine ourselves here to the advantages which he has conferred upon science by his publications.

With regard to Mammalia, he drew up a general conspectus of this class, in the essay mentioned above, for which he gained the gold medal. In his monograph on the Simiæ, a work which seems to be the most complete in regard to the number of species of any upon the subject, he has described 111 species, and among these several new ones, first defined by himself, as well as many others which had hitherto been merely named. In his monograph on the Bats of Germany, he made known three new species, and rectified many errors connected with the specific distinctions. In his Zoologiæ Auctaria, he has proposed a new genus, Saccophorus (the Mus bursarius of Shaw), and made known various new species of mammalia; so that before he left

Europe he had already increased the list of mammalia by many new ones, to which he would without doubt have added many more in Java.

But of all the departments of natural history, Ornithology was that which he most enriched by his discoveries, most of which he made along with the celebrated Temminck. His index to the coloured plates of Buffon, which Swinderen published with his consent, is also of much advantage to ornithology. This work of Buffon, which comprehends the whole range of the birds known in his time, is much superior to most of the works on the same subject, and will always remain so; but of what importance would these figures be without systematic names? This deficiency, then, was supplied by Kühl. Besides, he wrote a monograph on the genus Psittacus, in which he included 200 species, a considerable number of them being first characterised by himself, or distinguished and named with the assistance of Temminck. Moreover, he described in his Auctaria a new genus discovered by himself, to which he gave the name of Ptilonorynchus, and wrote a monograph on the difficult genus Procellaria. Lastly, during his journey, as well as in Java itself, he made many other interesting discoveries in this department, of which, however, we are as yet only acquainted with a small part.

With regard to the Amphibia, he has the merit of having added many names to Seba's figures in his Thesaurus, by which he has much facilitated a reference to that work. Many of his observations on Seba's figures are also contained in the additions already mentioned. We there also find critical remarks on Daudin's work on serpents, and very useful annotations regarding the number of the abdominal and caudal scuta of serpents, of which much use is now deservedly made for the purpose of specific distinction. Had it been his fate to have returned from India, he would assuredly have described the new species of amphibia which he had discovered, according to Merrem's method. With respect to invertebrate animals, he did not publish any of his discoveries previous to his Indian journey. Whatever, therefore, was found by him subsequently, was common to him and his companion Van Hasselt. In regard to comparative anatomy, Kühl made most of his observations along with

Van Hasselt, and their papers on this subject are consequently common. These papers, indeed, chiefly treated of the whole first four classes of vertebrate animals; but we may mention one in particular as worthy of praise, which contains a disputation regarding the hearts of various animals. In them, as well as in the other writings of Kühl, many new facts are detailed. On their voyage to Java, although they paid most attention to the dissection of invertebrate animals, yet, by their industry, they also extended the anatomy of the vertebrate ones.

In regard to the vegetable kingdom, they paid particular attention to the laws of the distribution of plants over the surface of the earth, in respect to which they instituted many and very diligent investigations in the Island of Madeira, at the Cape of Good Hope, and in Java.

In mineralogy and geology we are indebted to them for an account of the geological structure of Madeira, for a better view of the South Cape of Africa, as well as remarks upon the Cocoa Islands, and, lastly, for various communications illustrative of the colony of Buitenzorg in Java.

The printed works of Kühl are the following:

1. Die Deutschen Fledermäuse (in the Annals of the Society of Wetterau). Frankfort, 1819.
2. Responsio ad quæstionem, ab ordine disciplinarum mathematicarum et physicarum propositam: Cum, licet naturæ corpora varia modo inter se differunt, ex hucusque cognitis observationibus tamen constare videatur, ita comparatam esse rerum naturam, ut lento quasi passu ab una specie ad alteram progrediatur, atque sic continuam quasi catenam efficiat, ex variis quidem annulis, intime tamen junctis compositam, hæc catena, in Mammalium classe demonstranda quæritur. (Annals of the Groningen Academy, 1816, 1817. Groningen, 1818.)
3. Conspectus Psittacorum, cum specierum definitionibus novarum, descriptionibus, synonymis, &c. (Nova Acta Physico-Medica Acad. Cæs. Leop. Car. Nat. Curios. vol. x. part 1. p. 1,–104. Bonn, 1820).
4. Beitrage zur Zoologie. Frankfort, 1820. 4to.
5. Beitrage zur vergleichenden Anatomie von Dr Van Hasselt u. Dr Kühl. Frankfort, 1820. 4to.
6. Buffonii et Daubentonii Figurarum Avium coloratarum nomina systematica. Groningen, 1820. Fol.

Sketches of our Information as to Rail-Roads. By the Rev. James Adamson, Cupar-Fife. (Communicated by the Author *).

Before we can anticipate with any confidence the performance of an engine, we must know what part of its moving power is employed in the support of its own functions, independent of that expended on the object of its effort. Our knowledge of this subject is, I fear, very deficient with regard to most kinds of machinery, because the sort of effect which they are employed to produce, renders it difficult to estimate the power wasted upon it. It is to be hoped, that its great importance will secure greater attention to it, since the comparative advantage of many different forms of machinery can be determined only by the discovery of the comparative amount of power necessary to communicate motion through them. It is not easy to devise means for obtaining this object even in machinery much under our controul, and we ought, therefore, to feel grateful to Mr Wood for having opened up to us some novel sources of information, likely to be productive of considerable certainty on the subject. The locomotive engine is a peculiarly manageable thing, since all its parts may easily be put in motion, without employing its ordinary moving power, and the effort required to put them in motion becomes easily ascertainable. Of this advantage Mr Wood has taught us to avail ourselves, and though we do not find in the detail of his experiments the means of settling the question completely to our satisfaction, we can anticipate important consequences from the prosecution of the method he has pointed out. What we have chiefly to regret is, the small number of the experiments which are of use in this inquiry.

It is evident, that, if the engine were allowed to descend an inclined plane, having the steam restrained from acting upon the pistons, we could, from the observed time of its descent, estimate the retardation by the movement of all its parts, were all put in motion by the revolution of the wheels: and, besides, there are

* We trust Mr Adamson will continue his valuable sketches: they do him credit as a natural philosopher, and their style of execution is worthy of imitation.—Edit.

some of those parts which we could detach; and thus, by the effect of those which remained, judge of the proportionate influence of each of them. Mr Wood has narrated an experiment made for the purposes of ascertaining the total friction of an unloaded engine; and from the additional retardation caused by it, when attached to waggons descending an inclined plane, he estimates the friction of its joints, axles and pistons, to be no more than 213 lb. Now, the resistance, by the friction at the axles of the wheels, could not, according to the lowest estimate in the table of experiments or friction, have been less than 100 lb; so that only 113 lb. remain as the retarding force of the pistons, and other parts of the machinery.

Another method of estimating this retardation, is afforded by the experiments with wheels of different sizes. It was found, that, by applying to the same engine wheels of different diameters, different results were produced by the same expenditure of motive force in the same time. The retardation being equivalent to a constant pressure acting through unequal spaces, must have required, to overcome it, an expenditure of force in proportion to these spaces, which are as the diameters of the wheels. The resistance opposed by the rubbing parts would, therefore, when 3 feet wheels were exchanged for 4 feet wheels, be diminished in the proportion of 4 : 3; or the observed increase of effect from the same pressive power, must have arisen from the annihilation of one-fourth of the friction, by the addition of one-third to the diameter of the wheels. The increase of effect appears to have been equivalent to a force of 146 lb. *; and, therefore the total friction of the engine with 3 feet wheels amounted to 584 lb. If from this we deduct the 100 lb., which will represent the constant resistance at the axles of the wheels arising from the weight of the engine, we shall have 484 lb. as the measure of the resistance from friction, in all the other parts of the engine. The measure of this retarding force in the former case, when the engine was unloaded, was 113 lb. These two numbers cannot yet express the ratio according to which the friction increases as the load is augmented, for the friction created by

* This is greater than Mr Wood's estimate, and is found by taking the $\frac{1}{200}$ part of the additional load the engine carried with the same fuel.

the motion of the piston and piston-rod within the cylinder, cannot be affected by the load. Let c represent this constant quantity: then the remainders $484\text{-}c$ and $113\text{-}c$ may be assumed to have to each other the ratio of the pressures, to which the moving parts of the machinery, exclusive of the pistons, have been subjected. When the engine was unloaded, this pressure could arise only from the resistance of the piston. Now, if l represent the length of the stroke, and d the diameter of the wheel, then, the constant resistance c will be to the pressure upon the piston, which would counteract it, in the ratio of $1 : \frac{3.1416\,d}{2\,l}$, which is the ratio of the spaces passed over by the piston and the engine. When the engine is loaded and working with a pressure of 50 lb. per square inch of the pistons of two nine-inch cylinders, the whole pressure on the pistons will be 6367 lb. which, when diminished in the ratio of $1 : \frac{3.1416\,d}{2\,l}$, will be the pressure producing friction in the other parts of the engine; if $d = 3$ and $l = 2$, its numerical value will be 2702 lb. Part of this is absorbed by the constant resistance c; and, therefore, $2702\text{-}c$ will represent the effective load or pressure producing resistance in the rubbing parts of the engine when loaded. Hence, as the resistances are in the ratio of the pressures, we have $484\text{-}c : 113\text{-}c = 2702\text{-}c : c$ and $c = 98.3$ nearly; therefore the resistances from friction when the engine was loaded will be 385.7 and when unloaded 14.7.

The steam pressure required to overcome the friction of the pistons in the cylinders will be therefore, $98.3 \times \frac{3.1416\,d}{2\,l} = 231$ lb. This result is remarkable, as it is very far below the theoretical value of this kind of resistance: since there will be probably about 100 square inches of rubbing surface in each cylinder, the resistance is not quite $1\frac{1}{4}$ lb. per square inch of rubbing surface *.

The resistance created by the friction of the whole machinery, may be expressed as a multiple of either the pressure of the steam on the piston, or of the load attached to the engine; and if the numerical values of the quantities in question were to

* It would be interesting to know what pressure will render oiled hemp, or such substances as are used in packing the piston, impervious to steam. The experiment could be easily made, by exposing the substances (compressed between drilled plates) to the pressure of steam of different elasticities.

be depended on, we should be able to tell exactly either the steam power and weight of the engine necessary to carry a given load, or determine correctly the load which any given steam power could overcome. We are perhaps most in doubt respecting the relation between the weight of an engine and its power, or between the size of the boiler and the force of the steam which it can be made to afford. As there is a certain velocity of the piston which produces a maximum of effect, it is clear that this velocity alone should be preserved as much as possible, and the velocity of the load should be determined by the machinery, independent of that of the piston. Each engine ought, in fact, to be constructed for one determined velocity; and as the diminution of the engine's power by its friction, increases as its weight increases, it will be less expensive to have light engines and high velocities. None of those, as yet in use have been intended to travel faster than 6 miles per hour. The highest velocity which I have witnessed was about twice this; but then the force of the steam was lost on account of the excessive velocity of the piston, —there was no load to be overcome except the friction of the engine; and even this was diminished by the engine-man assisting to open and shut the valves. The experiments by Mr Wood, from which an estimate has been drawn of the travelling engine's work, cannot by any means give too favourable a measure of it: for the progressive effort of the engine, or that part of its power exerted on the load, must, on account of the undulation of the road, have varied in the ratio of 1 : 8, and there must have been a corresponding variation in the rate of the piston. Such inequalities in the load, and in the velocity of the machinery, are a disadvantage attending the application of steam power to rail-roads in every form, except when a dead level can be secured. The greatest irregularities would be found, when a fixed engine was made to work over a considerable extent of country, if such a thing were possible. But the applicability of this method of using the steam-engine must be reduced far within the limits which Mr Tredgold assigns to it. The risk of interruption, in the traffic of a whole line, by the failure of one engine, is almost decisive against the system; and, besides this occasional inconvenience, there would be the constant one of being obliged to have at one time, on a long line of road, no more than that quantity of goods which the ropes or chains were calculated to bear, while no other power could be employed on the same line to remedy its failure or add to its capabilities. The great and continual expence of renewing the exposed parts of the machinery, in addition to these inconveniences, ought to be a good reason for preferring even very expensive excavations to this method of avoiding them.

We could bring the fixed engine and the locomotive engine more directly into comparison, if we could tell exactly the loss of effect incident to each, in moving a given weight over a certain space. Whenever the friction of the rope or chain and its rollers becomes the same proportional part of the load, as the locomotive engine's friction is of its load, we may consider this waste of power as equal. Mr Wood's experiments on inclined planes afford us the means of approximating to a decision on this point, though we must regret that the instances of the kind required are too few, and too little varied, to lead us to certainty. If we compare Nos. 14. and 15. of these experiments, we find that the friction of a rope of a certain length, is represented in these two cases by the numbers 239 lb. and 250 lb., of which the difference is 11 lb. Now, this rope was, at the upper end of the plane, bent round a large fixed pulley or friction-wheel, the resistance to the revolution of which, independent of the friction produced by its own weight, we may assume as increasing in proportion to the tension of the rope; but from the manner in which the rope acts on the other friction rollers, the retardation caused by them may safely be assumed as constant. By examining the details of the experiments, we find that the tension of the rope, in the 15th experiment, was greater than it was in the 14th, in the proportion of $1 + \frac{1}{5.27} : 1$. This determines what fractional part of the friction of the large wheel, the difference of 11 lb. will amount to; and we will thus have 11×5.27, or 58 lb. as the resistance presented by the large wheel with the lighter load. The friction of the wheel caused by its own weight, will, by Mr Wood's rules, amount to 14 lb., and thus 72 lb will be the total friction of this part of the machinery; if this be subtracted from the total resistance of the rope, rollers, &c. it will have 147 ℔. as the friction of the rope, and the smaller rollers on which it rests. This is at the rate of 362 ℔. per mile, and equal to about one-fifth of the strain to which the rope was exposed; and therefore the utmost strain to which, from this example, a similar rope ought to be exposed, is the friction of 5 miles of rope of the same thickness, resting on the same proportion of rollers of the same weight. If we make m represent the distance at which the expenditure of power in overcoming the friction of the rope by the fixed engine is equal to that expended by the locomotive engines, in moving themselves, and let t represent the strain upon the rope, or power of the fixed engine, independent of its own friction, $\frac{t\,m}{5}$ will be, in this case, the resistance of the rope of the fixed engine, and will represent the friction of the locomotive engines; and, assuming that their friction is half the power available to move the load, or one-third of the power of the engine, then $\frac{t\,m}{5} = \frac{t}{3}$; hence $m = 1\frac{2}{3}$, the distance in miles. As the uncertain amount of the friction of the fixed engine and its rope-roll has not been taken into account, we may perhaps conclude, that the moving of goods by means of a rope of a greater length than $1\frac{1}{2}$ miles, will always be more expensive than their conveyance by locomotive engines, when there is no ascent on the line. To find the more general formula for an ascent, we must make the gravitating force of the load and of the rope to become elements in the equation. Now, as the weight of the rope per mile is nearly three times the strain to which it is subjected, making $\sin i$ to represent the inclination, $3\,t \sin i$ will be the gravitating force of the rope; hence $m' \times \left(\frac{t}{5} + 3\,t \sin i\right)$ will represent the whole loss of force incident to the fixed engine, from the weight and friction of the rope. Now, as $\frac{2}{3}\,t$ is the progressive effort or adhesion of the locomotive engines, $25 \times \frac{2}{3}\,t$ will be their weight; and the loss of power incident to them, which is to be equal to that lost by the fixed engines, according to the foregoing deductions, will be $\frac{t}{3}\left(1 + 50 \sin i\right)$;

hence,

$$m' = \frac{5}{3} \times \frac{1 + 50 \sin i}{1 + 15 \sin i};$$

which is the same equation as before, when $\sin i = 0$. When $\sin i = \frac{1}{27}$, then $m' = 3.125$; in which case, the power of the locomotive engine ceases, and the resistance of the rope becomes equal to the whole strain placed upon it. This must be considered as, on those conditions, the limit of the length of a stage between two fixed engines, and since a chain of short links, of the same strength as a rope, would be heavier, and would require heavier rollers, but would not acquire so great an excess of strength, to compensate for its wasting, the substitution of it would probably make no great change on the results.

It appears, then, that if a line of road were *worked* by fixed engines, the number must be very great; and though certainly the expenditure of power, on a given conveyance, may be rendered less than is required by locomotive engines, provided the distances between the stations be less than those determined by the preceding rules, yet, when we consider the many inconveniences to which the employment of them subjects us, we must conclude that they should be resorted to only when other means are inapplicable. They possess no peculiar advantages, as to safety, to counterbalance those defects; any danger arising from liability in the carriages to be overturned, or from swiftness of motion, should the machinery be suddenly stopped, will be the same in both cases, or will be increased by the employment of fixed engines. Carriages containing any persons, or any property easily injured, may be kept at a safe distance from a travelling engine, so as to be unendangered by its casualties, and easily brought to rest, before reaching it; but would be exposed to a dangerous concussion by a pause in the machinery of the fixed engine. The locomotive engines must certainly be high pressure-engines, but, from their size and treatment, are far more likely to be deficient in the power of generating steam, than able to spare any for explosions. There are circumstances, also, which render the employment of the high pressure-engine less dangerous in this form than in other cases. The distance at which it may be made to act, will render injury very improbable to all, except those in immediate attendance on it; and the slight oscillatory motions, to which the machine must always be liable, may be employed to keep the safety-valves from becoming fastened or rusted in their sockets.

For this purpose, it is only necessary to detach the valve from the lever, upon which the principal compressing weight is hung, and giving it the shape of a ball resting in a socket, to attach to it a considerable weight, hanging like a pendulum inside the boiler. This interior weight may also be so disposed as to give intimation of over-feeding with water, as the fluid, when it reaches the weight, will buoy it up, and help to open the valve. The method of conveying the heat through the boiler in a longitudinal tube, completely surrounded by the water, appears best fitted for deriving from the fuel all the advantage it can afford. A cylindrical tube has hitherto been used in the locomotive engine; but there are other forms which would expose more surface to the action of the flame, with equal security against the pressure within. Probably this pressure may even be converted into the means of safety. If the tube were elliptical, and on that account ready to yield in one direction sooner than another, this yielding may be employed to pull open a valve, and allow the steam to escape, when the pressure approaches to any dangerous intensity. The whole apparatus of the engine is susceptible of numberless different forms; and it is not too much to expect, that the mechanical knowledge and ingenuity of our countrymen will lead them to many more perfect than those yet in use. As far as I know, none has yet worked so advantageously as those constructed according to the patent of Messrs Stephenson and Losh, Newcastle-upon-Tyne, and employed at the collieries of Killingworth and Hetton, in that neighbourhood.

The estimates of the expence of the employment of steam power upon rail-roads, do not seem in its favour, when compared with horses moving at the velocity most favourable to them, provided the cost of coals continues to bear the same ratio to the expence of supporting horses as it does at present in those districts of the kingdom where such constructions are likely to be advantageous. Where coals are 10s. per ton, the total expence per annum of a locomotive engine, including allowance for wear and tear, and interest on its value, will be L. 330; the work done will, if estimated by their performance at Killingworth, be

126,000 tons conveyed one mile in 312 days. The performance at the Hetton colliery, during the same period, amounted to 198,000 tons conveyed one mile. The difference arises from the greater regularity of the line in the latter case. The effect, in the one case, is equal to somewhat more than that of three horses; and, in the other, somewhat more than four. The expence of neither of which, including that of their attendance, is likely to amount to the annual cost of the locomotive engine. But as the velocity in those cases is not much above the ordinary rate at which a horse travels, this may be looked upon as far under the rate of performance they are capable of attaining to. For few of the items composing the whole expence, are increased by increasing the speed of the engine, while its performance must increase in the rate of the velocity; so that a rate of speed may be found at which conveyance by them, will be cheaper than by horses moving at the velocity most favourable for their action. But the great advantage of steam-power lies in the economy with which quickness of motion may be produced. According to Mr Wood's estimate, an engine, which, at the velocity of two miles per hour, performs the work of four horses, will, at the rate of six miles per hour, perform the work of twelve horses. The increase of expence consequent on the increase of velocity, has not yet, I imagine, been correctly ascertained. It is evident, however, that it cannot approach to the ratio of the performances at the higher and lower velocity. It is well understood, that goods can be conveyed at a slow rate on a canal much cheaper than by any other method; and that as the motion is made quicker, the superiority of the canal vanishes; but in comparing them with rail-roads, the rate which produces equal effects with the same power has been stated at different values, generally, however, lying between three and four miles per hour, and varying with the shape of the tracts and size of the canal; for all velocities beyond this, the advantage of the rail-road augments in a high ratio. The system of water conveyance we must look upon as nearly perfect; and the other as yet offering many chances of improvement; and from its applicability in some of its many forms to all imaginable situations, and its success in those wherein it has been attempted, we must esteem it eminently worthy of having its properties more accurately investigated.

*On the Natural History and Economical Uses of the Cod, Capelin, Cuttle-Fish, and Seal, as they occur on the Banks of Newfoundland, and the Coasts of that Island and Labrador**. Communicated in a Letter to Professor JAMESON, by W. E. CORMACK, Esq. †

OF the fishes of the British North American Seas, the most abundant is, at the same time, the most important to man. The cod (*Gadus Morhua*) here holds dominion over all the habitable parts of the ocean,—from the outer edges of the great banks of Newfoundland, which are more than 300 miles from land, and more than 100 fathoms deep, to the verges of every creek and cove of the bounding coasts: it even ascends into the fresh-water.

To support such a mass of living beings, the ocean sends her periodical masses of other living beings; and these, in the economy of nature, are next in importance, and, of necessity, in abundance in these seas. Nature furnishes two successive tribes of animals as food for one tribe; and for the three together, this busiest part of the ocean seems to exist.

The Cod.—The cod is accompanied at one season by shoals of myriads of the capelin (*Salmo arcticus*), and at another by equal hosts of that molluscous animal the cuttle-fish (*Sepia Loligo*), called in Newfoundland the Squid. The three animals are migratory; and man, who stations himself on the shores for their combined destruction, conducts his movements according to their migrations. By art, he captures annually more than two hundred millions of the cod with the capelin, and one hundred millions with the cuttle-fish. On the coast of Labrador, and in the north part of Newfoundland, the cod is so abundant, that it is hauled on shore with lines in vast quantities. Thus, by these three means, and the use of herrings and shell-fish for bait,

* Read before the Wernerian Natural History Society, 14th January 1826.

† The interesting details in this communication, are the result of the author's inquiries and observations in Newfoundland. Mr Cormack, who is an active and intelligent Newfoundland merchant, has already distinguished himself, by being the first European who succeeded in crossing Newfoundland; of which achievment an account, with a map of the route, was published in the 10th volume of the Edinburgh Philosophical Journal, p. 56, *et seq.*—ED.

along the southern shores of the Gulf of Saint Lawrence, there is caught in the British North American Seas, upwards of *four hundred millions of cod annually*.

There appear to be four varieties or kinds of the cod in these seas; but their history has not been sufficiently attended to, to determine their relations to each other as species or variety. The first is the *bank-cod*, found on the great bank, many miles from land; the second is the *shore-cod*, caught in the bays around the shores, and in the Gulf of Saint Lawrence; the third is the *red-cod* (Gadus callarias), resembling the rock-cod or red-ware codling of Scotland, caught near the shores; the fourth and most remarkable, is what may be called the *Seal-headed-cod*, from its head resembling that of a seal or dog. The haddock *(Gadus Æglefinus)*, of a large size, is also met with among the proper cod. All the kinds approach towards one size, and are caught and dried promiscuously by the fishermen. The bank-cod differs from the other varieties in his place of resort, which is almost always on the banks, at a distance from land; he is also larger and stronger, with larger scales and spots; his body is of a lighter colour throughout, with the spots more generally diffused, and more distinctly marked; his flesh, too, is firmer. The shore-cod resembles most the cod in a healthy state on the coasts of Britain, and is that of which the greatest quantity is caught, owing to its being most conveniently taken: the back is of a dusky brown colour; the belly, silvery or yellowish, and the spots in general not remarkably distinct. The red cod is, probably, larger than our rock-cod, and is not numerous. The seal-headed cod, is of the same colour and size as the shore-cod, and its head is, in like manner, covered with skin; and it is comparatively rare. The young cod, tom-cod, or podley, swarms in summer in all the harbours and shallow-waters.

There are some other differences in the cod, which may partly arise from difference of latitude and of coasts where they are found. Thus, the farther north, the less oil is obtained from them, their livers being smaller; and the bank-cod yields the least oil of any.

The cod is sometimes caught six feet in length; but there are accounts of its having been taken larger. All the kinds of cod obey the same general laws of migration. They shift according to the changes of temperature in their element, arising from the seasons, and with the supplies of food which invariably accompany these changes. The bank-cod seems to be the most stationary.

As we advance northward from the Gulf of Saint Lawrence, the migrations of the cod assume a more decided character, and it strikes in in greater abundance. This holds as far north as fishing-posts have yet been established on the coast of Labrador. The same applies to the migrations and abundance of the other fishes inhabiting these seas, more especially of those connected with the cod, and they arise together from the same general causes. In the Gulf of Saint Lawrence, Lat. 45° 48°, particularly along the shores of Nova Scotia, New Brunswick, Canada, and the adjacent islands, where shell-fish are more abundant than farther to the north, and where, perhaps, in consequence, more other fishes remain during the winter, the herring * arrives in spring, about the same time that it arrives on the coasts of Newfoundland and Labrador, in April and May, when the cod, in consequence, becomes probably equally abundant at all places; but afterwards, worlds of food arrive on the coasts of Newfoundland and Labrador; first the capelin, over the shores of both these countries, and then, again, the cuttle-fish, around the shores of Newfoundland; they never failing to bring in with them their hosts of cod, and to retain them at these shores during the summer. Neither the capelin, nor any equivalent, ever appears at the countries farther south, although the cuttle-fish visits, and sometimes in considerable quantities, the east coast of Nova Scotia and Cape Breton: *Hence* the pre-eminence of Newfoundland and Labrador as a fishing-station, over every other part of the northern hemisphere.

At Labrador, and in the north part of Newfoundland, where the length of the summer is not more than six weeks or two months, the hook and line are often laid aside for the seine; for it is necessary that enough of cod should be taken within the first two or three weeks, otherwise the remainder of the warm weather would not be sufficient to dry it. Hence the cod-fishery,

* The Alewife or Gaspereau visits the coasts of the countries just named, Nova Scotia, &c., but is never met with at Newfoundland, nor farther north.

according to the present mode of curing, which is, with the exception of a very trifling proportion, by drying the fish in the sun, cannot be carried on farther north than a certain latitude.

The fishery of Newfoundland commences in June, as soon as the capelin appears on the coast, and ends about the beginning of September, when the cuttle-fish begins to move off from the shores. The capelin is the bait used during the first month or six weeks, and after that the cuttle-fish.

When bait is scarce, considerable numbers of cod are caught by *jigging*; the *jiggers* being an artificial bait, with hooks affixed.

The process of curing the cod requires about a month in favourable weather.

Of the four hundred millions and upwards of cod that are taken annually out of the British North American Seas, about one hundred millions, or upwards of sixty thousand tons, are exported in a dried state by the British, to the warm countries of Europe and America: Of the remainder, a part equal to double that of the British is taken away by the Americans,—a part by the French,—and a part is consumed in the countries themselves.

It is from the livers of the cod-fish, that the cod-oil of commerce is made. These are exposed in casks, and sometimes in vats, to the sun, and the heat in all these countries is sufficient to render them into oil *. There is a falling off, some years, in the average quantity of oil obtained from the cod throughout the British fisheries; but as the French have the exclusive privilege of fishing at those parts of the island where the different kinds of fish abound most, it is probable that the quantity of oil in proportion to the quantity of fish caught, including all the fisheries, in any one year may not vary much.

As the sun withdraws from the north, the temperature of the surface-water decreases; its vivifying principle vanishes, and it is no longer inviting to the free inhabitants of the deep. The cuttle-fish begins to retire, and with it man ends his warfare with the cod. All feel the warning, and begin to retire to the strongholds in their respective elements, leaving the field of their in-

* There ought to be obtained from all the cod caught, twenty-five thousand tons of oil, about five to six thousand tons of which are exported by the British, chiefly to Britain.

dustry and summer rejoicing, where air, earth, and water, had met in harmony together, soon to become the conflicting scene of an arctic winter.

Of the Capelin.—The value of this delicate and interesting little fish may be estimated, when it is known to constitute the bait with which more than half the cod caught in these seas are taken. The capelin arrives on the coasts of these countries to spawn about the end of June, and departs about the end of July and beginning of August. It arrives at Labrador about a month later, and remains from two to four months. Its numbers are often truly wonderful. Immediately on its arrival, it pushes its dense shoals into the small bays and creeks, as if to shun the jaws of the millions of its devouring enemies, the cod, and many other fishes which had followed it from the deep, and which remain arrayed at a little distance, impatient for its destruction. These massive clouds of capelin are sometimes more than fifty miles long, and many miles broad. Their spawn is sometimes thrown up along the beaches, forming masses of considerable thickness, most of which is carried back into the sea by a succeeding tide or two.

The capelin is six or seven inches in length; although the males sometimes occur nearly twice the ordinary size. It is caught for bait, in nets constructed of different forms for the purpose. It possesses some peculiar quality, which unfits it to be cured for domestic use like the herring, and is, therefore, merely dried in the sun. Whether the migration of the capelin is to and from the north sea, or limited to the adjacent deep-waters, does not appear to be yet well ascertained, notwithstanding that its appearance and disappearance at all parts of these coasts are watched, as important events, by every fisherman. On the great scale, it is as regular and certain in its appearance and disappearance, as the herring is on the coasts of Europe. It generally appears some days earlier at the south-east parts of Newfoundland, than at the neighbouring parts of the island farther to the north; and from its leading in the bank-cod to these places (as in 1825), it would seem to have come in from the Great Bank. There is little doubt that it is on the banks at certain seasons, as is shewn not merely by the circumstance of its appearing to have led in the cod from thence towards the shores, but by the fact, that, very early in spring, and some weeks before it appears every where at the shores, the cod on the banks take it very readily as a bait salted, when, at the same time, the cod at the shore will not take it in that state. It is well known, that the cod will take readily as a bait, on the great scale, that only which is its common food at the time; and, in the present case, as soon as the capelin arrives at the shores, the bank-cod, which we infer to have followed it from the banks, not only continue to take it salted *, but the shore-cod which refused it before, now take it fresh and salted promiscuously †.

The Cuttle-Fish. — About the beginning of August, the throngs of capelin which had enlivened the shores, give way to throngs of the cuttle-fish. This animal seems to succeed the other, as if to supply immediately provision to the cod. It is of equal importance in Newfoundland as the capelin, as it is the bait with which the other half of the cod here is caught.

The cuttle-fish does not appear at Labrador in quantities the same as at Newfoundland;—from which it might be inferred that it migrates only to and from the adjacent deep waters.

The common size of this animal is from 6 to 10 inches in length; but it has been met with of colossal size. During violent gales of wind, hundreds of tons of them are often thrown up together in beds on the flat beaches, the decay of which spreads an intolerable effluvium around. It begins to retire from the coast in September. It is made no use of except for bait; and as it maintains itself in deeper water than the capelin, instead of nets being used to take it, it is jigged; a jigger being a number of hooks radiating from a fixed centre, made for the purpose. The cod is in best condition after having fed on it.

When shoals of the cuttle-fish and of the capelin come in contact, the latter always retreat, and from the wounds they

* The capelin are salted the preceding year purposely, to fish for the cod on the banks earlier in the ensuing spring than the cod nearer the shore can be caught; that is before the capelin has struck in.

† The capelin is also sometimes taken in the month of April, by the sealing vessels, among the ice on the banks, more than 200 miles from the land; and then it is found also in the stomachs of the seals;—no doubt on its migration at that time from the deeps over the banks towards the coast.

carry with them, are sufferers in an attack: These animals dart backwards and forwards with a quickness which the capelin cannot escape.

The cuttle-fish is supposed to impart the crimson colour which the sea exhibits in various parts here, during the latter part of summer. The water of the harbour of St John's, two miles in extent, sometimes exhibits the phenomenon.

It may be unnecessary to say that the migrations of the cod, of the capelin, and of the cuttle-fish, are only once a year *.

Of the Seals.—Newfoundland, owing to its projecting into the Atlantic eastward from Labrador, intercepts many of the immense fields and islands of ice, which, in the spring, move south from the Arctic Sea. These fields of ice, in their original formation, present, at their edges, a sufficient barrier against the inroads of the ocean; and they are so extensive, that their interior parts, with the openings or lakes interspersed, notwithstanding the rage of elements around, remain serene and unbroken: Here are the chosen transitory abodes of millions of seals,—here these animals enjoy months of peace and security, to bring forth and nurture their young. Such fields collect on the coasts of Newfoundland, and, as it were, offer to the inhabitants the treasures they bring: The island is periodically surrounded by them for many leagues in all directions,—the inhabitants within the dazzling bulwark being as impotent towards the rest of the world, as the rest of the world is towards them.

The all-efficient sun, gradually returning, liberates the fields of ice from the shores to which they had for a time become attached, and enables man again to expose himself with impunity in his own element.

In the month of March, upwards of 300 vessels, fitted out for the seal-fishery, are extricated from the icy harbours on the east coast of Newfoundland;—the fields are now all in motion, and the vessels plunge directly into the edges of such as appear

* The cuttle-fish occurs in abundance in many of our estuaries and coasts, but has hitherto been considered as of no value. Now that it is known to form an excellent bait for cod, and even for other fishing, it is not to be doubted that it will in future, in this country, be used with equal advantage and profit as a bait for the capture of our cod, ling, &c.—Ed.

to have seals on them;—the crews, armed with heavy firelocks and bludgeons, there *land*, and, in the course of a few weeks, destroy nearly 300,000 of these animals for their fat and skins. The skins, with the fat which surrounds the body, are taken off together, and the scalped carcases left on the ice. When the vessels are loaded with these scalps, or otherwise, when the ice is scattered and dissolved by the advancing spring, which it always is, except the islands, before the middle of May, they return to their respective ports; the fat is then separated from the skins, and exposed in vats to the heat of the sun, where, in from three to five weeks, it is rendered into the seal-oil of commerce *. The field-ice extends, with interruptions, more than 200 miles off the land, but the vessels in general have not to go so far to look for the seals: The fields are even met with at sea continuous in a northerly and southerly direction for that extent, at that distance from land.

As these fields of ice are not formed at Newfoundland, and only partially formed at Labrador, the herds of seals which are found on them, when they appear at these places, must have come from the sea farther north, where the main body of the ice is formed, viz. from the Greenland Sea, and that in the vicinity of Davis' Straits. The Greenland winter, it would appear, is too severe for these animals, and when it sets in, they accompany the field-ice, which winds and currents carry southward, and remain on it until it is scattered and dissolved in the ensuing spring, in about Lat. 43° N., or about 200 miles south of Newfoundland. Old and young of these animals being then deserted in the ocean by their birth-place, nature points out to them the course to their favourite icy haunts, and thither their herds hurry over the deep to pass an arctic summer. Winter returns, and with it commences again their annual migration from latitude to latitude.

There are five different kinds of seals found on the field-ice at Newfoundland, all known in the Greenland seas. The three best known of which are, 1*st*, The Harp (*Phoca groenlandica*), the one-year old of which is called the Bedlimmer; 2*d*, The Hood or Hooded Seal (*Phoca leonina*,); and, 3*d*, The Square-

* From 3000 to 4000 tons of seal-oil, according to the success of the fishery, is made annually. The seal-fishery is prosecuted by the British only.

flipper. The other two kinds are the Blue Seal, so called from its colour, which is as large as the Hooded Seal; and the Jar Seal, so named from its form resembling that of a jar, thick at the shoulders, and tapering off suddenly towards the tail; head small, body 4 or 5 feet long, the fur spotted, and it keeps more in the water than the other ice-seals. These all differ from the shore or harbour-seal *(Phoca vitulina)* of these coasts. The ice-seals are alike migratory, and promiscuously gregarious; they differ much in size, and the flesh of them all is very unpalateable, unless to an acquired taste, more particularly that of the old ones, differing in this respect from the flesh of the shore-seal, some parts of which are very good. It remains to be proved, that some of the alleged differences in the ice-seals do not arise from age. Although the ice-seals, which are sometimes met with in herds of many leagues in extent on the ice, seem to have no ordinary means of subsistence, yet the hand of unerring Providence maintains both old and young excessively fat. The seal-hunters often find fresh capelin and other animal substances in their stomachs.

Notwithstanding the apparently immense annual destruction by man among the cod in these seas for more than two centuries, it does not appear that their numbers are at all diminished, or that their migrations are in any way affected: Nor is it likely that they ever will be, if we may judge from the migratory fishes of Europe that have been persecuted for many more centuries, between the North Cape and the South of England.

It is not so, however, with those animals which man can pursue in his own element;—thus, the walrus and the penguin, once abundant, may be said now to have entirely disappeared from the Gulf of St Laurence.

As the persecution of the seals in the field-ice increases, which it has, every year since it commenced, it will be interesting to observe, at some future day not far distant, the effect on their numbers. It is not much more than thirty years since any vessels ventured out among the ice at sea, purposely equipped and manned for their destruction.

The cod, the capelin, and the cuttle-fish, in their natural connection, and the seal, or rather the cod and the seal, constitute the political value of Newfoundland and Labrador, and render these otherwise desolate and inhospitable regions the scene of rivalry of British, French, and American national enterprise and industry *. The day is not far distant when vessels will be fitted out direct from Britain for the seal-fishery at Newfoundland.

Description of a New Reflecting Telescope, denominated the Aërial Reflector. By Thomas Dick, Esq. Author of the Christian Philosopher, &c. Communicated by the Author.

THE invention of the Reflecting Telescope was an important improvement on the long and unwieldy refractors, which were in use among astronomers towards the close of the 17th century. With a Newtonian reflector, only six feet long, celestial objects may be viewed with as high a magnifying power, and with equal distinctness, as with a common refracting telescope of 120 feet in length. By means of these instruments, the late Dr Herschel made those brilliant discoveries which have extended our views of the solar system, and of the grandeur of the universe, and which have rendered his name immortal in the annals of astronomy. It was not a little singular, however, that more than half a century elapsed, after the construction of this instrument was suggested by Gregory and Newton, before any reflecting telescope of a size calculated for celestial observation was actually constructed. In the year 1663, Mr James Gregory of Aberdeen published his account of the construction of that form of the reflecting telescope, which bears his name, in a treatise entitled "*Optica promota*;" and in the year 1672, Sir Isaac Newton constructed two small reflecting telescopes, about six inches

* The herring, mackerel, and whale, are in abundance at Newfoundland, and comparatively allowed to pass unmolested. The herring varies in size, from small to several pounds weight. The whale is of three or four kinds, and the fishery of it is prosecuted only by one enterprizing English mercantile house at the south part of the island; the whales have been taken upwards of 70 feet in length, yielding from six to eight tons of oil. The salmon abounds in all the rivers, and is taken in large quantities. The dog-fish sometimes occurs with the cod in great numbers.

in length, of a form somewhat different from that proposed by Gregory, which he presented to the Royal Society: But we hear no more about the construction of reflectors, till the year 1723, when Mr Hadley published, in No. 376 of the Philosophical Transactions, an account of a large Newtonian reflector, which he had just then constructed, and which left no room to fear that this invention would remain any longer in obscurity. The large speculum of this instrument was $62\frac{5}{8}$ inches focal distance, and $5\frac{1}{2}$ inches diameter, was furnished with magnifying powers of from 190 to 230 times, and equalled in performance, the famous aërial telescope of Huygens of 123 feet in length *. Since this period, the reflecting telescope has been in general use among astronomers in most countries of Europe, and has received numerous improvements, under the direction of Short, Mudge, Edwards and Herschel, the last of whom constructed reflectors of 7, 10, 20, and even 40 feet in focal length, which far surpassed in brightness and magnifying power, all the instruments of this description, which had previously been attempted.

Having constructed and made a variety of experiments on small Gregorian reflectors, I was generally disappointed in my expectations of the effects produced by their performance; and had always recourse to achromatic telescopes, both in terrestrial and celestial observations, where brightness, distinctness and accuracy, were required. This might be owing, in part, to a deficiency in the figure and polish of the specula I made use of in these instruments; but in all the Gregorian telescopes I have had occasion to use, there is a certain degree of dinginess and obscurity, which renders their performance less pleasant, and far inferior to that of good achromatic refractors. About four years ago, an old speculum, 27 inches in focal distance, very imperfectly polished, having accidentally come into my possession, and feeling no inclination to fit it up in the Gregorian form, I formed the resolution of throwing aside the small speculum, and attempting the *front view*, notwithstanding the uniform assertion of opticians, that such an attempt in instruments of a small size is impracticable. I had some grounds for expecting suc-

* A particular description of this telescope, with the machinery for moving it, illustrated with an engraving, may be seen in Reid and Gray's "Abridgment of the Phil. Transactions," vol. vi. part i. p. 147.

cess in this attempt, from several experiments I had previously made, particularly from some modifications I had made in the construction of astronomical eye-pieces, which have a tendency to correct the aberration of the rays of light, when they proceed somewhat obliquely from a lens or speculum.

In the first instance, I placed the speculum at the one end of a tube, of the form of a segment of a cone, the end next the eye being somewhat wider than that at which the speculum was fixed, and its length about an inch shorter than the focal distance of the mirror. A small tube for receiving the different eye-pieces was fixed in the inside of the large tube, at the end opposite to the speculum, and connected with an apparatus, by which it could occasionally be moved either in a vertical or a horizontal direction. With the instrument fitted up in this manner, I obtained some very pleasant and interesting views of the moon, and of terrestrial objects. But finding that one side of the tube intercepted a considerable portion of light from the object, I determined to throw aside the tube altogether, and to fit up the instrument on a different plan. A short mahogany tube, about three inches long, was prepared, to serve as a socket for holding the speculum. To the side of this tube an arm was attached, about the length of the focal distance of the mirror, at the extremity of which a brass tube, for receiving the eye-pieces, was fixed, connected with screws and sockets, by which it might be raised or depressed, and turned to the right hand or to the left, and with adjusting apparatus, by which it might be brought nearer to or farther from the speculum.

Plate I. Fig. 1. Exhibits a general representation of the instrument in profile. AB is the short tube which holds the speculum; CD the arm which carries the eye-tubes, which consists of two distinct pieces of mahogany; the part D being capable of sliding along the under side of C, through the brass sockets EF. To the under part of the socket F is attached a brass nut, with a female screw, in which the male screw *a b*, acts, by applying the hand to the knob *c*, which serves for adjusting the instrument to distinct vision. G is the brass tube which receives the eye-pieces. It is supported by a strong brass wire *d e*, which passes through a nut connected with another strong wire, which passes through the arm D. By means of the nut *f*, this tube may be elevated or depressed, and firmly fixed in its proper position; and by the nut *g*, it may be brought nearer to, or farther from, the arm D. By the same apparatus, it is also rendered capable of being moved either in a vertical or a horizontal direction: but when it is once adjusted to its proper position, it must be firmly fixed, and requires no farther attention. The eye-piece represented in this figure, is the one used for terrestrial objects, which consists of the tubes belonging to a small achromatic telescope. When an astronomical eye-piece is used, the length of the instrument extends only to the point I. In looking through this telescope, the right eye is applied at the point H, and the observer's head is understood to be uncovered. For those who use only the left eye, the arm would require to be placed on the opposite side of the tube, or the tube, along with the arm, be made to turn round 180 degrees.

Fig. 2. Represents a front or rather an oblique view of the instrument, in which the position of the speculum may be seen. All the specula which I have fitted up in this form, having been originally intended for Gregorian reflectors, have holes in their centres. The eye-piece is, therefore, directed to a point nearly equidistant from the hole to the exterior edge of the speculum, that is, to the point *a*. In one of these instruments fitted up with a four feet speculum, the line of vision is directed to the point *b*, on the opposite side of the speculum; but, in this case, the eye-tube is removed farther from the arm, than in the former case. The hole in the centre of the speculum is obviously a defect in this construction of a reflecting telescope, as it prevents us from obtaining the full advantage of the rays, which fall near the centre of the mirror; yet, the performance of the instruments, even with this disadvantage, is superior to what we should previously have been led to expect.

The principal nicety in the construction of this instrument, consists in the adjustment and proper direction of the eye-tube. There is only one position, in which vision will be perfectly distinct. It must neither be too high nor too low,—it must be fixed at a certain distance from the arm,—and must be directed to a certain point of the speculum. This position must be ultimately determined by experiment, when viewing terrestrial objects. A person unacquainted with this construction of the telescope, would, perhaps, find it difficult, in the first instance, to make this adjustment; but, were it at any time deranged, through accident or otherwise, I can easily make the adjustment a-new, in the course of five or six minutes.

In pointing this telescope to the object intended to be viewed, the eye is applied at K (fig. 1.), and looking along the arm, towards the eye-piece, till it nearly coincide with the object, it will, in most cases, be readily found. In this way I can easily point this instrument to Jupiter or Saturn, or to any of the other planets visible to the naked eye, even when a power of 170 or 180 times is applied. When high magnifying powers, however, are used, it is expedient to fix, on the upper part of the short tube in which the speculum rests, a finder, such as that which is used in Newtonian telescopes. When the moon is the object intended to be viewed, she may be instantly found by moving the instrument till her reflected image be seen from the eye-end of the telescope on the face of the mirror.

I have fitted up five or six instruments of the above description, with specula of 8, 16, 27, 35, and 49 inches focal distance. One of these having a speculum eight inches focus, and two inches diameter, with a terrestrial eye-piece, magnifying about 24 times, forms an excellent parlour telescope, for viewing land objects, and exhibits them in a brilliant and novel aspect. When compared with a small Gregorian, of the same size and magnifying power, the quantity of light upon the object appears nearly doubled, and the image is equally distinct. It represents objects in their natural colours, without that dingy and yellowish tinge which appears when looking through a Gregorian. Another of these instruments, having a speculum of 27 inches focal distance, and an astronomical eye-piece, producing a magnifying power of about 100 times, serves as an excellent astronomical telescope. By this instrument the belts and satellites of Jupiter, the ring of Saturn, and the mountains and cavities of the Moon, may be contemplated with great ease and distinctness. With a magnifying power of 40 times, terrestrial objects appear extremely bright and well defined. Another of these instruments is about 4 feet long. The speculum which belongs to it is a very old one: when it came into my possession, it was so completely tarnished, as scarcely to reflect a ray of light. After it was cleaned, it appeared to be scarcely half-polished, and its surface is variegated with yellowish stains, which cannot be erazed. Were it fitted up upon the Gregorian plan, it would, I presume, be of very little use, unless when a very small magnifying power was applied. Yet, in its present form, it bears, with great distinctness, a magnifying power of 170 times, and is superior in its performance to a 4 feet achromatic refractor, with a similar magnifying power. It exhibits very distinct and interesting views of the diversities of shade, and of the mountains, vales, caverns, and other inequalities of the moon's surface. The smallest instrument I have fitted up on this plan is one whose speculum is only $5\frac{1}{2}$ inches focal distance, and $1\frac{3}{4}$ inches diameter. With a magnifying power of about 15 times, it shows land objects with great distinctness and brilliancy. But I would deem it inexpedient to fit up any instrument of this description, with specula of a shorter focal distance than 10 or 12 inches.

The following are some of the properties and advantages peculiar to this construction of the reflecting telescope.

1. It is *extremely simple*, and may be fitted up at a comparatively *small expence*. Instead of large and expensive brass tubes, such as are used in the Gregorian and Newtonian construction, little more is required than a short mahogany tube, 2 or 3 inches long, to serve as a socket for the speculum, with an arm about the focal length of the mirror. The expence of small specula, either plain or concave, is saved, together with the numerous screws, springs, &c. for centring the two specula, and placing the small mirror parallel to the large one. The only adjustment requisite in this construction, is that of the eye-tube to the speculum; and, by means of the simple apparatus already described, it can be effected in the course of a few minutes. Almost the whole expence of the instrument consists in the price of the speculum and the eye-pieces. The expence of fitting up the four feet speculum, alluded to above, including mahogany tube and arm, brass sockets, screws, eye-tube, brass joint, and a cast-iron stand, painted and varnished, did not amount to L. 1, 7s. A Gregorian of the same size would have required a brass tube at least $4\frac{1}{2}$ feet in length, which would cost four or five guineas, besides the apparatus connected with the small speculum, and the additional expence connected with

the fitting up of the joint and stand requisite for supporting and steadying so unwieldy an instrument. While the one instrument would require two persons to carry it from one room to another, and would occupy a considerable portion of an ordinary apartment, the other can be moved, with the utmost ease, to any moderate distance, and the space it occupies is scarcely known.

2. *It is more convenient for viewing celestial objects at a high altitude than any other telescope.*—When we look through a Gregorian reflector, or an achromatic telescope of 4 or 5 feet in length, to an object elevated 50° or 60° above the horizon, the body requires to be placed in an uneasy and distorted position, and the eye is somewhat strained, while the observation is continued. But, when observing similar objects by the *Aërial Reflector*, we can either stand perfectly erect, or sit on a chair, with the same ease as we sit at a desk when reading a book or writing a letter. In this way, the surface of the moon, or of any of the planets, may be contemplated for an hour or two, without the least weariness or fatigue. A delineation of the lunar surface may be taken by this instrument, with more ease and accuracy than with any other telescope, as the observer can sketch the outline of the object by one eye, on a tablet placed a little below the eye-piece, while the other eye is looking at the object. For the purpose of accommodating the instrument to a sitting or a standing posture, I caused a small table to be constructed, capable of being elevated or depressed at pleasure, on which the stand of the telescope is placed. When the telescope is 4 or 5 feet long, and the object at a very high elevation, the instrument may be placed on the floor of the apartment, and the observer will stand in an erect position.

3. This instrument is considerably *shorter* than a Gregorian telescope, whose large mirror is of the same focal length. When an astronomical eye-piece is used, the whole length of the instrument is nothing more than the focal length of the speculum. But a Gregorian, whose large speculum is 4 feet focus, will exceed 5 feet in length, including the eye-piece.

4. The "aërial reflector" far excels the Gregorian *in brightness*. The want of light in Gregorians is owing to the second reflection from the small mirror; for, it has been fully proved by experiment, that, about the one-half of the rays of light which

fall upon a reflecting surface, is lost by a second reflection. The image of the object may also be presumed to be more correct, as it is not liable to any distortion by being reflected from another speculum.

5. There is *less tremor* in these telescopes than in Gregorian reflectors. One cause, among others, I presume, of the tremors which affect Gregorians, is the formation of a second image at a great distance from the first, besides that which arises from the elastic tremor of the small speculum, when carried by an arm supported only at one end. But, as the image formed by the speculum, in the aërial telescope, is viewed *directly*, without being exposed to any subsequent reflection, it is not so liable to the tremors which are so frequently experienced in other reflecting telescopes. Notwithstanding the length of the arm of the four feet telescope above mentioned, a celestial object appears remarkably steady, when passing across the field of view, especially when it is at a moderate degree of altitude; and it is easily kept in the field by a gentle motion applied to the arm of the instrument.

The specula used in all the instruments to which I have alluded above, are far from being good, being of a yellowish colour, and some of them scarcely half polished. They have likewise large holes in their centre, as they were originally intended for Gregorian telescopes. Were they fitted up in the Gregorian form, they would be of little use, unless with small degrees of magnifying power. Yet, with all these imperfections, they exhibit the object with more brightness and accuracy than the generality of reflectors; and therefore I have no doubt that, were instruments of this construction fitted up with specula of the best figure and polish, they would equal, if not surpass in brilliancy and distinctness, the general run of achromatic telescopes.

In prosecuting my experiments in relation to these instruments, I wished to ascertain what effect might be produced by using *a part of a speculum* instead of the whole. For this purpose, I cut a speculum, three feet in focal length, through the center, so as to divide it into two equal parts, and fitted up each part as a distinct telescope; so that I obtained two telescopes from one speculum. In this case, I found that each half of the speculum performed as well as the whole speculum had done before; at least there appeared to be no *sensible* diminution in the *brightness* of the object, and the image was equally accurate and distinct; so that, if *economy* were a particular object aimed at in the construction of these instruments, two good telescopes might be obtained from one speculum. I have also some reason to believe, that instruments of this kind might be fitted up with *glass specula.* My opinion on this point, however, is not quite decisive, owing to the want of glass specula of a proper figure and focal distance, on which to try the experiments. With a glass speculum, however, about 11 inches focal distance, and whose figure was obviously somewhat incorrect, I have seen distant objects tolerably distinct and well-defined, with magnifying powers of from 12 to 20 times.

From the experiments I have made in reference to these instruments, it is demonstrable, that *a tube is not necessary* in the construction of a reflecting telescope, whether it be used for viewing celestial or terrestrial objects; and, therefore, were a reflecting telescope of 50 or 60 feet in length to be constructed, it might be fitted up at a comparatively small expence, after the charge of casting, grinding, and polishing the speculum is defrayed. The largest instrument of this description which has hitherto been constructed is the 40 feet reflector of Dr Herschel. This complicated and most unwieldy instrument has a tube of rolled or sheet iron 39 feet 4 inches in length, and 4 feet 10 inches in diameter, which weighs several thousands of pounds; and it has been computed that a wooden tube, for the same purpose, would have exceeded this in weight by at least 3000 pounds. Now, I conceive, that such enormous tubes in instruments of such dimensions, are altogether unnecessary. Nothing more is requisite than a short tube for holding the speculum. Connected with one side of this tube (or with both sides were it found necessary), two strong bars of wood, projecting a few feet beyond the speculum end of the tube, and extending in front as far as the focal length of the mirror, and connected by cross bars of wood, iron, or brass, would be quite sufficient for a support to the eye-piece, and for directing the motion of the instrument. A telescope of 40 or 50 feet in length, constructed on this plan, would not require one-fifth of the expence, nor one-fourth of the apparatus and mechanical power for moving it to any required position, which were found necessary in the construction of Dr Herschel's large reflecting telescope *. With regard to telescopes of smaller dimensions, as from 5 to 15 feet focal length, with the exception of the expence of the specula and eye-pieces; they might be fitted up for a sum not greater than from 2 to 5 or 6 guineas.

Were any person to attempt the construction of these telescopes, in the mean time, it is not likely he would succeed, without more minute directions than I have yet given. The astronomical eye-pieces used in the aërial telescope, have a particular modification, which is essentially requisite to distinctness of vision; and, therefore, were any one to try the experiment with a common astronomical eye-piece, he would most probably feel disappointed in the performance of the instrument. A description of the peculiarity of the eye-piece to which I allude, with other particulars in relation to these instruments, I deem it expedient, for certain reasons, to postpone to a future opportunity.

I have sometimes used these instruments for the purpose of viewing perspective prints, which they exhibit in a beautiful and interesting manner. If a coloured perspective be placed at one end of a large room, and strongly illuminated with two candles, and one of those reflectors, furnished with a small magnifying power, placed at the opposite end of the room, the representation of a street or a landscape will be seen in its true perspective, and will appear even more pleasant and interesting than when viewed through the common *optical diagonal machine.* If an inverting eye-piece be used, which is most eligible in this experiment, the print, of course, must be placed in an inverted position.

That reflecting telescopes of the description now stated are original in their construction, appears from the uniform language of optical writers, some of whom have pronounced such attempts to be altogether impracticable. Dr Brewster, one of the latest

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* The idea here suggested will perhaps be more readily appreciated, by an inspection of Plate I. Fig. 3, where A is the short tube, BC and DE the two large bars or arms, connected with cross bars, for the purpose of securing strength and steadiness. At F and G, behind the speculum, weights might be applied, if necessary, for counterbalancing the lever-power of the long arm.

Fig. 3.

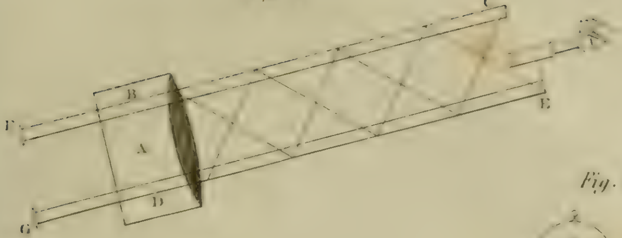
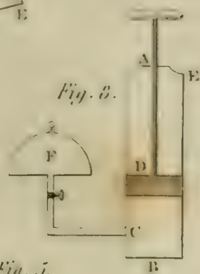


Fig. 8.



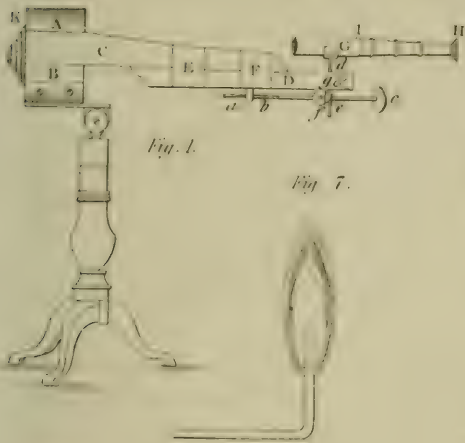


Fig. 1.

Fig. 5.

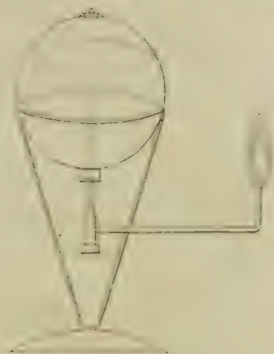


Fig. 7.

Fig. 6.

Fig. 4.

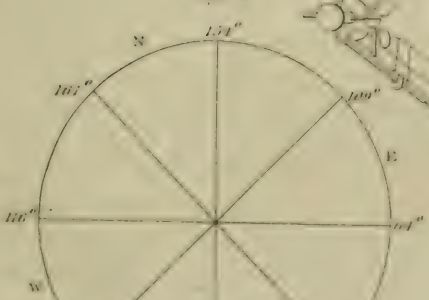
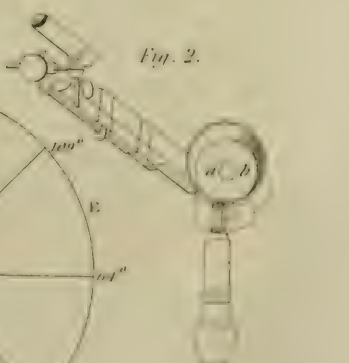


Fig. 2.



and most respectable writers on this subject, in the Edinburgh Encyclopædia, art. *Optics*, and in the last edition of his *Appendix* to "Ferguson's Lectures," has the following remarks:—"If we could dispense with the use of the small specula in telescopes of moderate length, by inclining the great speculum, and using an oblique, and consequently a *distorted* reflector, as proposed first by La Maire, we should consider the Newtonian telescope as perfect; and, on a large scale, or when the instrument exceeds 20 feet, it has undoubtedly this character, as nothing can be more simple than to magnify, by a single eye-glass, the image formed by a single speculum. As the *front view is quite impracticable*, and indeed *has never been attempted* in instruments of a small size, it becomes of great practical consequence to remove, as much as possible, the evils which arise from the use of a small speculum," &c.

The instruments now described have effectuated the desirable object alluded to by this distinguished philosopher; and the mode of construction is neither that of Dr Herschel's front view, nor does it coincide with that proposed by La Maire, which appears to have been a mere hint that was never realized in the construction of reflecting telescopes of a small size. The simplicity of the construction of these instruments, and the excellence of their performance, have been much admired by several scientific gentlemen, and others to whom they have been exhibited; and so much am I convinced of their utility, that I have dismantled every other Gregorian telescope I had in my possession, and fitted it up in the form now described; and I seldom use any other telescope either in terrestrial or celestial observations. As it is distinguished from every other telescope, in being used without a tube, I have chosen to denominate it "*The Aërial Reflector* *."

PERTH, *April* 1826.

* A caveat has been lodged at the patent office, in the view of taking out a patent for this construction of the reflecting telescope. A brief notice of it was published, about three years since, in the Appendix to a work entitled, "The Christian Philosopher.'

On the Combustion of Alcoholic Fluids, Oils, &c. in Lamps, with observations on the Colour and Constitution of Flame *. By Henry Home Blackadder, Esq. F. R. S. E. Communicated by the Author.

1.—*Of Lamps without Wicks.*

A porous or filamentous substance, that has the property of raising fluids by capillary attraction, has hitherto been considered an essential part of a lamp for burning oils or alcoholic fluids; and this part of the lamp, termed the wick, has been made of various vegetable and mineral substances, such as cotton, lint, moss, asbestus, mica, small wires, &c. All combustible fluids, however, that are commonly employed for producing light or heat, may be burned with advantage in a lamp, without making use of any wick. For this purpose, it is only requisite to have a burner in the form of a tube, and made of a substance that is incombustible, and a slow conductor of heat; and, perhaps, it would scarcely be anticipated how well glass and other slow conductors are adapted for burners of this description, or how easily such a lamp may be constructed. In their construction provision must be made for a constant supply of fluid to the burner, without the influence of capillary attraction; and this is effected by having the burner so placed, as to be lower than the reservoir, the supply being regulated by a stop-cock or valve, or by duly proportioning the size of the connecting tube. Lamps of this description may be made of almost any form, and of almost any solid material; it being only essential, as already stated, that the burner be a tube made of an incombustible and slow conducting substance. For alcoholic fluids, the length of the burner does not necessarily exceed an inch; and for oils, it may be reduced to the half or the fourth of that length. In Plate I. Fig. 5. is represented a convenient and easily constructed lamp for the combustion of alcoholic fluids. It consists of a small glass globe,

* The first part of this paper is an extract from a paper read before the Royal Society, 1st May 1826. On that occasion, some of the facts noticed in the second part were cursorily adverted to.

and a bent glass-tube, supported on a metallic stand or frame. The tube is of the size used for thermometers; its interior diameter being about one-fortieth of an inch. It is passed through an elastic piece of cork, which is cemented into the lower part of the glass-globe, and surrounded by a collar of metal: in this way the tube may be readily slid up or down, without allowing any of the fluid to escape between it and the cork. When the extremity of the tube is above the surface of the fluid, none of the latter can escape through it; and when the lamp is to be used, the tube is drawn down, as represented in Fig. 5.; the degree of its depression being regulated by the size of the flame that is wished to be produced. When a low flame is required, the horizontal part of the tube is cemented to a low flat stand; and when the lamp is to be lighted, the fluid is made to flow, by drawing up the reservoir, instead of, as in the former case, drawing down the tube. For occasional purposes, a tube bent, so as to form a syphon, and passed through a cork in the neck of a phial containing the fluid, constitutes a very convenient lamp. When, with a lamp of any form, it is wished to produce a large flame, it is only necessary to increase the number of the burners; and in this way the degree of heat can be regulated at pleasure, and with great accuracy. The advantages, &c. resulting from the combustion of alcoholic fluids in a lamp without a wick, will afterwards be considered.

A lamp for burning oils, for the purpose of illumination, is constructed on the same principle as that for burning alcoholic fluids. The reservoir may be made of metal, or of plain, cut, or coloured glass, so as to produce a beautiful effect. And a fine green, red, or yellow colour, can easily be communicated to spermaceti oil, producing the same effect as coloured glass. The form represented, Fig. 6., which may be modified according to taste, having additional branches, &c. may, perhaps, be found as suitable as any other. One that contains from one to two ounces of oil, and whose burner is not larger than an ordinary bugle bead, burns for eight or ten hours; and will enable most persons to read or write. A lamp of this description has continued burning three days and a half, or eighty-four hours, without having been touched; and the small conical crust, which formed on the burner, did not amount to two grains, though the oil was of the inferior quality that is sold under the name of whale oil. When a greater degree of illumination is required, the number of burners, and capacity of the reservoir, must be increased in proportion. It will be found, that a lamp of this description is as readily lighted as a candle, or lamp with a wick; and the burner may be such as to produce a flame that is a mere luminous point in a dark apartment, or only a blue speck, that is invisible at a short distance; or such as to give a flame similar to that of an argand lamp with a wick. This last may be effected, either by two short and wide tubes, having an arrangement similar to the metallic wick-holder of an argand lamp, or by means of small short tubes, placed nearly in contact, and in the form of a circle.

A convenient small hand-lamp, for occasional purposes, and either for burning oil or alcoholic fluids, is made, by fixing a long tube in the mouth of a small bag, formed of caoutchouc, or other impervious substance; the burner being supplied by the pressure of the hand.

When a thin narrow collar of metal is attached to the mouth of a burner, so as to project in the form of a small cup, the resemblance of the flame then produced, to that of a gas-lamp, is so complete as readily to deceive those who are not aware of the presence of oil. If the collar be made of impure silver, and the lamp has not recently been used, the flame, when first lighted, has a green colour; but this adventitious colour disappears in the course of a few seconds, when the metal acquires a red heat. In the practical line this modification of the wickless lamp is particularly deserving of attention.

Various attempts were made to take advantage of the capillary attraction of tubes, for maintaining a constant supply of oil to the burner, which at first proved unsuccessful; and the want of success was attributed to the well known fact, that, however high a fluid may rise in a tube, by capillary attraction, it will in no instance rise, so as to flow from its upper orifice. This, however, was found to be incorrect; for a small perforated disk of mica, having a small tube cemented into the perforation at its centre, will constitute a burner of this description. When such a burner is placed, so as to float on the surface of oil, the oil rises by capillary attraction, and fills the tube. If a lighted match be now applied, the oil in the upper part of the tube evaporates and produces a flame, fresh portions of oil rise to fill the empty space, and thus combustion is maintained. With such a burner there is no shadow; the reflected image of the flame being seen directly under the true flame. From a number of such burners, in an appropriate glass-vessel, the illumination is brilliant; and the floating disks are observed to be in continual motion, as if alternately attracting and repelling each other; which proceeds from the film of oil immediately under the mica becoming expanded by heat. Though such burners, when properly constructed, will maintain combustion for many hours, if the flame is by any means extinguished, they almost instantly sink to the bottom. This results from the structure of the mica, and the expansion of the oil by heat. Mica is composed of thin plates, which admit oil into their interstices; and the oil thus admitted, with that on the under surface of the mica, is expanded by the heat of the flame. When the flame is extinguished the oil cools, and then the mica, being specifically heavier than the oil, necessarily sinks.

A burner, similar to the one above described, but more applicable to ordinary purposes, seems to merit description, as it may be readily constructed, and will be found admirably adapted for a night lamp. In this form, a small light concave shell, or a light concave glass, resembling in miniature that of a watch, or a small disk of card paper, made concave by pressure, and coated with a solution of gum, is used instead of the mica. A small hole is made in the centre, and a piece of sound cork, about the size of a pea, is cemented on the convex side, and over the perforation. A small perforation is then made through the cork, and a rather wide and thin bugle bead is stuck firmly into it, from the concave side of the shell. The only use of the cork is to fix the burner, so as to admit of its being readily adjusted or replaced. When the shell floats on the oil, the upper extremity of the burner should be nearly on a level with the surface of the fluid; and if the burner be properly fixed in the cork, the shell, glass, or concave piece of paper, will not sink when the flame is extinguished. The quantity of pale rape seed oil (which, in every respect, is the best) that is consumed by a single burner, amounts to about three-fourths of an ounce in twelve hours, and the consumption is so regular and uniform, that, when a lamp is constructed in the form of a floating syphon, it is found to measure time with great accuracy.

Tallow, and other solid combustibles, of a similar nature, may also be burned without a wick. In such cases, it is only necessary to melt a small quantity of the solid substance, with the end of a hot wire or rod of glass; or to introduce a little oil into a hollow, previous to introducing the floating burner. Afterwards, the heat of the flame is sufficient to keep up a supply of fluid.

It is well known, that volatile oils, such as turpentine, give out so much carbon in the form of soot, during their combustion, as to prevent their being hitherto burned in a lamp, for the purpose of illumination. Turpentine, however, may be burned in a lamp, so as not only to give out no carbon in the form of soot, but to afford a beautiful white light, which, in splendour, far exceeds that given out by the fixed oils:—this was exhibited on a small scale, by means of a small experimental glass lamp. All the fixed oils are rendered empyreumatic, previous to combustion; and the same change is necessary in the case of turpentine, but, from its volatile nature, is less readily produced. From the extreme whiteness and splendour of the flame of turpentine, there is reason to expect, that it may yet be applied to valuable purposes. The preceding details have been entered into, with the view of facilitating investigation, and were, to a certain extent, necessary to the next part of the subject.

2.—*Of the Colour of Flame.*

Previous to entering on the subject of the colour of flame, it is necessary to attend to what, for the sake of distinction, may be termed its structure. Exterior to the central cone of gas or vapour, that is, in the proper flame, there are parts which can readily be distinguished, and which distinctly differ from each other. One part may be changed, or a part may be made to disappear, while the others remain unaffected. By means of a prism, the light of any flame may be shewn to be composed of several colours:—that, however, is a separate investigation, and which is left to those who are conversant in the branch of science to which it properly belongs; the structure of a flame has reference to what is cognizable by the naked eye.

When combustibles that are compounds of hydrogen are burned, so as to produce a blue flame, without the assistance of a blowpipe, or any similar contrivance, the flame appears in its most simple form, and two parts are to be distinguished. The one appears immediately exterior to the cone of gas or vapour, and, as seen on each side of the flame, has the appearance of a bright blue line, extending from the base to the apex of the cone. It must be unnecessary to explain how this part of the flame is only to be distinguished at the sides, though it surrounds the whole of the cone. Exterior to this narrow blue line, is an attenuated portion of an opaline or misty blue colour, which extends about the tenth of an inch, more or less, beyond the blue line, and whose exterior surface is ill defined, resembling a brush. This exterior portion surrounds the whole flame; and though its presence might not, in every instance, be suspected at certain parts of the flame, it surrounds the whole of white flames, when these are properly adjusted.

When the substances formerly mentioned are burned, so as to extricate white light, the white portion appears interior to the narrow blue line, but the former never extends to the base of the flame, and the latter can only be traced to a short distance on the exterior of the white portion.

On examining the flame of a properly adjusted candle, the blue line exterior to the white light is observed to disappear opposite to the apex of the transparent cone surrounding the wick, or at that part where the white light is extricated with great effulgence *. The same thing takes place with the exterior attenuated opaline brush, which is not readily distinguished above the middle height of the flame, where the white light becomes intense. In this instance, the attenuated blue flame seems to be rendered invisible by the intensity of the white light. If, even in foggy weather, with an overcast sky, a blue and white flame of diluted

* In a blue and white spirit-flame, the bright blue lines are seen extending on the exterior of the white portion; and between their upper extremities is a broad arch or belt of a dark blue colour, which surrounds the upper part of the white portion, and is observed occasionally to conceal or darken its apex. See Fig. 7. in which this flame is represented in outline.

alcohol be brought to the window, the flame becomes wholly invisible, not a vestige even of the white portion is to be discerned; so that any one ignorant of its presence, would almost inevitably meet with an accident, or might be induced to lay hold of the burner. This simple experiment will render the existence of an invisible, though intensely hot flame, sufficiently intelligible. The surface of the flame of a candle, where the combustion is most intense, is the hottest. Where the combustion is most intense, the flame has a pale blue colour, and when this colour comes to be contrasted with intense whiteness, it is too weak to make a sensible impression on the retina. By means of opaque skreens, the attenuated brush may be seen extending all over the flame; but its presence may also be detected, by changing its colour in a way afterwards to be described.

The colour of the light that is extricated in a flame, depends, 1st, On the mode of combustion; or, 2d, On the presence of some foreign body or extraneous ingredient. 1. When alcohol or rectified spirit, having a specific gravity of about 835, is burned in a lamp without a wick, and with a half inch flame, or when it is burned on a flat surface of glass, the flame is altogether of a *blue* colour. Again, when in burning the same fluid with the glass-burner, the flame is enlarged to an inch, or an inch and a half in length, a considerable quantity of *white* light is extricated. *Lastly*, When the extremity of the glass-burner is brought to a red-heat, or thereby, by holding it in the edge of a blue spirit flame, portions of the alcohol are successively exploded as they come into contact with the heated extremity of the burner, and then much *yellow* light is extricated. We have thus blue, white, and yellow light extricated during the combustion of the same fluid, and depending wholly on the mode of combustion.

Oil may also be burned so as to give out either a blue, a blue and white, or a blue and yellow flame. When oil is burned in a lamp without a wick, so as to give a large flame, the light extricated is blue, with a great proportion of white. But, if the stop-cock be cautiously turned, the white light diminishes, and at length there is only a blue flame. By again increasing the flow of oil, a spot of yellow light appears in the centre of the blue; and by still farther increasing the supply, the white, that is the usual yellowish white, flame reappears. On the same principle, a wine-glass full of oil may be made to exhibit either a blue flame, covering the whole surface of the oil, or a flame of a blue and white colour.

When diluted alcohol, vulgarly termed ardent or proof spirit, is burned in a lamp *without a wick*, the colour of the flame is blue, or blue and white, similar to the flame of alcohol formerly described. In this case, a simple distillation and combustion goes forward; the whole of the water being separated as cold, or nearly as cold, as before its passage through the flame; and the burner only acquires a perceptible increase of temperature. The flame has a fine conical form, and the combustion proceeds without any buzzing noise. Hence the advantage of a lamp without a wick for burning diluted alcohol, such as the whisky of the shops. When that fluid is burned in the usual way with a wick, there is, with other disadvantages and peculiarities to be mentioned, this great inconvenience, that if, after the combustion has continued a short time, the flame be extinguished, it cannot be relighted without renewing the wick. Besides, by using a glass burner, there is derived all the advantage of a spirit-lamp without the expence; and ardent spirits can readily be had in situations where alcohol cannot be procured.

When diluted alcohol is burned *with a wick*, the flame is not blue and white, as when a slow conducting tubular burner is made use of; on the contrary, much yellow light is given out; the white disappears, and a portion at the base has a blue colour. The form of the flame is much less regular; it has a disagreeable flickering motion, and the combustion is accompanied by a constant whizzing or buzzing noise. But, with all this difference of effect resulting from the mode of combustion, the wick undergoes no change, being in no degree carbonized by the flame. In this case there is a cotemporaneous vaporization and combustion of the alcoholic part of the fluid; but the watery part is not separated as in the lamp without a wick. Part of the water is converted into steam, and part of it remains in the wick; which last circumstance prevents the relighting of the lamp, after a short continuance of combustion, as formerly mentioned. Though the wick remains uninjured by the flame, it always becomes hot; and hence not only alcoholic vapour, but likewise steam, is generated, and discharged into the interior of the flame. After the diluted alcohol in the reservoir has been consumed, the quantity of water remaining in the wick is not equal to that contained in the original fluid, as may readily be determined, by ascertaining the specific gravity of the alcoholic fluid that is employed. It thus appears, that, in the interior of the yellow flame of diluted alcohol, there is present a certain admixture of steam, which does not exist in the blue coloured flame of the same fluid ; and when steam is generated, much heat is necessarily consumed ; but it does not follow that the presence of steam is the cause of the yellow colour. Alcohol of the strength formerly mentioned, and that which is considerably stronger, may be burned, so as to give out yellow light ; and alcohol that cannot be made, in one way or another, to extricate yellow light during its combustion, has not been procured for experiment.

It would appear that, though some attention has been paid to the noting of such substances as give out particular kinds of coloured light, when subjected to a high temperature, or when dissolved in the fluid which supports combustion, but little attention has hitherto been paid to the coloured light of a flame, with the view of ascertaining the mode of its production. That this and the other substance gives a yellow or green flame, and that the quantity of yellow light may be increased by particular means, has been ascertained ; but on what the extrication of yellow light depends, or what particular process goes forward during its production, remains to be investigated. The following short extracts from a publication of modern date, and by a gentleman distinguished in the ranks of science, will be found interesting :—" After numerous experiments, attended with much trouble and disappointment, I found that almost all bodies in which the combustion was imperfect, such as paper, linen, cotton, &c. gave a light in which the homogeneous yellow rays predominated ; that the quantity of yellow light increased with the humidity of these bodies ; and that a great proportion of the same light was generated, when various flames were urged mechanically by a blowpipe or a pair of bellows. As the yellow rays seemed to be the product of imperfect combustion, I conceived that alcohol, diluted with water, would produce them in greater abundance than when it was in a state of purity ; and, upon making the experiment, I found it succeed beyond my most sanguine expectations."—" I found that the discharge of yellow light depended greatly on the nature of the wick, and on the rapidity with which the fluid was converted into vapour." A piece of sponge, having a rough surface, was found to constitute the best wick, and for converting the alcohol rapidly into vapour, the heat of the wick-holder was increased by a spirit-lamp; or red hot wire gauze was brought into contact with the surface of the sponge *.

By these extracts, we are given to understand, that, when alcohol, " in its purity," is burned, it gives a yellow flame; but that, when alcohol, diluted with water, is burned, yellow light is given out in greater abundance; and the conclusion seems to be, that, as moisture increases the quantity of yellow light during the combustion of cotton, paper, &c. so water added to alcohol has the same effect; and that, on such occasions, the water acts by causing, or by increasing the disposition to " imperfect combustion." Admitting, however, that these views were established, such questions as the following immediately present themselves: What is imperfect combustion? Is the presence of water essential or only accessary? &c. This is a subject that might engage the attention of some one of the many expert chemists of the present day: there is certainly no want of interest, and much precise information is still wanting. The few facts that have been, or that may be, brought forward on the present occasion, are submitted as a contribution, with the hope that they may tend to promote investigation.

The blue flame of diluted alcohol has, as formerly stated, a regular form; is steady as that of a well-adjusted candle, and the combustion proceeds in silence; but, when burned with a wick, or otherwise, so as to give a yellow light, the flame is very unsteady, and the combustion is always accompanied with noise. Whether this noise proceeds, in every instance, from actual explosions, may be uncertain; but it is certain that when diluted alcohol is exploded, by throwing it into a red hot fire, or by other means, a profusion of yellow light is extricated; and, when

* See Description of a Monochromatic Lamp, by David Brewster, LL. D. &c. &c. published in the Transactions of the Royal Society of Edin., 1822.

it is burned with a wick, there is a constant buzzing noise, with an appearance as if this noise was produced by an infinity of minute explosions at that part of the flame where the narrow blue line appears. It is particularly to be observed, however, that this part of the flame remains unchanged, and that it is the exterior brush flame that is changed from a pale misty-blue to a mat-yellow colour. The blue flame of alcoholic fluids may be made to swell out or expand, by touching the fluid as it issues from the burner, with a hot wire, and without, in any degree, altering the colour of the flame; and, in this case, there is simply an increase of the distillation. But, with the same wire, or with a rod of glass, the mouth of the burner may be so touched as to produce a discharge of small particles of the fluid, similar to that which takes place on other occasions, when a very hot piece of metal is introduced into a vessel containing water. These minute particles are impelled against the inner surface of the flame, seem to explode, and then produce the dull-yellow colour of the exterior brush flame. When a wick of cotton, or of sponge, is used, it acts the part of the hot wire; and the rougher its surface, and the nearer it approaches to the inner surface of the flame, without being carbonized, the more copious is the discharge of the particles, and consequently of the yellow light. This may be farther illustrated as follows:—Let a small ball of cotton thread be attached to the end of a glass tube, and moisten the ball with alcohol. When the latter is made to burn, yellow light is extricated; but if the ball be now made to turn rapidly on its own centre, the quantity of yellow light will be increased an hundred-fold. In this case, two causes operate; the flame is brought closer to the ball, producing a greater discharge of minute particles; and, at the same time, the alcohol is expelled by the rotatory motion in a thick shower into the flame.

Steam issuing forcibly from a small orifice will answer the purpose of a blowpipe; and, even when it is condensed into a white vapour, it has no effect in changing the blue colour of a spirit-flame. But if a small vessel of water be placed under the burner, and a hot rod of metal be introduced, so as to discharge particles of the water on the *exterior* surface of the flame, yellow light is extricated. Some of the coloured light is, in this case, apparently produced by small solid particles from the surface of the metal, bright sparks being observed; but rods of different metals produce similar effects; and when numerous minute particles of cold or boiling water are made, by mechanical means, to impinge on the exterior surface of the flame, the blue colour is not thereby affected. A perfectly clean rod of glass, however, has the same effect as rods of metal, only no sparks are observed; and hence particles of the water of wells, thus elicited, cause the extrication of yellow light; but pure water, that is, the pure compound of hydrogen and oxygen, has not been procured for experiment. When the particles of alcoholic fluids, or of water, impinge on the interior or exterior surface of the flame, there is doubtless an absorption of heat; but the mere absorption of heat cannot produce the observed effects, as appears by an experiment already noticed. If we approach a blue spirit flame, to another of the same colour, no change is produced; but, if a flame of that colour be brought near to a yellow spirit flame, so that the gaseous products of the latter may come into contact with the former, the blue flame acquires a yellow colour. Hence the products or substances emitted from a yellow flame are different from those of a blue flame; and as steam, as formerly stated, does not change the colour of a blue flame, we are led to trace the extrication of yellow light to some other cause.

It is known that carbonic oxide gas, in a certain state, and likewise light hydro-carburet gas, give out yellow light during their combustion. If a splinter of wood (and various other vegetable substances may be used) be lighted, and in a few seconds again extinguished, the white vapour or smoke that issues from it gives a fine yellow colour to blue flame. If the carbonized extremity of the wood be brought into contact, or only near to the flame, there is a profuse extrication of yellow light from the exterior or brush flame; and if the extremity of the carbonized wood be held quite above the flame, there is a copious discharge of yellow light, similar to that of the brush flame, but which might, with more accuracy, be termed luminous vapour than a flame. In all these cases, it is possible that a minute quantity of aqueous vapour may be present; but if, after the wood has been lighted, and the flame extinguished, the combustion of the carbonized portion be allowed to proceed, until an attenuated, extremely light, and spider-web-like substance alone remains, the minutest particle of this substance, when brought to the margin of the blue flame, produces a discharge of light of a fine yellow colour; and, in this case, no moisture can be present. In this way a beautiful flame, of a yellow colour from the base to the apex, may be produced, and which is altogether free of any unsteady or flickering motion.

When a piece of wood that has been carbonized in a spirit flame, and completely extinguished, is brought under a blue flame, a very slight motion given to the wood will be followed by an extrication of yellow light; and by rubbing two such pieces of wood, the one upon the other, under the flame, the whole of the latter will acquire a yellow colour. Scraping the carbonised wood with a knife produces a similar effect; but, in this case, larger particles are also separated, which give out light of a brilliant yellow colour, and much better suited for the purpose of illumination, than the dull mat yellow of diluted alcohol, or that produced by the smoke, &c. of carbonized wood above described. For, in both these cases, the light is similar, and proceeds from a modification of the same part of the flame. By means of carbonized wood, &c. the exterior attenuated brush-flame of a candle or lamp may be rendered visible all over the flame, a yellow colour being communicated to it. It may be remarked, that there is reason to believe that pure carbon would not produce the effects above described; but that has not been procured for experiment. If, when a blowpipe is used with a candle, the wick be cut short, so that the stream of air may pass through the white part of the flame, the jet has a fine blue colour: when the jet has a red or reddish-yellow colour, it will be found that particles of the carbonized portion of the wick, or of soot, are carried off by the current of air from the blowpipe; and whether a blowpipe or bellows be used, the yellow light is similarly produced in all cases in which the combustion is supported by solid carbonaceous substances.

When a wire or rod of glass is introduced into a blue flame, yellow light is commonly extricated, and this always proceeds from some foreign substance on the surface of these bodies, such as condensed smoke, dust, &c.; it is almost impossible to handle glass or unpolished metals, particularly when the hands are hot, without leaving condensed perspiration on their surfaces. An opportunity occurred last summer, of pointing out this circumstance to Dr Brewster, to whom had been exhibited, and with whom were repeatedly discussed all these experiments on coloured flame, &c. It was stated by him, that glass or mica introduced into a blue flame, produced yellow light; but it was immediately shewn, that when a glass-rod was brought to a white heat, and thereby perfectly cleaned, previous to its being introduced, when cold, into a blue spirit flame, no change of colour was produced; and that the yellow light proceeded from some foulness of the glass. Apparently clean glass and wire kept for a length of time exposed in a room with a fire, have been observed to change the colour of blue flame. But as soon as the glass or wire is made red-hot, the yellow light disappears, and cannot be made to reappear without a renewal of the combustible substance on their surface; and hence a monochromatic lamp giving a yellow light, cannot be constructed by a coil of wire in the centre of a blue flame.

Various salts, such as the muriate of barytes, the muriate of soda, &c. are well known to give a yellow colour to flame; and it has been supposed, that the yellow light was produced by the water of crystallization; but in this case, it would be difficult to imagine why the sulphate of alumina and potass, and other salts, should produce no change on blue flame, and that the muriate of lime should give it a beautiful crimson colour. The water of crystallization may be accessary to the production of coloured light; but it does not seem evident that it is the primary cause. By means of the blue flame of diluted alcohol, and the muriate of soda, a steady flame, extricating yellow light, may easily be kept up. An opportunity occurred about a year ago, of showing to the gentleman formerly mentioned the following simple experiment. A narrow slip of paper, or of thin soft muslin, well soaked in a solution of the muriate of soda, was rolled on a short and rather wide glass-tube; and the roll was retained and defended by another wider tube passed over it. This, as a collar, was placed on the glass-burner of a lamp for burning alcoholic fluids, and when the lamp was lighted, the collar was brought up so as to bring the circular edge of the paper into contact with the base of the blue flame; and in this way a steady conical yellow flame was produced. A collar, consisting of several rolls of a particular kind of paper was preferred for experiment, the roll being easily raised between the tubes by the hand, after the manner of the circular wick of an argand lamp. A monochromatic lamp, made exactly after this method, has lately been exhibited, the blue flame being produced from condensed oil-gas. In this instance, the flame was extremely unsteady, having the appearance of the feather-shaped flame produced by a blowpipe; and it is well known, that an unsteady wavering light is extremely unfavourable to distinct vision.

Other experiments and observations relating to flame are necessarily delayed for want of room.

Tour to the South of France and the Pyrenees, in 1825. By G. A. Walker Arnott, Esq. A. M. F. L. S. & R. S E. &c. In a Letter to Professor Jameson.

Sir,

YOU have kindly signified to me a request that I should devote a few hours of my time to the giving a short account of my late excursion abroad. This to me is no very easy matter, having kept no regular diary, and but few notes that may amuse you or the readers of your Journal. Such notes, however, as I did keep, aided with Cassini's map of France reduced by Donnet, may enable me to give you at least an outline of my short tour; and I shall employ the very words of my notes as often as possible.

It is scarcely necessary to enter upon my journey from London to Paris: that ground is travelled over by so many at the present day, that nothing can be said that almost every one does not know. None, however, but those who have crossed from Dover to Calais can believe in the shortness and pleasure of the sail. In days of yore I do not know how many hours, or even days, were devoted to this *perilous* passage; but, at present, three or four hours is only requisite in those blessed inventions ycleped Steamboats. The sailors, too, are surely more expert than formerly, or Æolus has more mercy, as we never hear now of a Tom Pipes thrusting his body through the deck to take the command of the vessel, when captain and all have given over every thing for lost. Nor do we feel that any one now thinks of taking the precaution (still, however, recommended by the *sapient* translators of Ebel's Guide through Switzerland *) of laying in a store of provisions, of benefit, not to the traveller, but to the steward. At Calais our passports are taken from us, and a provisionary one given as far as Paris. This, if not attended with inconvenience, is at least attended with a small expence; and I have never been able to find out any good reason for it. If a person goes any where else than to Paris, he is allowed to retain the passport he received in London, and is charged nothing; so that one going first to any town in the north of France, there gets a visa for Paris, and the passport is not changed.

I arrived in Paris on the evening of the 12th February, having been inclosed thirty-six hours in the *Exploitation generale des Messageries Royales*, "the general blowing-up of the royal post-houses,"—a species of vehicle which, though much improved since my short residence in France in 1821, may still be rendered much more comfortable. This is throughout denominated a "Diligence," but ought to receive rather the appellation of "*Paresseux*," or the Sloth; but I ought not to complain. The distance is 32½ posts, or 162½ English miles; so that we had travelled at the enormous rate of 4½ miles an hour. But is it possible to make the French "*Paresseux*" comfortable? I fear not. This English term has no corresponding one in the French language. The French emigrés, as I am informed, had acquired, by their long residence in England, some indistinct ideas of English comfort, and actually went so far, after their return home, as to use the English word with a French twang. This, however, was never countenanced by the French Academy, none of the members having the least conception of what was meant; and I now believe the word is dropt for ever. I have often been asked for an explanation of *comfort*, but I have always found, that the present nature and habits of the people rendered it impossible for them to enter into my feelings.

Of a month's residence in Paris, and of my motives for being there, I need not trouble you with any notice. It was the season of the Carnival—all was gaiety. On Tuesday, 15th Fe-

* "The passage is seldom more than twelve hours, and sometimes less than three; only a small stock of provisions is therefore necessary."

bruary, I had occasion to be much in the streets. "The whole of to-day I every where encountered the masqueraders of the carnival. One says the English are attached to raree-shows and wonders; but all is nothing to what I have to-day witnessed. Every one here turned out, some in carriages or cabriolets, others on foot, others on horseback,—all to look on a few fools with masks on their faces and tawdry clothes on their backs. There was neither spirit nor character in their costumes; their caps being principally of two sorts,—one like a fool's cap, the other like a turban. They did nothing, said nothing, but paraded the streets and boulevards in open landaus and carriages. To me all in costume appeared to be of the lower classes, mixed with a few hired troops of rope-dancers. Yet so important a business is the Carnival, that the king of these fools was introduced on Sunday last to his Majesty King Charles X.; and was yesterday again introduced into the Court of the Tuilleries. One almost expected to hear them cry out "*Vivent les rois.*" All this mummery has no doubt meaning, but—I am no Roman Catholic."

* * * * *

"The French may talk of politeness, but, in some respects they are entirely devoid of it. The military hold the civilians (as our own East India nabobs, who, to say the best of them, sell their services for money, do the merchants at Madras and Calcutta) quite beneath them; and farther, those who can ride on horseback, in carriages, *cabriolets* or *fiacres*, seem to consider those on foot as the very canaille. This spirit pervades even the drivers of these vehicles: the streets are narrow, and if one is not somewhat nimble, he is sure to be run down. Today I was squeezed into a shop-door to avoid a cabriolet trundling along at six or eight miles an hour; and had I not taken refuge, the brutality or incivility of the driver would not have allowed him to rein up his horse. The last time I was in Paris, a horse patrole came galloping through a street crowded with people, and a porter close to where I was, who could not get quickly out of the way with the load he carried, was literally rode down; and although a few *sacres* were bestowed on the gens d'armes, and cries to stop bawled out, he never deigned to look over his shoulder, laughing, I have no doubt, at the noble exploit of trampling under his horse's feet a foot-passenger. A Frenchman is more polite in many things than the English, but in much he falls far behind us."

When I left England, my intention was, after getting through the private business that called me to Paris, to set off direct to Switzerland, and there spend the summer. When, however, at Paris, I received so many requests from my valued friend Mr Bentham to pay him a few days' visit at Montpellier, that I was induced to accede to his wishes until the season was sufficiently advanced for a Swiss tour. You know that natural history is one of the branches to which I have long paid attention; indeed, I have to thank yourself for that taste, having acquired it when attending your classes eight or ten years ago. One branch of natural history leads to another, and if I have now given up mineralogy, and attended chiefly to botany, it is not that I dislike the former, but find it rather a too *weighty* and *bulky* study, while plants are much more portable. The kindness of Baron B. Delessert, in throwing open to me his rich herbarium, gave me an opportunity of studying attentively the collection of Palisot de Beauvois, now in his possession, and enabled me to make out what many of his hitherto doubtful species of mosses are. A notice of these may be of little interest to some, while to others it may be useful. I shall, therefore, here mark a few of the most important.

Bartramia subintegrifolia.....is *Bartramia gracilis.*

Bryum gymnostomoides.......is not in Beauvois' herbarium, and may be therefore rejected as a doubtful species. It is possibly *Weissia Templetoni.*

Cecalyphum cylindraceum....is, I think, a variety of his *Cecalyphum perichætiale:* both belong to *Dicranum*, and approach closely to *D. calycinum.*

——— longirostratum..is *Dicranum Schraderi* in a young state.

——— tortile.............is *Dicranum flagellare.*

Dicranum dichotomum.........is *Thysanomitrion nivale.*

——— phascoideum.........is *Grimmia pugiopodon.*

——— striatum...............is a *Trichostomum.*

Fissidens dubius...................is *Dicranum adiantioides* var.

Fontinalis squamosa.............The fruit is in a bad state, so that I am doubtful whether this belongs to *F. squamosa*, or should be united with *F. disticha* Sprengel, and form a distinct species.

Gymnostomum dilatatum......
——— splachnoideum } are only *Gymnostomum pyriforme.*

Hedwigia nervosa................is *Grimmia apocarpa* var. It is the *G. stricta* of Turner, as Beauvois himself had long ago discovered and marked in his herbarium.

Hypnum arbuscula...............This is a *Hookeria*. It resembles exceedingly *Hookeria rotulata*, but is much larger, being about 3 or 4 inches in height. I should be unwilling to separate the two, however, as Beauvois' plant has not yet been found in fruit.

——— confertum ....is *H. murale*.

——— gnaphalium...........is *Bartramia tomentosa*.

——— longiflorum...........is *H. stramineum*. But there is another plant in Beauvois' herbarium under this name; it is *H. fluitans*.

——— magellanicum.........is *Hookeria magellanica* N.

——— sipho....................is *H. riparium*.

——— stoloniferum..........is *H. attenuatum*, or *Leskea attenuata* Hedw.;

Mnium palmifolium.............is *Dicranum semicompletum*.

——— rubellum..................is *Bryum carneum*.

Orthotrichum americanum.....is *O. Hutchinsiæ*.

——— heterophyllum..is *O. diaphanum*.

——— breve..............This is a mistake of the printer. In Beauvois' herbarium it is *læve*, and the plant is the same with the *Schlotheimia torta* of Schw.

Pilotrichum biductulosum.....is *Daltonia polytrichoides* N.

——— denticulatum......is *Jungermannia Thouarsii* Hook.

——— serrulatum.........is probably a *Neckera*. There is no fruit, and it resembles somewhat *Hookeria Langsdorfii*.

Polytrichum elatum..........
——— remotifolium.. } appear to be only *P. commune*.
——— subpilosum....

Splachnum pusillum..............This, of which Beauvois is ignorant of the locality, comes from Norway. It was sent to Jussieu by Vahl, and was properly named by him *Spl. vasculosum*.

Trichostomum obtusifolium....is *T. aciculare*.

My partiality for botanical science was indeed no small reason for my visit to the south of France; and although the month of March had only commenced, yet I had the prospect of seeing wild the *Mibora verna* and *Hutchinsia petræa* (two plants although occurring in England, yet very scarce), with the *Valantia cruciata*, *Andryale nemausensis*, *Astragalus incanus*, *Taraxacum lævigatum*, *Erodium Romanum*, and some other *midi de la France* plants, which Mr Bentham wrote to me had long been in full bloom.

25th March, Lyons.—" I left Paris on Tuesday morning (the 22d) at half-past 5 o'clock, and got to Fountainbleau about 1 to breakfast; proceeding to Montargis to dinner, about half-past 7,—the travelling most provokingly slow. During the night I was awakened from sleep by a tremendous row between the rest of the passengers and the postilion, who had been coolly walking his horses for a league or two, whilst he on foot was enjoying the fineness of the night. Got on to Pouilly to breakfast. Between Neuvy and Pouilly I saw, for the first time this year in France (so backward I suppose is the spring), a wild flower in blossom: it was *Helleborus fœtidus.* This was the first decided vine country we had come to, but here all the rising grounds were closely planted with that shrub. Between Pouilly and La Charité I observed also, for the first time since leaving Paris, bullocks commonly used for ploughing and drawing loaded carts; but all these—the wild flowers, the vines, and use of bullocks—became more common as we got towards Lyons. The bullocks are yoked quite in the Roman fashion: a beam of wood is fixed across the brows of each pair of oxen, and is tied to their horns; and to the centre of this beam, between the two animals, is attached the extremity of the pole of the cart.

"We arrived at Lyons last night about 12 o'clock. The road down Mount Tarare is very beautiful, and in many respects resembles Glen Farg in Perthshire; but the descent is much more rapid. Lyons is the richest town in France, and is famous for its silk manufactures, and on that account the inhabitants hate the English, and take every opportunity of cheating them. An English Jew is an upright man in comparison with the Lyonais. Moreover, the most respectable houses think it a kind of duty to charge the English two or three prices. An English gentleman whom I met to-day at the table d'hôte informs me, that even the bankers do not refrain from this system. He wished to pay in some money at Lyons, and get their bill on Paris: a banker at Liverpool would give one on London, payable at sight; but here, when my informer first called, they told him they would not give a bill for less than ten days. This he refused; but when he resolved to accept these terms, and called again, they saw he was anxious, and they raised the term to fourteen days. Again he called, and they raised it to twenty; and the last time he went to them, they told him they would not do it under a month. One of the first places to which Buonaparte proceeded on his escape from Elba, was to Lyons; and a great proportion of the inhabitants are still Buonapartists in their hearts."

27th March.—" Left Lyons yesterday morning at 5 o'clock. Mules now began to be more generally used for drawing loads. At Vienne (where died Pope Pius VI.) the country becomes finer: both hills and dales were now covered with vines, and the almond trees began to show forth their blossoms. The environs abound in Roman relics. A little below this is a remarkable ancient monument: it is a huge pyramid on four high supports or arches; but, what is singular, the base of the pyramid is plain, not arched, and, with the large flag-stones which constitute it, seems ready to fall upon one's head.—Many plants now begin to make their appearance; indeed the difference between the vegetation of Paris, and that to the south of Lyons, is very great: the crops are here far above the ground, and the lambs were already several weeks old. On a hill to the south of Vienne that we walked up, I saw the *Buxus sempervirens*, the common box, in flower. I collected some of the *Grimmia africana* (*Dicranum pulvinatum β*, Hedw.): this has a hemispherical operculum, and is certainly to be distinguished from the *Grimmia pulvinata*. By some, the south of France plant is considered as different from that of the Cape of Good Hope; but I can detect no difference, although I carefully examined the latter in the herbarium of Mr Burchell at Fulham. It appears, although unnoticed till met with at the Cape by Thunberg, to be even more common in the region of the olives in France, and probably also in Spain and Italy, than at the Cape. The hill on which we were was of puddingstone, and is quarried for gravel to the roads: the mine is carried in nearly a horizontal direction, pillars being left of the material to prevent the roof falling in. The hills still continue along the west side of the Rhone."

" *Péage de Roussillon. St Vallon.*—The hills now begin to get small, and are covered with vines: they are terraced, and seem of a red gravelly rock. Côte-roti, and several other of the fine Rhone wines are produced in the neighbourhood of St Vallon, below which the view gets more beautiful as we arrive at an elbow of the Rhone. The beauty of the landscape continues to Tain, immediately below which, on the left hand, is the Hermitage, famous for the wine of that name. Opposite to Tain, on the other side of the river, is the pretty village, or rather town, of Tournon. Formerly the only communication between these two was by a boat pulled across in a manner somewhat similar to what I have seen in Scotland : A rope is suspended between the two abutments as a guide, while a small rope attached to the boat slides, by means of a ring on the larger, to prevent the bark being swept away by the force of the stream. In Scotland, I believe, they generally push over the boat by resting the hands on the guide-rope; while at the Bac de Tain, and other *Bacs* or ferries in this part of France, they have a small contrivance to pull it over. There is now so great a communication between the towns of Tain and Tournon, that a handsome chain-bridge has been commenced, and is expected to be finished in the course of the season *.

" We now proceeded towards the river Isère. The Hirondelle diligences are the chief ones opposed to those of the Messageries Royales in France. There is one between Paris and Lyons, and a corresponding one between Lyons and Marseilles. This last left Lyons an hour before our diligence the *Paresseux ;* but by stopping shorter time at breakfast, and by *overdriving*, we had made up to our antagonist at Tain. As the first arrived at the ferry or Bac d'Isère must get first over, we had a competition, for the first time I ever saw such a thing in France : still the Swallow kept a-head, and never gave us an opportunity to *lay salt on its tail ;* but, driving near the pier, their postilion thought that we would not attempt any farther struggle, and stopped ; but he reckoned wrong, for, at the instant, we doubled our pace, and in a second drew up before the other, leaving him to launch against us not a few of those tremendous oaths with which the mouth of a French postboy is peculiarly well stored. I was rascal enough myself to enjoy the fun, and even tipped the postilion a piece of silver for his good deeds, and promising another should he prevent the Swallow flying past us."

* This bridge was nearly completed when I returned this way on the 19th September.

We crossed and got to Vallence, close to which is a great artillery arsenal. Leaving Vallence, the moon shone clear, and illuminating the Rhone at the intervals we could see the river. There was none besides another gentleman and myself in the coach, and, stretched at full length on the seat, I enjoyed the night extremely. It was so mild that we kept down both the windows; and although only in the end of March, I found it much warmer to sleep here, than I have experienced on some of the Scottish mountains, under a tent, in the month of August.

"This morning the sun rose upon us about 6 o'clock, shining on the old fortress of Donzère. The scene is now much changed from that of yesterday: we have now entered the "Region des Oliviers," the "Region mediterrannée," or, as it is also called, the "Midi de la France." The mulberry trees now cover the plain; low hills are at each side in the distance, studded with white houses, which probably appeared more beautiful as the sun was shining on them so very obliquely. Towards Pierre-Late, the mountains again appear on the left; and just before entering this wretched village, there is a very singular, and apparently isolated rock of great height, almost close to the road, and which resembled, on a small scale, our own Dunbarton rock. Passing Mondragon, it is on the left side rocky and hilly; the olive trees now commence, and flank the hills like the beeches on a Highland mountain.

"*Mornas.*—I walked on while they changed horses. My eyes were now beginning to get confused with looking on plants that I had never seen wild before, growing out of all the dry dusty walls that I passed. I had neither, however, time for gathering them, nor means for drying them; and it was of the less consequence, as I expected to meet with them all at Avignon or Montpellier. On entering Orange, we passed the ancient triumphal arch of Marius. On leaving the town, we saw large and apparently barren plains, covered with cailloux, or round hard stones: all the soil seemed of a plumpuddingstone nature, and by the dissolution and sinking of the argillaceous cement, the cailloux are finally loosened, and lie on the surface. There was nothing on these plains but a few mulberry trees, which, however, I am told do well, if the soil is loosened about their roots, with a *pioche* or mattock, twice or thrice a-year, to allow the scanty rain that falls, or the water used in irrigation, to penetrate to their fibres. A less stony and more argillaceous soil continues to Avignon, and appears to be well adapted to the vines: these between Paris and Lyons must be supported by stakes, but here they have enormous roots, and short arborescent stems, and require no supports."

I arrived at Avignon between 2 and 3 o'clock, and found that my friend Mr Bentham had come here from Montpellier to meet me. We went together to M. Requien's. This gentleman, *inter alia*, directs the public garden at Avignon, but, besides being a good and active botanist, attends also to other parts of natural history. His library of botanical works is the best in the south of France, and his herbarium is exceedingly rich in European, but particularly in French plants. His liberality as a botanist is also very different from what one often meets with. He seems to have even more desire to give than to receive,—and he has the power of giving. Upwards of a month's excursion made to a distance every summer for these some years past, has enabled him to lay up a stock of much that may give pleasure to the botanist. Switzerland, the Grenoble Alps, Iles Hieres, Piedmont, Marseilles, Toulon, Narbonne, and lately Corsica, have all been examined by him. Besides, his residence at Avignon, in the heart of one of the richest parts of France for plants, was sufficient itself to furnish him with ample provision for his friends.

30*th March*.—" Requien having made up a party to-day for Vaucluse, we set off from Avignon at 6 o'clock, in a calache and cabriolet. It is about twenty or twenty-three miles distant. The rocks are very steep, and encircle the fountain, so that the water has no egress in the dry seasons, when the fountain is low, but by percolating the rocks; it consequently is for some distance lost, but again appears a little below in a large stream. Farther down some other streams gush out of the rocks on both sides; so that, in the course of one or two hundred yards, a large, deep, and wide river, the Sorgues, is formed; but this, again, is soon afterwards made to split into eight or ten branches, each of which serves, in their course, to turn mills, or irrigate the fields during the droughts of summer *. To-day the fountain was uncommonly low, and all the stones which are covered by the water when high, were now absolutely green with the *Hedwigia aquatica* and *Cinclidotus fontinaloides*, but of which the former was the more abundant. We were so fortunate as to observe here during the short time we remained, *Tortula chloronatos (T. membranifolia* Hook.*)*, *Grimmia africana*, *Clypeola Jonthlaspi*, *Hutchinsia petræa*, *Thymus vulgaris* (or garden thyme), *Vallantia cruciata*, *Hesperis laciniata*, and *Asplenium glandulosum* Loisl. (called by some *A. Petrarchæ*, and by others *A. Vallisclausæ*). Of the two last we gathered only one or two specimens; they are very scarce, and if not taken care of may be soon entirely eradicated. The *Targionia hypophylla* actually grows here, though, if the notes I have be correct, Sir J. E. Smith seems to think there is

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* It may be interesting to some to have Sir J. Smith's observations on this scene. They are contained in his "Tour to the Continent," a book I regret I had not carried with me.

"*Nov.* 30.—Nothing about Avignon could interest us so much as the famous fountain of Vaucluse, consecrated to immortality by the sweet muse of Petrarch, and now rivalling in celebrity the Castalian font, which it excels in beauty and magnificence. We arrived on its brink about 3 o'clock in a bright afternoon, when the glowing refulgence of the declining sun on the rocky scenery around, increased, by contrast, the charms of the sequestered vale, at whose extremity the fountain is situated.

"It was now in great perfection, rather fuller than usual. The water, though clear as crystal, appears green as it runs, from the depth of the channel. This fountain is, in fact, a considerable river, arising from an unfathomably rocky basin of a circular form, at the foot of a stupendous perpendicular, or rather impending rock. A few yards from its source, the stream falls, in the most majestic and picturesque manner, over fragments of rock, and then forms a rapid river, winding through the vale, whose sides, for some distance, rise suddenly to an immense height from its banks, and then gradually expand into an open plain. The village (Dr Smith might have called it miserable) of Vaucluse is built on some of the most accessible parts of these precipices, and many of its houses overhang the river. The only approach to the fountain is by a single path along the bank opposite to the town.

"Although it may seem approaching to impiety to visit this place with any other thoughts than that of Laura and her sublime lover, whose eloquence I almost adore, and to whose refinement I do all possible reverence; yet I cannot but remark, that its beauties are in themselves sufficient to render it one of the most interesting spots in the world. A naturalist or painter, as well as a poet, might spend many days here most delightfully. The neighbouring scenery wants only a little more wood."

some mistake *. As to the *Hedwigia aquatica*, few botanists would credit me should I say I gathered none of it; but fewer still will believe that I was at the pains to fill all my pockets, and my hat as full as possible. While thus engaged, one of our companions came up, and assured me I had taken "bien assez pour tous les botanists en Europe." "Voila dont pour l'Amerique," was all I had time to answer, while I proceeded in my labours. There is certainly something very delightful in finding in quantities any thing one has been long eager to lay hold of. At the fountain, or rather in the river below the fountain, I was highly satisfied to have clear demonstration that the *Hypnum Vallisclausæ* was only *H. filicinum* in an injured state. I had long suspected such to be the case, from my examinations of both in the herbarium. At the edge of the river I found the *H. filicinum* abundantly, and in fruit; while in the deeper part of the river, I detected the *H. vallisclausæ* without fructification. By a careful examination I, however, at length found, in a place where the water was shallow, a few specimens so completely between the two species, that now none I should think can doubt of their identity. Of the *same specimen*, the lower part was the *H. vallisclausæ*, while the upper part, which was out of the water, was in fruit, and belonged as certainly to *H. filicinum*.

"On the road out from Avignon in the morning, we had observed fields as yellow with the *Crepis nemausensis*, as they are white in England with the *Bellis perennis* or daisy. Abundance of *Erodium romanum* was every where by the way side; while some *garriques*, or waste lands, were as well stocked with *Genista scorpius* and *Quercus coccifer*, as some fields in Scotland with the *Ulex europæus* or furze.

"Had time permitted us I should have been delighted to have gone over the mountains some leagues farther than Vaucluse to Mont Ventoux, a mountain of considerable elevation (6650 feet English), and on which there are some very remark-

* I had been led into an error. Dr Smith's words, I find, are, "Here, too, we found something much resembling *Targionia*, but which proved only *Marchantia hemisphærica*, with its flowers budding. It is, however, the *Aitonia rupestris* of Forster (*Rupinia lichenoides* of Linn. Supp.), as I can prove from original specimens. Messrs Broussonet and Sibthorp assured me they found the true *Targionia* in this place."

able plants. The season was not, however, sufficiently advanced, the mountain being still covered with snow, and, besides, it would have required at least a day or two. We, therefore, returned to Avignon in the evening."

(To be continued.)

Notice of a New Zoophyte (Cliona celata, Gr.) from the Frith of Forth. By R. E. Grant, M.D. F.R.S.E. F.L.S. M.W.S. &c. Communicated by the Author.

We frequently find on the shore the decayed shells of the common oyster, *(Ostrea edulis, Lam.)* entirely perforated on both sides with small round holes, about half a line in diameter. These holes do not pass in a straight line through the substance of the shells, but open on both sides into chambers, which have been somehow excavated in the interior of each valve: they have probably been perforated by some marine worms, in order to feed on the animal matter connecting the layers of the shell, and to obtain a safe abode, as we generally observe a variety of these animals come from the interior, when such shells are kept a few days in a vessel of sea-water. When these perforated shells are first brought up by the dredges from the oyster-beds of the Frith of Forth, I have almost always found the holes on their surface, and the excavated chambers between the layers, filled with a soft yellow organised matter, which appears not to have been described by naturalists, but whose singular properties entitle it to a minute examination. This yellow fleshy substance occupies the perforated shells of the living oyster, as well as the detached valves of the dead animal; but, in the living oyster, as the perforations are only seen on the outside, and never pass through the innermost layer, there is always a thin layer of shell between the yellow substance and the living animal. On the death of the oyster, and separation of its valves, the inner layer soon becomes likewise perforated, and the yellow matter is then seen projecting through the holes on both sides of the shell at the same time. By removing successively the outer layers, we easily discover that the internal excavations communicate freely with each other, and with the apertures on the surface, and that all the pulpy matter which fills them, and projects through the superficial openings, is connected within so as to form one continuous fleshy mass pervading the whole shell. This yellow fleshy substance forms a distinct and well marked zoophyte, which I have termed *Cliona celata*, and I have not yet found this animal in any other situation than that above described.

The *Cliona* in the living state consists of a soft, fleshy granular and distinctly irritable substance, of a greenish yellow colour, traversed like many other zoophytes, with minute and regularly formed *spicula*. Its form depends on that of the cavities which it fills; it insinuates itself into their minutest ramifications, and adheres so closely to their smooth parietes, that it cannot be separated without tearing. The parts of the *Cliona* which project through the holes on the surface of the shell are tubular; and on removing the outer layers of the shell, we can perceive several empty canals winding and ramifying from these tubular papillæ, through the body of the zoophyte. During the months of March and April, when these observations were made, numerous small yellow ova were seen in the vicinity of the canals, agreeing much in their form, colour, size and mode of distribution with those of the *Spongia papillaris* and *Spongia panicea*, which were then nearly in the same stage of advancement. The projecting tubular papillæ possess a complicated structure, and a high degree of contractile power, and exhibit a singular series of appearances, when the zoophyte is attentively examined while at rest in pure sea-water. When under water, the papillæ are seen projecting from the apertures of the shell, sometimes to the length of a line and a half; they present a wide circular opening in their centre, and a rapid current of water issues constantly from them, conveying occasional flocculi of a grey membranaceous matter. But on being touched with a needle, or withdrawn from the water, the opening gradually closes, the current ceases, and the whole papilla continuing slowly to contract, is withdrawn completely within the aperture of the shell. The papillæ, viewed in their contracted state, present a smooth, rounded, shut extremity; but when they begin to advance beyond the surface of the shell, their extremity becomes flat and slightly dilated, assumes a villous appearance, with open fissures, radiating from the centre to the margin of the papillæ, and at length a minute circular opening is perceived in the centre of the villous surface. The papilla advances from the shell, and its central opening enlarges in proportion to the healthy state of the zoophyte, and the purity and stillness of the water; its flat downy radiated surface gradually diminishes by the widening of the central opening, till only thin margins are left around the orifice, and the current is again seen to play briskly from it. In recent specimens of the *Cliona* dredged from an oyster-bed near the shore at Prestonpans, and examined under the most favourable circumstances on the coast, I have twice observed polypi of extraordinary minuteness and delicacy placed around the margin of the orifice, and which, kept in constant motion, advancing and withdrawing themselves into the substance of the papilla, while the current flowed from its central opening. The polypi were perfectly invisible to the naked eye in an ordinary light and position; but by suspending the *Cliona* in a crystal jar with clear water, and placing it between the eye and a candle, or the sun, they were seen like filaments of silk or asbestus constantly rising and sinking on the margin of the papilla. On cutting off a papilla, and placing it under the microscope in sea-water, the polypi continued their motions, and were seen to consist of a long, slender, transparent, cylindrical, tubular fleshy body, at the farther extremity of which were placed about eight short broad tentacula, slightly dilated at their free ends, which were constantly inflecting and extending themselves irregularly, while the polypi advanced or retreated. In two entire and fresh specimens, the polypi continued visible and in motion for more than twenty-four hours in a jar of water at Prestonpans; but I have not yet succeeded in perceiving them in any of the numerous specimens which I have preserved alive in the water procured from Newhaven. The spicula of the *Cliona celata* are *siliceous*, and have a very close resemblance to those of the great *Spongiæ pateræ*, or Neptune's cups of the Indian ocean, many splendid specimens of which are preserved in the Museum of the University; when procured separate, by removing the animal matter with the blowpipe, or with nitric acid, we observe them to be long, slender, cylindrical, tubular, slightly curved, shut at both ends, a little fusiform in the middle, acutely pointed at one end, and terminated by a small hollow round head at the other. They are about the fourth of a line in length, and appear through the microscope as minute curved pins spread irregularly through the whole fleshy substance of the animal: they do not impede the irritability of that substance, as, on tearing off a portion of it partially from the shell, we observe it slowly contract its dimensions, and a portion of it entirely detached, soon becomes contracted and more hard to the feel.

This zoophyte, though one of the least attractive in its external appearance, and one of the most common inhabitants of our coast, presents to the comparative anatomist a new and very interesting combination of properties; it is closely allied to the *Alcyonium* by its contractile fleshy texture, and by its distinct though microscopic polypi; and it is allied to the *Sponge* by its siliceous tubular spicula, ramified internal canals, tubular papillæ, regular currents, and the distribution of its ova. It differs, however, from the *Alcyonium*, in not presenting a free surface, covered with a coriaceous integument, marked with stellate pores for the lodgment of distinct polypi; and it differs from the *Sponge* in the obvious contractility of its papillæ and general texture, in its possessing distinct polypi, and in its surface not being free, and covered with open angular pores. It constitutes a distinct genus, forming a connecting link between the *Alcyonium* and the *Sponge*, and throws much light on the nature of the latter zoophyte. I have termed this genus *Cliona*, (from κλειω, *claudo)*, from its most obvious and remarkable property of retracting and shutting the papillæ when irritated; and the above described species, the only one I have met with, is named *celata*, from its concealed and secure habitation within the substance of oyster-shells. It has an extensive distribution in the Frith of Forth, occurring abundantly in the oyster-beds at Prestonpans, off Inchkeith, and in the Roads. I have only found it in the shell of the common oyster, and it may be questioned whether the sharp siliceous spicula, and constant currents of its papillæ, do not exert some influence in forming or enlarging the habitation of this zoophyte.

Geological Observations,—1. *On Alluvial Rocks*: 2. *On Formations*: 3. *On the Changes that appear to have taken place during the different periods of the Earth's formation on the Climate of our Globe, and in the nature and the physical and the geographical distribution of its Animals and Plants.* By A. Boué, M. D. Member of the Wernerian Society, &c. Communicated by the Author.

I.—On Alluvial Rocks.

1. *Old Alluvium*, syn. Diluvium.

This series of alluvial deposits, in the regular succession, immediately follows the newest tertiary rocks. We do not believe that it is always distinctly separated from the modern alluvium, although Cuvier, Professor Buckland and others, maintain that such is the case. When a distinct separation takes place, it only occurs accidentally here and there. On the contrary, there is in general a transition from the one to the other, as in all the preceding formations; so that the two would seem to be nothing else than the product of the same and still existing causes, although the effects of these causes would appear to have diminished from the older to the more recent epochs. When both alluvia are well separated, it indicates that the causes to which the old alluvium has owed its existence had suddenly ceased to operate. Thus, in a great basin, it would be thought that the water has rapidly subsided by a rupture or debacle, &c.

In this deposit we find remains of vegetables still existing; also of marine, fluviatile, and terrestrial shells, of species still living; likewise remains of extinct and living quadrupeds, but no human bones.

Old Deposites of the Sea.

Accumulations of sand, rolled stones, and decayed vegetables, along the coast, more or less elevated above the present level of the sea, at high-water, (Britain).

Banks of sand and shelly marl, with bones and remains of marine animals, (East coast of England, Forth, Clyde, Norway, Oyster Bank near Rochelle, and at the mouth of the Gironde, Boston in the United States).

Sandy calcareous matter deposited by the sea, in holes and fissures in calcareous rocks of the Mediterranean; compact limestone, with still existing marine shells (Nice), Mediterranean of M. Risso.

Sandy calcareous breccia, with bones of animals not all still existing in the country, and sometimes with marine and terrestrial shells still existing there, (Nice, Corsica, Cette, Gibraltar, Cerigo, Dalmatia).

Banks of corallines or madrepores above the level of the sea, (Island of Lamlash).

Traces of Pholades at different heights on the rocks of the sea-shore, and much above high-water mark, (near Nice).

Some sandy submarine banks produced by currents (Newfoundland Bank).

Old Deposits of Lakes and Rivers, along their sides or at their mouths, and much above the present level of their waters.

Accumulations of sand, rolled stones, and decayed vegetables, on *platforms*, or often in the form of *terraces*, (Glen Roy, Lake of Geneva); some conglomerate clay-marl, with carbonized vegetables, (along the Missisippi).

Lake or river marl, with indurated calcareous nodules, bones of large animals, in part extinct, and fluviatile and terrestrial shells, of which the species exist, but are often not frequent in the country, (Garonne, Rhine, Danube, north of Germany, great plain of Eastern Hungary).

Old Deposits of Calcareous Tufa; spring and lake deposits of different epochs, with bones of terrestrial animals not existing in the country, or of which the species or even the genus is lost (Pyrmont, Southern Hartz); also with lacustrine and terrestrial shells which still exist, but of which the species is not always frequent in the country, (Baden in Austria).

Calcareous Breccia, with bones, in the interior of the Continent, (Romagnagno in the country of Verona, and Concud in Arragonia, Perigord, Adelsberg in Carniola, Mixtnitz near Berneck in Styria, Belenyesh in Eastern Hungary, Gailenreuth).

Deposits of Bones of Animals (partly of extinct species), in clay or calcareous tufa, in holes and caverns, frequent in limestone rocks.

Old Turf, sometimes under old calcareous tufa (Pyrmont), with pyrites and selenite; sometimes accidentally beneath the present level of the sea, or actually under the water of the sea, (Pomerania).

Accumulated matter, produced by the falling in or falling down of mineral masses at a remote period, accidents produced by earthquakes, erosion of water, or watery infiltration, (in all hilly countries).

A part of the vegetable mould, especially on the elevated parts of the earth, produced by the decomposition of rocks, and vegetable and animal matter.

2. *Modern Alluvium*, syn. Alluvium.

In this deposit we find only remains of existing animals and vegetables; and here also human bones and products of the arts are met with.

Modern Deposits of the Sea, very little higher than the highest tide.

Accumulations of sand and rolled stones, and decayed vegetables, (Dunes in Gascony, Scotland).

Masses of Sand, sometimes calcareous, and cemented by a calcareous infiltration (Messina), with marine shells and human bones (Guadaloupe).

Coral and Madrepore Reefs, still forming (South Sea).

Traces of Pholades, in the columns of the temple of Serapis.

Sand-banks forming under the sea.

Modern Deposits of Lakes and Rivers, on their sides, or at their mouths, and rising very little higher than the highest tides.

Accumulations of sand, rolled stones, and decayed vegetables.

Mud mixed with vegetable and animal matters.

Deposits { *of Carbonate of Soda*, in some lakes of Egypt, the Barbary States, and centre of Africa. / *of Common Salt*, in some lakes of Russia. }

Modern Deposits of Calcareous Tufa, still forming in small lakes (Roman States, Transylvania), or from springs (Alps); pisolites, with fluviatile and terrestrial shells, and bones of animals (Valley of the Gave du Pau).

Modern Turf deposits, still going on, and containing human bones and products of art (Scotland, Mecklenburg).

Matters accumulated by the falling in or down of rocky masses or earth (Rigy, between Deva and Dobra in Transylvania).

Moraine of the *glaciers*, (Switzerland, Savoy).

Saline products, forming in mines, caverns, and on the soil, in many countries (Hungary, Asia); for example, saltpetre, nitrate of lime, sulphate of lime, ——— ? sulphur.

Deposits of Mineral Waters, ferruginous, saline, or hot; for example bog iron-ore (Scotland, Mecklenburg).

Sulphur, pulverulent or crystallised (Baden in Austria).

Vegetable Mould, still forming.

II.—On Formations.

From the want of extensive geognostical knowledge, observers have sometimes been unable to distinguish properly the local from the general formations; formations, also, have been unnecessarily multiplied, and some have even fancied that new ones occurred in every country. At other times, geologists have fallen into the opposite extreme, and unnecessarily reduced the chief formations. Not having always a clear idea of the mode of formation of modern and ancient mineral masses, they have often separated the deposits of one country from those of another, because they have not agreed in all their characters. Is it not natural to suppose that an arenaceous or calcareous formation should present differences in different countries, or on the opposite sides of a basin, or in the intermediate points between the two sides of a basin. If these deposits are the products of sea and river alluvium, it is evident that the nature of the debris will vary according to the localities, and that their quantity will be more or less great; which would also partly be the case, should these rocks be attributed to a chemical precipitation. If the observed deposits are nothing else than the remains of marine animals, or similar productions, taken up and arranged by the sea-water, the same bed will present, in different localities, varieties not only in the nature of the rock, but also in the *fossils*; for marine animals are not the same at different depths of the sea, at different distances from the coast, or under different zones, or in different places of the world; and their debris must also be variously arranged or grouped together by the sea, according to the unequal motions and bottom of the ocean. For farther elucidations of this subject, I may refer the reader to the late excellent Memoir of M. C. Prevost. On the other hand, there are mineral masses, which are generally distributed, as sandstones, &c.; while others are much more local, as all unstratified rocks, also limestones, gypsum, salt, and coal. The unstratified rocks seem to have given rise to certain deposits in the countries where these rocks have appeared; thus the granite rocks are accompanied with certain conglomerates, the serpentines are near certain sandstones, the porphyries occur in the neighbourhood of the coal-formation, and of various flœtz sandstones, the basalts are associated with deposits of lignite and arenaceous rocks, &c. It should not then excite surprise to find differences in the beds of the same formation in different countries. In this manner, the transition, or flœtz sandstones of a country, which contain no unstratified rocks, will differ a little from those of another country, in which these igneous, or unstratified rocks, are present. It is acknowledged that limestone rocks are not equally distributed over the earth's surface, but that they have been formed in particular localities, as in basins, sinuosities of a basin, or along submarine rocky chains. The gypsum and salt also evidently belong to the local deposits, if their mixed igneous and aqueous origin be admitted. Lastly, the combustible deposits must be placed in the same order, as facts shew that they are nothing else than vegetable and animal matters, which have been carried away from the continent by rivers, debacles, or the sea, and which have been buried under certain conglomerated rocks.

In conformity with these views, it will be perceived how erroneous it would be to search, for instance, in the middle of a very large basin, for the coal, lignite, gypsum or salt, which are found accidentally at its margins. We will not entirely deny the success of such researches; but we may affirm, that the probability of the existence of such extensive deposits, always diminishes in the ratio of the magnitude of the basin. In an extensive basin, which might shew coal or salt at its margins, we ought not to be surprised to find here and there, instead of these inflammable or saline bodies, arenaceous matters, with little or no coal or salt.

These preliminary observations have seemed to me to be especially necessary, with the view of enabling us to classify with accuracy the deposits of a great part of the Alps, the Appenines, the Carpathians, and the Pyrenees. The three first chains present, in my tables, a great arenaceous or marly deposit, which is pretty similar to the greywacke, and which would seem to occupy the place of more than one of the arenaceous flœtz formations of other countries, or which, perhaps, is an equivalent for the whole of these flœtz formations, up to the Jura limestone. This new fact would be explained, according to my ideas, by the total absence of porphyries in these great chains; for in every other part where these igneous rocks have appeared, they have given to the ancient flœtz deposits their peculiar and ordinary characters; and some parts, even of the Alps, and of Hungary and Transylvania (as the Southern Tyrol, the country round Funfkirchen and Zalathna), afford us very striking examples of this general law.*

These remarks also give rise to general geognostical views regarding the flœtz formations. It would seem, that, from too great a desire to examine the details, geologists have lost sight of the general facts presented by this class of deposits. With-

* See my Memoir on Germany, in the Journal de Physique, 1822.

out sufficient examination, they have united under the names of ancient and recent transition class, an immense quantity of beds, containing numerous alternations of sandstone and limestone rocks; and have, on the other hand, subdivided, to a great degree, much smaller masses of deposits, because they abounded more in fossil shells, or were more easily studied. I ask, if there really exist in the flœtz period, more than two great essential and universal formations; of which the one would be eminently calcareous, and would contain the chalk and the Jura limestone, and the other generally arenaceous, and containing all the older flœtz sandstones posterior to the Jura limestone?

I confess I am inclined to this arrangement. I see in the flœtz formations the arenaceous deposits decreasing from below upwards, and the limestone from above downwards. I find between the chalk and the Jura limestone, or even in this latter (England, Dalmatia, France), nothing else than very small arenaceous masses, which even do not occur generally. On the other hand, in the older arenaceous deposits, I see only accidentally two limestone masses, of which the lowest is nowhere very thick, and of very partial distribution, and of which the other also does not seem to have the general extent of the Jura limestone. Lastly, this latter limestone shows, how extensive one's observations must have been, before we could decide whether a particular deposit is universal, or entitled to rank as a formation; for the different divisions recognised here and there in that limestone, do not exist every where; some of these divisions are sometimes represented by very different rocks, and even that which seems the most important, the lias, is wanting in the whole of the south-eastern part of Europe, as in the Appenines, the Alps, Austria, and Hungary.

Whatever other opinions may yet be formed on the subjects in question, these are the ideas which seem to have been embraced by many eminent geologists, who are accustomed to consult nature with the hammer in their hand, and not through the medium of books. I may also remark, that, so early as 1816, Professor Jameson was not far from these ideas, with which every known fact in geological geography is in accordance. Nevertheless, I believe it of importance to retain all the existing subdivisions, and even to endeavour to establish still more, in order to enable us to comprehend more easily the whole details of the complicated structure of the earth's crust.

III. *On the changes that appear to have taken place during the different periods of the Earth's formation, in the climate of our globe, and in the nature, and the physical and geographical distribution of its animals and plants.*

If we attend to the changes produced on the earth by volcanoes, rivers, the ocean, the atmosphere, and various chemical agencies, we shall obtain very simple theoretical ideas, which will enable us to explain the formation of the groups of rocks of which the crust of the earth is composed, by well known physical and chemical facts. The Tabular View of Rocks, given in volume 13th of *The Edinburgh Philosophical Journal*, shews the causes of the changes that have taken place in the temperature of the surface of the globe, and, in consequence of it, in the three kingdoms of nature; and it resolves in a very natural manner the greatest geological problem, for it assigns the reasons for the formation of the various zones in latitude, longitude, and height, for the establishment of different climates on the earth, for the successive changes in the various creations of the three kingdoms, and for the particular distribution of the remains of the ancient or lost creations. All these problems seem to be resolved, by admitting, at a former period, a much greater activity in the chemical actions which are still the source of presently existing volcanoes. This first proposition is founded on a series of facts, stated in my Tabular View of Rocks, from which it appears that the igneous action decreases in a contrary ratio to the Neptunian, from the ancient to the modern periods. If these chemical subterraneous operations have gradually diminished from ancient to modern times, less volcanic matter has been formed, and smaller tracts of countries have been volcanized or subjected to the igneous action and change; and as the high temperature of these volcanic products must have elevated the temperature of the atmosphere, it is clear, that, in proportion as the formation of these volcanic masses became less considerable, the heat of the atmosphere and surface of the earth also diminished. Volcanic actions are generally accompanied by fissures, by fallings in and risings up of tracts of country. These effects must also have been produced formerly as now; but their causes being then infinitely greater than at present, the changes operated must also have been proportionally much more considerable. This, also, seems to explain to us the rising up of certain strata, or certain parts of continents, as well as the successive sinking of the level of the sea, or its inclosure within its present limits. It is obvious that a consequence resulting from this is, that, in the earlier states of the globe, the seas and continents were changing more rapidly than in the more modern; that the temperature of the earth also was decreasing more rapidly: but, at the same time, in consequence of this decreasing heat, the evaporation must have diminished; the rays of the sun, in a less moist atmosphere, must have become less hot; the rains must have decreased in quantity, and the atmospheric meteors must have generally become less considerable; the streams of water must have gradually lost their original greatness, as well as their destructive energy; and the inclined planes along which they flowed must have diminished, or increased, according to local circumstances. On the other hand, the countries from which the sea was retiring, or those which had been raised up, must have lost a part of their temperature. It is also to be concluded, that the diminution of the temperature was not equally the same over the whole surface of the globe, but that it took place in proportion to the extent of the volcanic masses, to the degree of their cooling, to that of the retreat of the sea, and to the position of the different parts of the earth, compared with their level above the sea, with their removal from the sea, and with their position in reference to the sun. The last propositions shew, first, the probability that there have always been parts on the earth warmer than the others; and explain, besides, how the zones of temperature have been established in latitude, longitude and height, and also, according to local circumstances, the various climates of the whole earth. It is known that every zone, and nearly every climate that is more or less general, has its peculiar animals and vegetables; or, at least, it is a fact, that the distribution of animals and vegetables is most materially influenced by the division of the surface of the earth into zones, and into countries or climates. Is it not natural to search in the successive establishment of these different zones and climates, the cause of the differences observed, not only between the present vegetable and animal creations, and those similar creations which are buried in the earth, but also of those known variations in these last creations? Geology has shewn, that the farther we penetrate into the crust of the earth, the more simplicity do we observe in the vegetable and animal productions, and the more uniformity must the surface of the earth formerly have presented in its creations. This can only be a consequence of the greater equality of temperature which took place formerly over the whole terrestrial surface, for the assigned causes had then converted into warm zones those which are now cold or temperate; and they perhaps gave the torrid zone a temperature much higher than it now possesses, while, at the same time, certain parts of this zone could only have the temperature of the other zones by various circumstances not understood. As the zones and climates gradually became established, the vegetables and animals became diversified; the vegetables of certain parts of the earth also presently became extinct, because they no longer found the climate which they required; and, according to their distribution at that period, and to the temperature necessary for their existence, some are no longer found upon the earth, others have degenerated, and some genera, or even perhaps some species, requiring a pretty high temperature, still live within the tropics. The animals which were not possessed of the faculty of locomotion, must have experienced the same fate as plants; but those species which could move, must have employed the means thus afforded them to travel, when it became necessary, into climates which were favourable to their existence. Some, suddenly brought into cold climates, in consequence of volcanic elevations, or the retreat of the sea, must have perished entirely, or must have remained in life only near the equator; others would soon have nowhere found the climate adapted for them, and their races would have become extinct; while, at the same time, others would have descended, first, from the hills into the valleys and flat country, and, afterwards, they would no longer have been able to emigrate, when the temperature would already have been too cold for them in these last localities.

These ideas afford a clear explanation of those mixtures of vegetables and animals of the temperate and torrid zone, that seem at first unintelligible; they also afford us the key to those centres of creation which have been perceived on the globe, and account for the intimate relations which seem to be established between the geological structure of the earth's crust, and the geographical distribution of plants and animals, and particularly the accidental isolated state of some of them. The fossil conchologist will conclude, *a priori*, from these propositions, that the more we approach the poles from the equator, the more will the fossil remains be similar or analogous in genera or species, to those at present existing between the tropics. The more recent the formations are, the more hope may we have of still finding the analogous, or even identical, species of their fossils. But, on the contrary, the more ancient the deposit is, the less reason will we have to expect to find identical, or even analogous, species in the sea or fresh water of the torrid zone; for this zone perhaps no longer presents all the circumstances necessary for the existence of such beings, notwithstanding the actual heat of that part of the earth. Lastly, the more recent the formations observed in different continents, or in a particular continent, are, the more must their fossils differ from one continent to another, or rather from one zone to another, and also, at the same time, from one basin to another. But the fossils of these various countries will always be in the same relation with respect to the number of the analogous or similar species, with the animals still living in these various localities. These last propositions, deduced *a priori*, are conformable to experience, and have been, and will still probably be, ably elucidated by Baron de Ferussac.

Thus far does geology conduct us. We see with some pride on our side, a Ferussac (see his Geological Ideas on Tertiary Basins, in the Journal de Physique, and his article on the Geographical Distribution of the Mollusca in the Dictionnaire Classique d'Histoire Naturelle, 1825), a Humboldt, (see his Nouvelle Recherches sur la Distribution des Vegetaux, in the Dictionnaire des Sciences Naturelles, and his Discours sur les Volcans), a Fourier, (Memoires sur la Chaleur Terrestre), a Von Buch, (see his beautiful Memoirs on Trap Porphyries, and those on the Tyrol and Germany, in Leonard's Taschenbuch, 1824).

a Crichton, (Memoir on the Climates of the Globe, in the Annals of Philosophy, February and March 1825), and a Daubeny. Geology certainly enables us to perceive an uninterrupted series of igneous and neptunian phenomena; that science alone cannot yet explain all the details of these in a satisfactory manner; but she expects additional light from the progress of chemistry, natural philosophy, and astronomy; and then only will it be allowed to the philosopher to elevate himself to ideas of pure geogony.

Observations on the Climate of the Canary Islands. By Baron LEOPOLD VON BUCH *.

AMONG the many important additions made to the physical knowledge of the earth by the travels of Humboldt, and one of the most distinguished in its consequences, is the determination of the temperature under the tropics. For, before this was known, it was not easy to determine in how far the formulas which should express the distribution of temperature at the earth's surface, were consistent with observation. Inquired into in temperate and northern climates, the result of observation was always affected by disturbing causes, and the object of the investigation, which was to ascertain and give a distinct view of the anomalies, could only be unsatisfactorily and imperfectly attained.

Having now, however, obtained nearer information concerning the degrees of temperature in the neighbourhood of the equator, at the level of the sea, a series of observations are still required to connect it with those made beyond the 50th degree of latitude; but it is remarkable enough that there are none from which the temperature of the intermediate 40 degrees might be ascertained, with the exception of those conducted in Madeira by Dr Heberden in 1750, which it would be desirable to exchange with others more recent, and, on that account, probably more accurate.

Hence, it is presumed the observations instituted by the able naturalist Don Francisco Escolar, at Santa Cruz in Teneriffe,

* Memoirs of the Royal Academy of Berlin, &c.

from May 1808 to August 1810, will meet with a favourable reception. However much they still leave undetermined, such as they are, they fill up an important gap in our knowledge of the distribution of temperature, and, it may well be affirmed, cannot be dispensed with in the formation of a scientific meteorology.

I have reckoned the observations of Don Francisco, which he has had the goodness to communicate to me, by decades. Taking the mean of these, I reduced the whole to a tabular form *.

Don Francisco had provided himself with good English instruments, which were placed in the shade, in an open gallery, remote from reflection. In this respect, his observations are fully deserving of credit. The time of observation was at sunrise, and at midday, or somewhat later. Hence, it might be thought, that, in this way, the extreme heat would never be observed; that the medium would consequently be too low. This impression would be strengthened by the remarkable fact, that the temperature at midday exceeds that at sunrise, on an average, only by 1.16 of Reaumur, (2.61 Fahr.) But Monsieur Thibant de Chanvallon, (Voyage à la Martinique, 1763), has long ago shewn, that, in islands in warm climates, the extreme heat never falls later than one o'clock, or, what very rarely happens, half past one, but is frequently found to be soon after eleven, and very generally at midday; the elevation of the temperature, by the culmination of the sun, being probably prevented by the sea-breeze, which has now reached its greatest strength. Now, however much the small difference of temperature at the hours of observation might cause an error or unfavourable position of the instruments to be suspected, this singular phenomenon is, nevertheless, fully confirmed by the observations of Heberden, 60 years earlier, at Funchal in Madeira. For, besides the mean monthly temperature, he gives also the extremes in each month; and the mean difference of these, in the course of four years, amounts to not more than 2.91 of Reaumur, (6.55 Fahr.) It is therefore very probable, that the difference of the medium temperature may only be half so great. There is no plain at Santa Cruz any more than at Funchal, the mountains

* This will be found in the Scientific Intelligence of this Number.

ascending, in part very abruptly, at no great distance. Hence there is, during the night, no perfect radiation of heat to the open sky, and the diminution is inconsiderable. Around Laguna, on the contrary, which is elevated 1588 Parisian feet above the sea, there is a plain, about half a German square mile in extent, and there the nights are sensibly cold; so much that, in winter, it is no way rare for ice to be formed, though only of the thickness of a knife. Yet it never snows in Laguna; the fall of temperature is peculiar only to the ground, since it is not in the atmosphere, but arises from the radiation of heat, which is not again reflected from the clear sky, and at places not far from Laguna, though at the same level, would probably not occur.

On these grounds, I do not think that any thing ought either to be added to, or subtracted from, the observations of Don Francisco; and am of opinion, that they may be regarded as giving a fair view of the climate of Santa Cruz.

The mean temperature for each month is as follows:

		Fahr.
January,	-	63.84
February,	-	64.29
March,	-	67.17
April,	-	67.32
May,	-	72.12
June,	-	73.89
July,	-	77.27
August,	-	78.89
September,	-	73
October,	-	74.66
November,	-	70.43
December,	-	65.82
	Mean,	71.09

These are, it must be allowed, very high temperatures. The mean heat of January, the coldest month, is as great as that of the whole year in the southern parts of Italy; but from the range of temperature in the several months, it is evident that the sun here no longer passes through the zenith. There is no twofold elevation and depression of the temperature, as in all places under the tropics; but as is almost universal in the temperate regions, the greatest depression is in January, the greatest elevation a month after the summer solstice. The Canary Islands, also, no longer experience any thing resembling tropical rains; or such as, in the language of seamen, are said to follow the sun, and set in when he has reached the zenith. The rains of these climates first make their appearance when the temperature in winter sinks perceptibly, and has become considerably lower than that of the equatorial regions. The cause of the rains, then, appears to be nothing else than that which produces them in all countries towards the pole; the cooling of the warm south-west winds coming from the tropics and lower latitudes. But since these winds, by the temperature of the harvest months in the Canary islands, are not immediately cooled down to the point where the condensation of vapour takes place; the reason is obvious, why the rains should here begin much later than in Spain and Italy, and still more so than in France and Germany. Rain does not often fall on the coast, before the beginning of November, nor later than the end of March. In Italy, the rainy season lasts from the first half of October till the middle of April.

On the other hand, the summer of the Canary Islands identifies the climate with that of the tropics; so that, in these latitudes, both zones pass into each other. For, from April to October the north east trade-wind blows without intermission, just as it does all the way down to the Mexican Gulf. The trade-wind in summer always stretches farther north, till at last it reaches the coasts of Portugal. In like manner, it recedes back towards the equator, in proportion as the sun advances southward, and the temperature falls. But how far do they proceed? Do even the south-west winds, if only for a few weeks in December and January, descend on the Cape-Verd Islands? And is this position, on the boundaries as it were, of the tropical and winter rains, which proves so beneficial and fertilizing to their respective countries, perhaps the cause why these unfortunate islands, in the midst of the ocean, frequently, for many years together, are never blessed with a single drop of rain?

The invariableness of the trade-wind during summer is such, that it interrupts, like an insurmountable barrier, all communication at this season, in the direction of south-west to north-east. In two days, one can conveniently reach Teneriffe from Madeira;

but no one will easily be induced to go from Teneriffe to Canary or Madeira, for he would run the risk of consuming a whole month in the attempt. Few people on the globe live more solitary than the inhabitants of Ferro. Only one day is required to go thither from Teneriffe; but the return, which can only be effected by the help of strong and unusually far spreading land-winds, is so insecure and dangerous, that people only make this voyage when it is absolutely necessary. Generally, eight or ten days are calculated upon; but it may happen that three, four, or five weeks, will be required.

The manner in which this north-easterly trade-wind is, towards winter, supplanted by that from the south-west, is very singular, as well as instructive, and of the greatest importance to the science of meteorology. These winds do not previously prevail in the south, and then advance towards the north, as, from their direction, might at first be imagined; but, as has been before remarked, they appear sooner on the Portuguese coast than in Madeira, and there earlier than in Teneriffe and Canary; as if, from the north, they descend gradually from the upper regions, where they were at all times, even during summer, when the north-east trade-wind blew at the level of the sea with the greatest violence. It was conjectured long ago, that there might be, in the upper regions of the atmosphere, a current running in an opposite direction to that below; and on this supposition was founded the generally received theory of the trade-winds, viz. that which ascribes their origin to the rarification of the air at the equator, and the rushing in of the colder air from the north and south, which, having at first a course from north-east to south-west, is at last entirely converted into an easterly; because in lower latitudes, the rotatory motion is greater than in those from whence it proceeded. But this returning current was, till of late years, only a conjecture. In 1812, a great volcanic eruption took place in St Vincent's. To the eastward lies the Island of Barbadoes, at no great distance, but so decidedly separated by the easterly trade-wind, that it could only be reached by making a circuit of many hundred miles. This east wind brings to Barbadoes no rain and no clouds. All of a sudden, however, dark clouds appeared over the island, and the ashes from the volcano in St Vincent's fell in great abundance, to the great astonishment would they have seen mountains in motion, than such matters brought to them through the air from the west. But, by this striking occurrence, the returning current in the upper regions was proved, and with it the theory of the trade-winds, for which we are indebted to Hadly (Phil. Trans. vol. xvi. p. 151.), was become something more than conjecture. With not less certainty can this current be daily observed in the Canary Islands; for the Peak of Teneriffe is high enough to reach it even in the middle of summer. There is scarcely any account of a journey to the top of the Peak, in which mention is not made of the violent west-wind blowing there. Humboldt ascended it on the 21st of June; and, when arrived at the brink of the crater, the raging west-wind scarcely allowed him to stand on his feet, (Relat. i. 132.) Had such a wind blown at this season at Santa Cruz, or at Orotava, people would have been as much alarmed by the circumstance as they were in Barbadoes by the clouds of ashes. I found a similar, though somewhat less powerful, west-wind at the summit of the Peak on the 19th of May; and George Glass, an attentive and accurate observer, who, as a seaman, had for many years carefully explored the winds of these islands, says in his work, which still contains much valuable information, that strong west-winds always blow upon the heights of these islands, when those from the north-east prevail below, " which," he adds, " takes place, as I believe, *in all parts of the world in which there are trade-winds.*" " I venture not," he farther adds, " to explain this circumstance, but it certainly is so on the Peak of Teneriffe, and on the heights of some others of these islands," (History of the Canary Islands, p. 251.) Glass knew the islands too well not to speak here from his own experience.

These winds descend gradually upon the mountains from the high regions of the atmosphere, as is evidently seen from the clouds, which, after October, cover the top of the Peak from the south, and which appear always lower till they rest on the range of mountains, more than 6000 feet high, between Orotava and the southern coast, and there break out into dreadful thunder-storms. After that, perhaps, a week may pass, or more, before they are felt on the sea-coast. There they continue to prevail for months. Rain now falls in the declivity of the mountains, and the Peak is covered with snow.

Have we not, then, reason to believe that the west-wind, which, on the passage in summer from Teneriffe to England, is sought for in the neighbourhood or in the latitude of the Azores, and is also generally found there; have we not reason to believe, that the almost constantly prevailing west and south-west winds, which cause the voyage from New York or Philadelphia to England, to be called down (bergab), and from England back, up (bergauf), as well as that which blows at the top of the Peak, are the upper equatorial current, which has here descended to skim the surface of the ocean? It would then follow, that the equatorial air of the upper regions does not reach the pole, at least along the Atlantic ocean; and that the polar air must be subject to other movements, dependent on the temperature of the neighbouring countries of the temperate zone; and thus new causes would be ascertained for modifying the laws which regulate the distribution of temperature. How much for the clearing up of this point is not a series of meteorological observations from one of the Azores to be wished! How much, also, with this view, the narrative of a journey to the Peak of the Azores!

Glass details some other phenomena, which appear to me to be important, in order fully to comprehend the true course of these currents, one above the other. All experienced seamen hold it as a rule, that continents in the warmer climates at all times attract fixed winds, probably because the air being more rarified over the land, ascends, and must be replaced by the trade-wind. Thus the Canary Islands feel the influence of the neighbourhood of Africa. The north-east wind is always more diverted towards the coast, the nearer the islands are to it. Near the land the wind is almost directly north, or N. by E.; at Lancerote and Fortaventura, N. N. E.; at Canary, N. E.; at Teneriffe, N. E. by E.; and at Palma, a little more to the east, and thus continues along the Atlantic. These winds are so completely intercepted by the higher islands, Canary, Teneriffe, and Palma, that, when they are blowing violently on the north-east side, there is a perfect calm on the one opposite. Of this appearance there is a striking account given in the manuscript of Mons. Borda's voyage, which has been communicated to me by the Bureau of Marine at Paris. Borda had given orders to Mons. Chastenest to sail round the island of Canary, who sailed accordingly with a strong north-east wind from Sardina to the Punta de l'Aldea. Having got round this point, however, he found himself all of a sudden involved in such a calm, that he required two days to reach the Punta Descojada, only about a league distant. He took four days more to double the Punta d'Arganeguin, the southernmost part of the island. Then, on the following day, he advanced slowly to Cape Tanifet; but no sooner had he weathered this, than the north-east wind came against him with such violence that he was obliged to take in the greater part of the sails. Now, the line from Punta Aldea to Cape Tanifet lies as exactly at right angles to the direction of north-east, as if artificially laid down.

Glass investigates how far this interruption extends out to sea, and fixes it at from 20 to 25 leagues for Canary, 15 for Teneriffe, 10 for Gomera, and 30 for Palma. He asserts that he had visited and ascertained all these calm projections, and that they are very dangerous to ships, because the high waves break upon the quiet water of these unruffled spaces, as upon a shelving shore, and occasion a very hazardous and foaming surf. These distances are so very considerable as to justify the belief that these winds do not proceed parallel to the earth, still less that they have their course downwards; but that they ascend gradually, or, what is the same, towards low latitudes occupy greater spaces. It were scarcely accountable, on any other supposition, why they should not sooner unite again behind the islands.

Barometrical observations do indeed seem to indicate a particular accumulation of the atmosphere over the Canary Islands; at least the appearances the barometer presents are, in this respect, very deserving of attention, and more careful examination.

From the 21st July till the 10th August, I daily observed the barometer at Las Palmas in Grand Canary, and found it reduced to the freezing point.

At	7 A. M.	28 inches	2.882'''
	11 ——	28 ——	3.0217
	4 P. M.	28 ——	2.524
	11 ——	28 ——	2.7445

The mean of these is 28. 2‴.791, or adding, for 30 feet above the sea, 28 inches 3‴.09 lines.

This is very considerable, and is fully confirmed by the observations of Don Francisco Escolar, at Santa Cruz. The mean of the extremes, for three years, reduced to the freezing point, and to the level of the sea, is 28 inches 2‴.441 lines. And if these monthly extremes be not fallacious, the pressure of the air in summer, when the north-east and westerly winds are placed above each, appears, in fact, to be greater than in the winter months, when the south-west alone prevails. For the mean of the four months, May, June, July and August, is 28 inches 3.173 lines. The mean height from September to April 28, 2.017 ; the difference of which is 1.156 lines.

How very different is this from the state of the barometer in countries at the equator ! How very different from what it is found to be in England, Ireland and Norway ! Seven days' observations in May, at Puerto Orotava, gave the height of the barometer, at the level of the sea, at 28°1.79. Seven days' observations at the same place, in September and October, gave 28°2.38. And, lastly, three days' at Lancerote, 28°3.8.

When to this is added, that the naturalists who have ascended the Peak with barometers, have never marked them low at the level of the sea, Lamanon 28°.3‴, at Santa Cruz, Cordier even 28 inches, 5‴.6 at Puerto Orotava, on the 17th of April, (Journal de Physique, lvii. 57.), a somewhat greater height of the atmosphere, over these islands, becomes almost probable.

When the west wind of the upper regions descends obliquely in autumn, and thereby reaches the surface sooner in northern than in more southern parts, it must, long before it reach the latter, have completely interrupted the course of the north wind ; and hence it is, that, at this season, places particularly exposed to the trade wind are left in a perfect calm. Is the course of local winds prevented by the nature of the environs ? The heat being no longer carried off, will increase considerably, till again reduced, by regular winds. In this way I would explain the very singular, and, as I believe, unprecedented phenomenon, that at Las Palmas in Grand Canary, the greatest heat does not occur in July or August, but in the middle of October ; and so singular is it, that, till September, the heat, as compared with the other islands, rises only slowly, but now ascends rapidly, and reaches such a height as is only found in the warmest tropical climates. The fact is indisputably established, by the observations of Dr Bandini de Gatti in Las Palmas, made for ten years, with good and properly placed thermometers, which he communicated to me, and from which I have reckoned the decades for three years. It is to be regretted that M. Bandini observed only at midday, and thus the true mean temperature cannot be obtained. In order, however, to bring it in some respect near the truth, I have applied the difference between the mean and midday temperature, as obtained from Don Francisco's observations, to those of Bandini; the difference, however, must certainly be greater in Las Palmas. The result is as follows.

Las Palmas in Grand Canary.

		Mid-day.	Fahrenheit. Means by calculation.			Mid-day.	Fahrenheit. Means by calculation.
January	1. to 10,	63.81	62.19	July	1. to 10.	74.10	72.45
	10. to 20.	63.77	62.15		10. to 20.	75.74	74.10
	30. to 31.	63.25	61.63		20. to 31.	75.99	74.34
		63.61	61.99			75.27	73.63
February	1. to 10.	64.51	63.54	August	1. to 10.	77.49	75.72
	10. to 20.	64.49	63.52		10. to 20.	77.99	76.21
	20. to 28.	65.05	64.06		20. to 31.	78.48	76.71
		64.68	63.71			77.99	76.21
March	1. to 10.	65.66	64.44	September	1. to 10.	80.53	79.14
	10. to 20.	65.75	64.53		10. to 20.	81.95	80.55
	20. to 31.	66.49	65.28		20. to 30.	83.75	82.35
		65.97	64.75			82.08	80.68
April	1. to 10.	67.12	66.06	October	1. to 10.	86.00	84.69
	10. to 20.	67.75	66.44		10. to 20.	86.27	84.96
	20. to 30.	67.68	66.40		20. to 31.	84.00	82.69
		67.52	66.30			85.42	84.10
May	1. to 10.	68.85	67.55	November	1. to 10.	78.26	76.95
	10. to 20.	69.75	68.45		10. to 20.	71.52	70.97
	20. to 31.	69.90	68.67		20. to 30.	69.26	67.95
		69.53	68.22			74.01	71.96
June	1. to 10.	70.65	69.19	December	1. to 10.	65.75	64.44
	10. to 20.	71.60	70.14		10. to 20.	64.20	62.87
	20. to 30.	72.09	70.63		20. to 31.	63.99	62.69
		71.45	69.99			64.65	63.33

Were we to form a curve from these data, it is at once evident, that all the warmth, from the end of August to the end of November, will seem not to belong to it, but to flow from quite a distinct source. The opinion of the inhabitants fully coincides with the indications of the instruments, that the heat in the middle of summer is not to be compared with that towards the middle and the end of October. The products of nature also confirm these results. Las Palmas has not been improperly named from the palm tree; for there is, at this day, a wood of date palms, extending along the valley, whose fruit ripens well; which, however, is not the case with the few scattered trees at Santa Cruz, or at Oratava, in Teneriffe. The Euphorbia balsamifera, which requires much heat, and which, at Oratava and Santa Cruz, scarcely appears above ground, is found in this neighbourhood, on heights of 800 feet; and it is in no way unusual to see bushes of it from ten to twelve feet high. The Placoma pendula, very rare near Santa Cruz, grows equally large. A multitude of East and West India trees also adorn the gardens of Canary, which are not seen in Teneriffe: Poinciana pulcherrima, of extraordinary beauty and size; Bixa orellana; Tamarind trees, as large as our limes, and a noble alley of large trees of the Carica papaya, surrounds the inner court of the Hospital of St Lazarus, which obviously succeed here better than the few found scattered on the north coast of Teneriffe. Wherefore this singular circumstance is well deserving the attention of those who inquire into the laws for the distribution of temperature at the earth's surface, and the other meteorological phenomena therewith connected.

Such irregularities and traces of local variation are not met with in the curve of Santa Cruz. Hence, I think, it may safely be employed in the investigation of the decrease of heat in the various latitudes which lie in equal longitudes of temperature. I have, therefore, attempted to place several well ascertained curves over each other, which seem to admit of being referred to similar, or slightly modified laws, and inserted the observations themselves in the accompanying table. It contains the temperatures of Cumana, Santa Cruz, Funchal, Kendal, in the north-west of England; Söndmör, near Drontheim, in Norway; and, lastly, several months, accurately ascertained from twelve years observations in 78° of latitude; for which we are indebted to the indefatigable, learned, and bold Greenland navigator William Scoresby of Whitby in Yorkshire.

Havannah, on the contrary, and Cairo, form, on the table, two curves, which belong to quite different meteorological longitudes, running parallel on each side of the Atlantic. The influence of the winter is considerable on both. In Havannah, just under the tropic, the thermometer sinks in winter almost to the freezing point, at the level of the sea, (Humboldt). On the other hand, the summer in Cairo ascends so very considerably above that of the Canaries, which lie still farther south, that it is quite evident the decrease of temperature is not here subject to the same laws.

When the above mentioned temperatures of the Atlantic zone are calculated by the known formula of Mayer, according to which the temperatures decrease as the quadrant of the sine of latitude, multiplied by an arbitrary co-efficient, it will be found, that the respective results are by no means exact which Humboldt has already remarked in his excellent treatise on isothermal lines; one of the richest sources for the meteorological knowledge of the earth's surface. (Mem. d'Arcueil, iii. 481). But it results at once from such calculations, in what latitudes the temperature decreases more rapidly, and where more slowly, than is consistent with the fundamental law; and we are thereby led to investigate and ascertain the interfering and modifying factors. Thus, the mean temperature of the pole, as obtained from a comparison of the observations of Santa Cruz and at Kendal, is 4°.9 of Reaumur, (20°.98 Fahr.) that of the equator 28°.2 (95°.45 Fahr.) The first is not so far from the truth as the latter; for Scoresby has shewn that the medium temperature of the polar sea is several degrees under the freezing point. He, indeed supposes the mean temperature of the 78th degree of latitude to be 6°.7 of Reaumur (16°.93 Fahr.); but this is probably too low, and rests on the untenable supposition that the polar curve would have a similar progression with that of Stockholm. But this place is too remote from the sea. It would be more correct to suppose the curve similar to that of the Norwegian coast, and, were it determined by the data, furnished by M. Ström of

Söndmör, the mean temperature would be 5°.4 (19°.85 Fahr.) which may perhaps approach very near to that of the pole.

From the observations at Kendal and Söndmör, on the contrary, we obtain the mean temperature of 17°.8 of Reaumur, (72°.05 Fahr.) for the equator, and + 0°.5 (33°.12 Fahr.) for the pole ; results which should be mutually at greater distances from each other. It is hence evident that the decrease of temperature in the Northern Atlantic is much less than the general rule requires. Some new principle of heat, modifying the results, must here have interposed ; and what is that else than the upper equatorial current, which, between America and Europe, descends to the surface of the ocean, and distributing its heat, mounts upwards towards the pole !

	Cumana.	*Havannah,* Lat. 23°8.	*Cairo,* Lat. 30°2.	*St Cruz, Teneriffe.*	*Funchal, Madeira.*	*Kendal,* Lat. 56°.17.	*Sondmor,* Lat. 62°.30.	*Polar Sea in* Lat. 78°.0.
January, -	80°.35	69°.98	58°.10	63°.84	64°.49	36°.59	23°.938	2°.75
February, -	80.51	71.96	56.12	64.29	63.77	38.50	29.489	5.56
March, -	81.95	75.74	64.58	67.17	65.28	38.19	33.51	10.40
April, -	83.84	78.98	77.90	67.32	65.52	43.21	37.49	14.23
May, -	84.54	82.58	78.26	72.12	66.20	50.99	46.47	22.55
June, -	83.10	83.12	83.66	73.89	69.80	55.80	53.37	31.37
July, -	83.28	83.30	85.82	77.27	73.62	57.09	57.717	36.99
August, -	81.50	83.84	85.82	76.89	75.00	58.21	56.997	35.94
September, -	—	82.04	79.16	77.43	75.69	52.70	53.25	30.88
October, -	—	79.52	72.32	74.64	72.95	46.29	42.507	21.88
November, -	83.21	75.56	62.96	70.43	69.08	40.59	36.50	15.69
December, -	80.80	71.78	61.34	66.42	65.25	35.10	27.88	10.06
Mean Fahr.	82.31	78.20	72.17	70.94	68.89	46.11	41.593	19.86

On the Wombat of Flinders. By Dr Knox, F.R.S.E. M.W.S. Lecturer on Anatomy and Physiology, Fellow of the Royal College of Surgeons in Edinburgh, and Conservator of the Museum *. (Communicated by the Author.)

THE genus Phascolome was established by M. St Hilaire for the reception of certain animals brought from New Holland by

* Read before the Wernerian Society 14th January 1826.

the French ships of discovery, which circumnavigated the world during the reign of the late Emperor. Of two or more specimens, one was landed alive, so that M. St Hilaire had an opportunity of observing some of the habits of this very curious class of animals. His memoirs on the natural history of the Phascolome will be found in an early number of the *Annales de Museum*; the anatomical descriptions were drawn up by Baron Cuvier, and have been long submitted to the public in the "*Anatomie Comparée.*"

The *Regne Animale* of Baron Cuvier notices certain other marsupial animals, somewhat resembling the Phascolome of St Hilaire, yet sufficiently different to constitute distinct genera: these are, the Koala, the Phalanger, and the Perameles. Of these, the first, or Koala, seems to have been established by naturalists without sufficient authority. It resembles, it is true, very closely the animal I am about to describe, under the name of the Wombat of Flinders; but we shall afterwards find, that, if the character given in the *Regne Animale* be correct, they cannot be considered as belonging to the same species.

But previous to the arrival of Peron and his associates in Europe, and consequently to the description and dissection of M. St Hilaire and the Baron Cuvier, Mr Bass, a British surgeon, companion of the great but unfortunate Flinders, had discovered and described, under the name of *Wombat*, an animal of Australia, differing essentially from the Phascolome, and even in certain respects from the Koala, so as evidently to constitute a distinct species. A certain degree of vagueness, however, in the observations of Captain Flinders and of Mr Bass (who at the time were deeply interested in more important discoveries), led Baron Cuvier to suppose that there might exist some error,—some erroneous combination of two different descriptions; and, consequently, that the Wombat described by Captain Flinders might not have a real and distinct existence; but, should this not be the case, he observes, the animal described by Bass and Flinders would form a *subgenus* apart, and ought to be arranged with or near the Perameles.

Illiger, whose acuteness in the classification of objects appertaining to natural history was avowedly great, suspected this

Wombat, described by Mr Bass, to differ from the Phascolome of Peron, and he gave to it the name of *Amblotis*, the bestowing of new names being with him, as with many naturalists of the present day, an object of much greater importance than the discovery of new species.

I am not acquainted with all the sources whence M. Illiger may have derived his information, relative to this species of animal,—probably from the voyage of Collins,—from a very imperfect notice on the subject contained in the Mem. de l'Academie Imperiale des Sciences de St Petersbourg, t. i. p. 444.—and from the very excellent compilation of M. Desmarest.

The Wombat of Bass is distinctly enough described by that bold navigator, with the exception of the teeth. He says *, that "the opening of the mouth is small: it contains five long grass-cutting teeth in the front of each jaw, like those of the kangaroo; within them is a vacancy for an inch or more; then appear two small canine teeth, of equal height with and so much similar to eight molares, situated behind, as scarcely to be distinguishable from them. The whole number in both jaws amount to twenty-four." It is not improbable that this account of the teeth may prove incorrect. Notwithstanding, I am inclined, from various circumstances, to view the Wombat described by Mr Bass as different from that I have called the Wombat of Flinders, of the natural history of which I shall now offer a brief history to the Society.

It is far from being improbable, that the animal described by Captain Flinders was really the Phascolome of naturalists; for that great navigator says, in the Introduction to his "Voyage to Terra Australis," that there are two sorts or species of the Wombat, one inhabiting the islands, which burrows like the badger, and does not quit its retreat till dark: another species of this animal has been discovered in New South Wales, which lives in the tops of trees, and in manners bears much resemblance to the sloth.

Whether I am right in supposing that the description given more in detail by Mr Bass, really applies to the Phascolome of

* Collins's New South Wales, vol. ii. p. 155.

St Hilaire, or to the animal, the skeleton of which is now before us, and which we shall call the Wombat of Flinders, is perhaps a matter of little moment, since both species are undoubtedly alluded to in the writings of Flinders.

In June 1808, Sir E. Home published in the Philosophical Transactions " an account of some peculiarities in the anatomical structure of the Wombat," which contains many very valuable and original observations, and, as we shall presently find, is the only account of the internal anatomy of the Wombat that has as yet been submitted to the public. To explain this assertion, it will be necessary to premise the circumstances which led to the discovery, that the *Wombat* of Flinders *, and the Phascolome of Peron, however they might appertain to the same genus, do yet constitute two distinct species.

Sir Thomas Brisbane, Governor-General of Australasia, having transmitted to this country a specimen of an animal much resembling the Wombat, an opportunity was thus offered me of dissecting this animal ; and here I may be permitted to state, that, on this, as on all other occasions, my pursuits in comparative anatomy have been forwarded to the utmost by Professor Jameson, to whose kindness I owe the success I have experienced in anatomical investigation.

The first step I took before proceeding to the dissection of the species of Wombat put at my disposal, was the comparing of the external characters, in as far as they could be made out, with the descriptions of Cuvier and of Desmarest. The result of this comparison was, that the animal under examination differed essentially from the Phascolome of Peron, with which it had been confounded by anatomists and naturalists of high reputation. Nor could it be made to agree with another genus, the *Koala* (Cuv.) a marsupial animal described briefly in the " Regne Animale †."

Let us now proceed to examine the sources whence those errors have arisen, by means of which the internal anatomy of the

* Called so by me in honour of that truly great man.

† The engraving of the Koala, as given in the 4th volume of the *Regne Animale*, has no resemblance in form to the animal dissected by me.

Wombat of Flinders has been thought applicable to the Phascolome of St Hilaire; that is, to an animal of a very different nature, and belonging to a distinct genus, and endeavour, as far as the very limited opportunities as yet permit, to rectify them.

I.

The only account hitherto published of the animal to which I have given the name of the *Wombat of Flinders*, is that by Sir E. Home, already quoted. This great anatomist has described some of the habits of the animal (for it was brought to him alive by Mr Brown), and several peculiarities in its internal structure; but, by an error inexplicable to me, he fancied that the Wombat he described was the same as the Phascolome of Peron, the internal anatomy of which had already been accurately given by the Baron Cuvier; and this has led to a confusion which can scarcely be imagined, but by those who may have had to unravel the anatomy of two distinct species of animals, given partially by different observers, who both fancied they were describing one and the same animal.

The external form of the Wombat, observes Sir E. Home, has been described by M. Geoffroy in the 2d volume of the *Annales du Museum*, and several parts of its internal structure have been taken notice of by M. Cuvier in his *Leçons d'Anatomie Comparée*; but in order to shew, that to suppose this is a great error, and to prove satisfactorily to the Society, that the great French anatomist never dissected an individual of the species which Sir E. Home speaks of in the memoir alluded to, I have only to call the attention of the Society to the following circumstances:

The Phascolome of Peron, Cuvier, and St Hilaire, has two long incisive teeth in each jaw; ten molar teeth, but no canine teeth. The Wombat of Flinders has, on the contrary, six incisive, two canine, and ten molar.

The peculiarities which Sir E. Home supposes to have escaped the observation of MM. Cuvier and St Hilaire, are three in number, and they comprise all the observations which Sir E. Home has thought fit to offer on the subject.

1. There is no patella. 2. The stomach of the Wombat resembles that of the beaver,—a remarkable gland or assemblage of glands, resembling the glandular crop in birds, being found in the smaller curvature of the stomach, but nearer the cardiac than the pyloric orifice. 3. The prostate gland exists, and is very distinct.

Now, I am not surprised that these peculiarities should have escaped the French anatomists and naturalists; for it may easily be shewn from their own writings, that, notwithstanding the assertions of Sir E. Home, they never saw the Wombat of Flinders, which in the above account he has partially described; they described the Phascolome, and not the Wombat.

Having verified in the specimen before me the peculiarities just spoken of, and ascertained the cause of error, I became anxious to add as many new facts as possible to the three discovered by Sir E. Home; but the specimen was not a little unfavourable for anatomical investigation.

	Feet.	In.
The total length of the animal is - - -	1	11
Length of the small intestines, from the pylorus to their termination in the large intestines, - - -	7	8
Length of the large ditto (cæcum not included), -	10	8
Length of the cæcum, - - - - -	6	5

We have seen that the Phascolome or Wombat of Peron has a short and wide cæcum, and an appendix vermiformis; *the cæcum of the Wombat of Flinders is 6 feet 5 inches long, tapering gradually to a point; there is not a vestige of an appendix vermiformis.* The toes of the anterior extremities are divided into two groups, the thumb and index constituting one, and the remaining three toes the other. The great toe of the posterior extremity is really a very strong and opposable thumb; the two adjoining toes are very weak, and united to the insertion of the nail. I presume that it will now scarcely be believed by any one that these animals belong to the same species.

The Wombat of Flinders constitutes the link connecting the Marsupial animals with the Rodentia. It must precede that of Peron in a systematic arrangement, if we regard the nature of the teeth; but the intimate form and structure of its intestinal canal places it in the closest relation with the Beaver, and with the class Rodentia.

II.

The natives of New Holland give the name of Wombat or Womback to several animals which seem to differ essentially from each other, and to constitute distinct species, of which some inhabit the mountains, and others the islands. They use, therefore, the term *Wombat* generically, and they add to it other terms, expressive, I presume, of some particular quality, or conveying a notion of species as distinct from genus. It is in this way that they seem to use the term *Koala*, which very erroneously has been employed to designate a particular genus of an animal distinct from the Wombat, and entitled to precede it in systems of natural history. As it might be asserted, that, under the head Koala, the animal I have described as the Wombat of Flinders, is sufficiently characterised, and, if not identical therewith, must be merely a variety of the Koala, as it has been termed, I shall here offer my objections to such an inference.

It is probable that European writers became first acquainted with the term *Koala* through the medium of a communication transmitted by Colonel Paterson, Lieutenant-Governor of New South Wales, to Sir E. Home, nearly twenty years ago. Colonel Paterson observes, that the species of Wombat which the natives call the *Koala Wombat*, inhabits the forest of New Holland, about fifty or sixty miles to the south-west of Port Jackson, *and was first brought to Port Jackson in August* 1803. From this time, the term Koala came to be considered as a distinct genus, and we find it figuring in systems of natural history as a subdivision of the marsupial animals. The distinct and precise manner in which Baron Cuvier notices the Koala, would lead one to suppose that he had examined a specimen; for he has not only given the generic character of the animal, but also an engraving, which bears but little resemblance to the Wombat of Flinders. The characters of the Koala, as given in the Regne Animal, are, two long incisive teeth in the lower jaw, without any canine teeth, and in the upper jaw two long incisive teeth, with some smaller ones at the sides, and two smaller canine. He moreover adds, that the posterior extremities wants the thumb. On the other hand, the excellent naturalist M. Desmarest describes the Koala as having, *incisiv.* $\frac{6}{2}$, *fausses canines*

$\frac{2-2}{0-0}$, *molaires* $\frac{4-4}{4-4}$. A little farther on, he says, that there are four small teeth intermediate between the incisives and the upper molar teeth; and he asserts, contrary to the statement of Baron Cuvier, that the thumb on the posterior extremities is very large. M. De Blainville, whose extreme accuracy as an anatomist and naturalist I am well acquainted with, gives a third description, differing considerably from the two already spoken of.

With these conflicting statements before us, I may venture to question the existence of the Koala, as now described in books of history, however nearly it may seem to approach the animal called by me the Wombat of Flinders. Perhaps it may be permitted me to propose the abolition of the term *Koala*, and restore the names employed by the natives of New Holland. The classification, then, of these very extraordinary animals would be as follows *:

Genus WOMBAT.

Phascolarctos of De Blainville.—Koala, Cuv. †

Charact.—Incisiv. $\frac{6}{2}$. Canin. $\frac{2}{0}$. Molar. $\frac{5-5}{5-5}, = \frac{18}{12}$.

The two upper middle incisives much longer than the others; the lower incis. like those of the kangaroo.

Ears large and pointed, with the conch directed forward. Five-toed; toes of the anterior extremity divided into two groups; thumb and index, and the other three together. Thumb on the posterior extremities large, separated without any nail; the two following toes smaller, and re-united as far as the nails.

I. Sp. Wombat of *Flinders*.

Phascolarctos of De Blainville.—Koala of Cuvier and Desmarest.

For the anatomy and natural history, see Sir E. Home in *Phil. Trans.* 1808, and the foregoing paper.

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* The arrangement here proposed is nearly the same as that employed by M. Desmarest in his "Tableau methodique des Mammiferes," published in 1804. He describes the *Wombat* as having 6 incisors in each jaw, two canine, and 16 molar teeth; the only species being the *Wombatus fossor.* I am not at all certain to what animal the above description is applicable, if not to some species of the Wombat entirely unknown to me.

† Baron Cuvier has not given any authority for the establishment of the Koala as a distinct genus.

II. Phascolome *(Geoff.)*

Wombat of Bass.—Didelphis, Shaw.—Phascolome, St Hilaire, Cuvier.

For the anatomy and natural history, see *Anatomie Comparée*, and the *Annales du Museum*.

On an Air-Pump without Artificial Valves. By William Ritchie, A. M., Rector of Tain Academy. (Communicated by the Author.)

In the common construction of the air-pump, the valves are very liable to be deranged, the repairing of which is attended with much trouble and expence. In the following construction no such derangement can possibly take place, which must of itself give this air-pump a decided advantage.

The machine consists of a barrel shut at the lower end, and having a small aperture at C, forming a free communication with the receiver, F. (Plate I. fig. 8.) The piston D is solid, and stuffed in the usual way. The piston rod works in a small stuffing box at A, so as to render it completely air-tight. There is a small aperture at E in the top of the barrel, to allow the air to make its escape, when the piston is raised. This air-pump may be worked in the usual way, or by the method of continued motion. In commencing the exhaustion of the receiver, the piston is supposed to be below the small aperture at C. The piston is then raised, and the air which occupied the barrel is forced out through the aperture at E. The point of one of the fingers is applied to the perforation, in the same manner as in playing the German flute. The air easily passes by the finger, which, when the piston begins to descend, shuts the opening, and completely prevents the entrance of the external air. The piston is again forced down below the opening C, the air in the receiver rushes into the barrel, and is again expelled by the ascending piston.

Since the air in the receiver has no valve to open by its elasticity, it is obvious that there is no limit to the degree of exhaustion, as in the common construction.

Table exhibiting the Highest and Lowest Degrees of Temperature, with the State of the Weather, of New Brunswick in North America, as observed on the coast, and at a distance of about fifty miles from the sea, from October 1. 1818 *to September* 30. 1820. By ALEXANDER BOYLE, M. D. Fellow of the Royal College of Physicians of Edinburgh, and Surgeon to his Majesty's Forces. Communicated by Dr DUNCAN *jun.*

Station and Dates.		Thermom. Max.	Thermom. Min.	Winds.	Weather.
1818.					
Oct.	Inland,	67°	25°	W. NW. E. SE.	Fine, frost towards end.
	Coast,	65	30	WS.	
Nov.	Inland,	62	14	N. W. E. NE.	Cloudy, showers, snow.
	Coast,	60	20	SW. W.	Fine, serene sky.
Dec.	Inland,	60	— 15	NW. SE. NE.	Clear, snow.
	Coast,	45	— 18	N. NW.	Clear, much snow, high wind.
1819.					
Jan.	Inland,	46	— 18	N. W.	Clear, fine, snow.
	Coast,	50	32	S. SW.	Mild, fog, rain, no snow, unusual.
Feb.	Inland,	48	— 14	NW. SE.	Clear, much snow.
	Coast,	46	33	S.	Much fog, rain, mild, snow gone.
Mar.	Inland,	50	— 4	NW. NE. S.	Clear, much snow.
	Coast,	32	— 15	N. NW. NE.	High wind, clear, much snow.
April,	Coast,	70	10	Very variable.	Mild by day, and frost at night.
May,	Coast,	80	25	Do.	Mild, rain, fog.
June,	Coast,	86	54	S. SW. NW.	Fog, clear towards end.
July,	Coast,	84	70	SW. W.	Fine, dry.
Aug.	Coast,	82	65	N. E. S.	Sultry, cloudy, showers.
Sept.	Coast,	82	60	S. W. E.	Cloudy, rain, thunder.
Oct.	Inland,	83	20	NW. W. E. SE.	Fine, sultry, snow towards end.
	Coast,	76	10	SW. W. NW.	Much rain, cloudy, frost.
Nov.	Inland,	55	10	S.SW.SE.E.NW	Much rain, snow, clear, frost.
	Coast,	70	28	N. NW. SE.	Much rain, dry, and pleasant.
Dec.	Inland,	44	— 6	NW. W. S. SE.	Rain, sleet & snow every day, mild
	Coast,	60	— 5	W. N. W.	Pleasant.
1820.					
Jan.	Inland,	65	— 5	NNW. NE.	Clear, much snow.
	Coast,	40	— 17	W. NW.	Clear, snow.
Feb.	Inland,	70	— 19	NW. NNE.	Clear, mild towards end.
	Coast,	50	— 15	W. NW. NE.	Clear, cloudy, snow.
Mar.	Inland,	74	— 5	NNE.	Much snow, rain, high wind.
	Coast,	54	— 3	NW. NE.	Clear, much snow.
April,	Inland,	74	12	E. SE. NW. W.	Fine.
	Coast,	64	32	W. SW.	Dry, serene.
May,	Inland,	78	27	NE. SE. S. SW.	Mild, rain and fog, frost.
	Coast,	70	40	SE. W.	Fog, rain.
June,	Inland,	98	32	S. SE. N. SW.	Heavy rain, thunder.
	Coast,	75	48	SW. S.	Fine, cloudy.
July,	Inland,	99	44	S. SW.	Very fine, showers, thunder.
	Coast,	84	50	SW. S.	Serene, dry.
Aug.	Inland,	94	44	W. S. SW.	Dry, dews at night.
	Coast,	82	45	W. S. SE.	Fine, rain, high wind.
Sept.	Inland,	92	31	W. SW. NW.	Fine, dew, fog, frost.
	Coast,	78	32	SW. S. NE.	Dry, serene, fog.

Notices regarding Fiery Meteors seen during the Day. By J. H. Serres, Sub-prefect of Embrun *.

Professor Hansteen relates, that while he was observing the polar star, on the 13th August 1825, at a quarter past 11 in the morning, he saw, passing in the field of his telescope, a luminous point, the light of which was brighter than that of the star. Its apparent motion was upwards, it was slow and somewhat sinuous. He imagined it to be a falling star.

Mr Dick of Perth, in the Edinburgh Philosophical Journal, is of opinion, that the phenomenon observed by Professor Hansteen, was not a falling star, but some bird placed at a great distance, the convex surface of which reflected the solar light in the direction of the axis of the telescope. Without denying that the light reflected very obliquely from the feathers of a bird, is capable of producing an effect similar to that described by Professor Hansteen, I am yet of opinion that the explanation ought not to be generalized. While observing the sun at the repeating circle, I have frequently perceived, even through the coloured glass adapted to the eye-piece, large luminous points, which traversed the field of the telescope. They appeared too well defined not to admit them to be distant, and subtended too large angles to imagine them birds. I have sometimes thought that these points shewed themselves more frequently at the periods of the year when great quantities of spiders' webs are carried by the winds into our atmosphere. The phenomenon certainly merits investigation. Why, in fact, should there not be falling stars during the day as well as at night? Who can affirm, if these meteors are produced on the extreme limits of our atmosphere, that the presence of the sun does not favour their formation? I leave to the reader to decide if there be not some analogy between the phenomena of which we speak, and that described, in a letter addressed to the President of the Academy of Sciences, by the subprefect of Embrun, dated the 5th October 1820.

"Chance has made me the spectator of a phenomenon which I imagine to be new, and which I have deemed interesting for natural philosophy and astronomy. Under this twofold relation, I have been induced to make it known to you. The following

* From the *Annales de Chimie*, October 1825.

Mr President, is the fact such as I have seen it: On the 7th of last month, about a quarter after four in the evening, after having, with all other people, observed the eclipse of the sun, I took a fancy to have a walk in the fields. On crossing the town, I saw at first, in one of its public places, a pretty numerous group of individuals of every age and sex, who had their eyes fixed in the direction of the sun. Among this group, I remarked only a young student of law, named *Cezanne*, but still preoccupied with the eclipse, I passed without remarking that, in the position in which this young man was, as well as the persons who were with him, they could not perceive the sun, which left me in the belief that they were all looking at the eclipse, as I had myself been doing.

Further on I met another group, having their eyes, in like manner, turned towards the sun; but as, at this time, I noticed that the individuals, composing this group, were in a street, and completely in the shade, I understood that they were looking at something else than the occultation of the sun, and then it came into my head to question the Sieur Thommé, a veterinary artist, who was among them, in order to know from him the object that fixed his attention. He replied to me, "We are looking at the stars which are detaching themselves from the sun." "What say you?" "Yes, sir; but look yourself, that will be the shortest way." I looked, and saw, in fact, not stars, but balls of fire, of a diameter equal to that of the largest stars, which were projected, in various directions, from the upper hemisphere of the sun, with an incalculable velocity, and although this velocity of projection appeared the same in all, yet they did not all attain the same distance.

These globes were projected at unequal and pretty short intervals. Several were often projected at once, but always diverging from one another. Some of them described a right line, and were extinguished in the distance; some described a parabolic line, and were in like manner extinguished; others again, after having removed to a certain distance in a direct line, retrograded upon the same line, and seemed to enter still luminous into the sun's disc. The ground of this magnificent picture was a sky-blue, somewhat tinged with brown.

This, Mr President, is what I saw, and what I attest, as well as a very great number of other people of the town, who would attest it if required. I forgot to mention, that, at the moment of my observation, I was placed at the corner of a house which prevented me from seeing the sun, and that my visual ray, passing by the roof of the house, terminated at a point not far distant from the edge of the planet. The eclipse was then on its decline.

You will easily comprehend what must have been my astonishment at the sight of so majestic and imposing a spectacle, and one so new to me. It will suffice to say, that it was impossible for me to keep my eyes off it until it ceased, which happened gradually in proportion as the eclipse wore off, and the solar rays resumed their ordinary lustre. The same happened to the persons present. One of them added, at the moment when I left the group, that "the sun projected most stars at the time when he was palest;" "le soleil lancait plus d'etoiles, alors qu'il etait plus pale." These were his words.

Having recovered from the astonishment into which I was thrown by this wonderful phenomenon, I inquired of the two observing individuals whom I had distinguished in the two groups of spectators spoken off, how they had been led to notice the phenomenon. The Sieur Thommé replied, that, on coming from his stable, a woman cried out, "Come here, M. Thommé, come and see the flames of fire that are issuing from the sun." That, at this invitation, having approached, he saw, for the first time in his life, what he had put me in a condition of seeing myself; and the young Cézanne told me, it was children of ten or twelve years of age that had noticed it first, and who, wondering at the sight, called out, "Come and see, come and see now!" and that thus was formed the group by which I had passed a little after; that he had said nothing to me, because he had conjectured that the phenomenon, which at that moment excited his admiration, must have been known to me.

I have the honour, &c. J. H. Serres.

P. S.—Since this letter was written, I have learnt from M. Fouré, Engineer of Bridges and Highways, of this residence, that this public functionary also had occasion to observe the phenomenon, which he will attest if required."

Picture of Vegetation on the Surface of the Globe.

THE Creator of the universe has not confined himself to decorating our world with all the luxury of a brilliant vegetation; he has varied it in every locality; diversified its forms to infinity in their general arrangement, in their comparative size, in the correspondence or contrast of all their parts. Elegance of form, richness of colouring, delicacy of perfume, are the seducing characters under which those varied and numerous flowers, the lovely children of spring, disclose themselves to the eyes of man. What, then, is that Omnipotence which covers the barren rock with vegetation, peoples deserts, carries vegetation to the very bottom of rivers, and even to the depths of the sea? What sublime pencil has designed these rich decorations of the abode of man? Who could refuse to own in this the invisible hand of the Creator?

All are admitted to the enjoyment of this spectacle; but it is he only who has been enlightened by observation that can enjoy it to its full extent, or comprehend its beautiful order. In the midst of apparent confusion, he will perceive that plants have not been thrown at random over the surface of the globe, but that each has its peculiar place, that it could not be in any other, that the beauty and variety of the landscape would disappear were each portion of it not covered with its own peculiar ornaments; that the plants of the shores would be misplaced upon the heights, while those of the mountains, descending from the icy summit of their vast amphitheatre, would no longer produce the same effect in our level plains; that they would lose their native graces, as well as the delicacy of their perfumes, or the variety of their colours, as has happened to the greater number of such of them as have been rendered objects of cultivation. How inferior the interest which the most brilliant flowers of our parterres excite, compared with that which they would inspire, were we to meet with them in their native abode? Nor are the systematic order, and the air of finery which we give them, in any degree equivalent to the loveliness of that disorder which reigns in their distribution in the midst of the fields, scattered in the woods, or dispersed among the meadows.

In reality, vegetation is not equally brilliant throughout

With regard to the place which she has to embellish, she assumes the character of adaptation which associates best with the aspect of the locality. Gay and smiling upon the banks of streams, elegant and graceful in the valleys, rich and majestic in the great plains, she is no longer the same when she mounts the burning rock, or when she struggles upon the Alps with the snow and ice. Thus, in this admirable distribution of vegetables upon the surface of the earth, no place has been forgotten; all its parts, if we except the sand of the desert, have been invested with the clothing which best suits them. Twenty, thirty leagues, or more, of plain, in the same country, and with the same exposure, would produce throughout nearly the same vegetables; but if this plain be intersected by forests, furrowed by valleys, bristled by rocks and mountains, watered by springs; if the soil is variable, if it is humid or dry, composed of peat, or of a chalky nature, the mass of vegetation will equally vary with each change of situation and of temperature.

If the localities of the same country present very different plants, this effect is still more striking, in proportion as we advance from south to north, from east to west, and especially when we pass from one continent to another; whether we traverse the burning regions of Africa, the vast countries of Asia, or the numerous islands of America. In the greater number of these countries, the vegetation is so abundant, so varied in its forms, so different from that with which we are acquainted, that often we could scarcely give credit to travellers, were not their relations confirmed by the possession of the objects of which they speak; although, in our possession, they are isolated, mutilated, and altered. It is in their native place that we must observe them, to form an idea of the richness and of the beautiful order which nature has established, in all her productions. Let us listen, upon this subject, to one of our most celebrated travellers Baron Humboldt.

"It is," says he, in his *Tableaux de la Nature*, "under the ardent sun of the torrid zone, that the most majestic forms of vegetation are developed. In place of those lichens and thick mosses, which, amid the hoarfrosts of the north, invest the bark of trees; beneath the tropics, on the contrary, the odorous *vanilla*, and the *cymbidia*, animate the trunk of the acagou (*ana-*

cardium) and gigantic fig. The fresh verdure of the leaves of the *pothos* contrasts with the flowers of the orchideae, so varied in their colours; the bauhineæ, the climbing grenadillæ, and banisteriæ, with gold yellow flowers, interlace themselves around the trunks of the trees of the forests; delicate flowers spring from the roots of the *theobroma*, as well as from the thick and rough bark of the calabash-tree *(crescentia)* and gustavia. Amid this abundance of flowers and fruits, this richness of vegetation, and this confusion of climbing plants, the naturalist is often at a loss to determine to what stem the leaves and flowers belong. A single tree, adorned with *paullinia*, *bignoniæ*, and *dendrobia*, forms a group of vegetables, which, if separated from one another, would cover a considerable space.

" In the torrid zone, the plants are more abundant in juices, of a fresher verdure, and clothed with larger and more shining leaves, than in the northern climates. The vegetables which live in society, and which render the plains of Europe so monotonous, are almost entirely wanting in the equatorial regions. Trees, twice the height of our oaks, are clothed with flowers as large and beautiful as our lilies. On the umbrageous banks of the river of Madalena, in South America, we find a climbing aristolochia *(A. cordiflora*, Kunth). whose flowers are four feet in circumference.

" The prodigious height to which, under the tropics, not only isolated mountains, but even entire countries rise, and the cold temperature of this elevation, procure for the inhabitants of the torrid zone, an extraordinary spectacle. Besides the groups of palms and bananas, they have also around them vegetable forms which seem to belong only to the regions of the north. Cypresses, figs, and oaks, barberries and alders, which approach very near to ours, cover the mountainous districts of the south of Mexico, as well as the chain of the Andes, under the equator.

" In these regions, nature permits man to see, without leaving his native soil, all the forms of vegetables diffused over the surface of the earth; and the vault of Heaven, uncurtained as it were from one pole to the other, does not conceal from his view a single one of those resplendent orbs with which it is studded. These natural enjoyments, and a multitude of others, are denied to the northern nations. Many constellations, and many forms of vegetables, especially the more beautiful, those of the palms and bananas, the arborescent gramineæ and ferns, as well as the mimosas, the foliage of which is so delicately divided, remain for ever unknown to them. The sickly individuals which our hot-houses contain, can present but a feeble image of the majesty of vegetation in the torrid zone.

"He who can embrace the whole of nature at one glance, without dwelling upon local phenomena, sees how, from the pole to the equator, in proportion as the vivifying heat increases, organic power and life also increase in a corresponding degree; but in the course of this increase, particular beauties are reserved for each zone; for the tropical climates, the diversity of forms and pre-eminent size of vegetables; for the climates of the north, the pleasing prospect of meadows, and the periodical revelling of nature upon the return of the first breezes of spring. Besides the advantages which are peculiar to it, each zone has also a character of its own. If, in every organized individual, we recognize a determinate physiognomy, in like manner we can distinguish a certain natural physiognomy, which belongs exclusively to each zone. Similar species of plants, such as pines and oaks, equally crown the mountains of Sweden and those of the most southern part of Mexico; and yet, notwithstanding this correspondence of forms, and this similarity of partial outlines, the general picture of these countries presents an entirely different character.

"The size and the development of organs in plants, depend upon the climate which favours them. In the impossibility of presenting a complete picture of the plants of America, we shall venture to trace the characters of the most prominent groups, commencing with the palms. They have, of all vegetables, the loftiest and most noble form, and to it the prize of beauty has been adjudged by all. Their tall, slender, and channelled stems, sometimes furnished with prickles, are terminated by a shining foliage, which is sometimes pinnate, and sometimes fan-shaped. Their smooth trunk often attains a height of 124 feet. The size and beauty of palms diminish in proportion as they retire from the equator to approach the temperate zones. A striking character, and one which very agreeably varies its aspect, is the direction of the leaves. The very dense leaflets of the date and cocoa trees, produce beautiful reflections of light from the upper surface of the leaves, of a brighter green in the cocoa, duller, and, as it were, mingled with grey in the date. What difference of aspect between the pendent leaves of the *bovira* palm of the Orinoco, even between those of the date or the cocoa, and the branches of the *jagna* and *pirigao*, which point toward the heaven. Nature has been prodigal of her beauties to the *jagna* palm, which crowns the granitic rocks of the cataracts of *Atures* and *Maypures*. Their slender and smooth stems attain a height of 160 or 170 feet; so that, according to the expression of Bernardin de Saint Pierre, they rise in the form of a portico above the forests. Their aerial cyme contrasts in a surprising manner with the dense foliage of the *ceiba* trees, with the forests of laurels and *melastomata* which surround it. In the palms with palmated leaves, the tufted foliage is often placed upon a bed of withered leaves, which gives to these vegetables a melancholy character.

"In all parts of the world, the form of the palms is associated with that of the *bananas*. Their stem less elevated, but more succulent, is almost herbaceous, and crowned with leaves of a thin and loose structure, with nerves delicate and shining like silk. The groves of bananas are the ornaments of the humid districts. From their fruit is derived the subsistence of all the inhabitants of the tropics; they have accompanied man from the infancy of civilization. If the vast and monotonous fields which are covered by the cereal plants, diffused by cultivation in the northern countries of the earth, afford little embellishment to the aspect of nature, the inhabitant of the tropics, on the contrary, in establishing himself, multiplies, by his banana plantations, one of the most noble and magnificent of the forms of vegetation.

"The delicately pinnated leaves of the *mimosæ*, *acacia*, *gleditsia*, *tamarinds*, &c., have a form which the vegetables peculiarly affect between the tropics. It occurs, however, beyond the limits of the torrid zone; for these plants are not wanting in the United States of America, where vegetation is more varied and more vigorous than in Europe, although in a similar latitude. The deep blue of the sky of the torrid zone, as perceived through their delicately pinnated foliage, has an extremely picturesque effect.

" The *cactuses* are almost exclusively peculiar to America. Their form is sometimes spherical, sometimes articulate; sometimes it rises like the pipes of an organ, into long channelled columns. This group forms in its exterior the most striking contrast with that of the liliaceæ and bananas; it belongs to those plants which Bernardin de St Pierre has so happily named *the Vegetable Springs of the Desert.* In the parched plains of South America, the animals, tormented by thirst, look out for the *melocactus,* a spherical plant, half concealed in the sand, enveloped in formidable prickles, and whose interior abounds in refreshing juices. The stems of the *columnar cactus* rise to the height of thirty feet, and form a sort of candelabra; their physiognomy has a striking affinity to that of some African Euphorbiæ.

" While the cactuses form *vases* dispersed through leafless deserts, and the orchideæ, under the torrid zone, animate the fissures of the wildest rocks, and the trunks of trees blackened by excess of heat, the form of the vanillæ is brought into notice, by their pale-green leaves, filled with juice, and their variegated flowers, so singular in structure. These flowers resemble a winged insect, or the small bird which feeds upon the perfume of the nectaries. A whole life would not suffice an artist to paint all those magnificent orchideæ which adorn the deeply furrowed valleys of the Andes of Peru.

" The *Casuarinaceæ,* which occur only in India, and the islands of the great ocean, are denuded of leaves, like the greater part of the cacti: they are trees whose branches are jointed like the stems of equisetum. We find, however, traces of this type in other parts of the world. The pines, the thuyæ, and cypresses, belong to a northern form, which is of rare occurrence in the torrid zone. Their continual and always fresh verdure, enlivens the landscape saddened by winter, and announces at the same time to the nations bordering upon the poles, that even when the earth is covered with snow and frost, the internal life of plants, like the fire of Prometheus, is never extinguished upon our planet.

" The mosses and lichens in our northern climates, the *aroideæ* under the tropics, are parasites as well as the *orchideæ*, and clothe

the trunks of trees as they grow up. They have fleshy and herbaceous stems, sagittate, digitate, or elongated leaves, but always with very large veins. The flowers are inclosed in sheaths. These vegetables belong rather to the New Continent than to the Old. The *caladium* and *pothos* inhabit only the torrid zone.

"With this form of the aroideæ, is connected that of the *lianas*, of a remarkable vigour in the warmest countries of South America, such as the *paullineæ*, *banisteriæ*, *bignoniæ*, &c. Our trailing hop and vines, may give an idea of the elegance of forms of this group. On the banks of the Orinoco, the leafless branches of the *bauhiniæ* are often forty feet in length; sometimes they fall perpendicularly from the elevated cymes of the acajous; sometimes they are diagonally extended from one tree to another, like the cordage of a ship. The stiff form of the bluish-coloured aloes, contrasts with the pliant shoots of the lianas of a fresh and light-green tint. Their stems, when they have any, are, for the greater part, without divisions, having approximated knots, bent upon themselves like serpents, and crowned at their summit with succulent fleshy leaves, terminated by a long point, and dispersed in dense rays. The aloes, which have a tall stem, do not form groups like the vegetables which love to live in society; they grow isolated in arid plains, and, by this circumstance, give to the tropical regions a peculiar character of melancholy. A sad stiffness and immobility characterize the forms of the aloes; a cheerful slimness and mobile suppleness distinguish the gramineæ, and, in particular, the physiognomy of those of them which are arborescent. The bamboo thickets of both Indies form umbrageous alleys. The smooth stem, often recurved and floating, of the gramineæ of the tropics, surpasses in height that of our alders and oaks.

"The form of the ferns is not less ennobled than that of the gramineæ in the warm countries of the earth. The arborescent ferns, often thirty-five feet in height, resemble palms, but their trunk is less slender, shorter, and very rugged. Their foliage, more delicate, and of a looser contexture, is transparent, and slightly dentate upon the edges. These gigantic ferns are almost exclusively indigenous to the torrid zone; but they prefer to extreme heat a less ardent climate. Depression of temperature being a consequence of elevation of the soil, we may consider as the principal abode of these ferns, the mountains, which rise to a height of from 2000 to 3000 feet above the level of the sea. The tall-stemmed ferns accompany, in south America, that beneficent tree whose bark prevents fever. The presence of these two vegetables, indicates the happy region where the mildness of spring continually reigns."

(To be continued.)

On Falling Stars. In a Letter from Professor BRANDES of Breslau, to Professor JAMESON.

SIR,

THE phenomena known by the name of Falling Stars, have for some time past attracted the attention of naturalists: I therefore hope that you will read with interest a small work on the subject, which I have the honour of transmitting to you, (entitled, "Beobachtungen über die Sternschnuppen,"—Leipzig, 1825.)

I am exceedingly anxious that there should be observers of these phenomena in your country also, and you will therefore pardon me for requesting you to insert a short notice of the results of our observations in your Journal.

Those which seem to me the most worthy of attention, may be expressed in few words.

1. Although falling stars move in all directions, in respect of the vertical, yet those which fall, that is to say which approach the earth, are more numerous than those which recede from it; and it might therefore be concluded, that they are subjected to the earth's attraction, during the short period of their appearance.

2. Falling Stars move in almost every direction, in respect of azimuth, yet those whose course is directed toward the south-west, are much more numerous than those that follow the opposite direction.

Our observations furnish us with the direction of the paths of 34 of these meteors, and it would seem from calculation, that the greatest number had a motion almost exactly the opposite of the earth's motion in its orbit. I calculated, therefore, for the observed times of the appearances of the meteors, the azimuth of the direction of the earth's motion, and, by taking the mean of the results, I found the direction exactly opposite of that of the earth's motion to be $48\frac{1}{2}°$ to the west of the meridian.

Beginning from this point, I divided the whole horizon into 8 equal parts, so that the azimuth $48\frac{1}{2}°$ from south to west would be the middle of the first octant. Then, for every octant, I found the courses of the 34 meteors to be as in Fig. 4. Plate I.

1*st*, 9 directly opposite to the earth's motion;
2*d*, 0 coinciding with the earth's motion;
3*d*, 7 and 4 in the two octants adjacent to the first.
4*th*, 3 and 2 in the two octants adjacent to the second.
5*th*, 6 and 3 in the two octants which are in the middle.

It seems to me, therefore, that falling stars disclose to us the earth's motion; and although they have doubtless a proper motion, yet the greater part of their celerity is only apparent, and arises from the proper motion of the earth, which passes near them in its course round the sun.

If this be true, might it not be desirable that the result should be confirmed by a great number of observations? But I shall not trouble you with my reasonings on the subject. Have the goodness to communicate these observations to such of your countrymen as feel an interest in meteorology. I trust you will pardon me for troubling you with this letter. I am, Sir, &c. BRANDES.

BRESLAU IN SILESIA,
3d April 1826.

On the Management of the Water-Melon and the Cucumber in Russia. By WILLIAM HOWISON, M. D. Lecturer on Materia Medica and Botany. (Communicated by the Author.)

DIFFERENT kinds of water-melon, or arbouse, are cultivated in surprising quantities in the southern parts of the Russian Empire, from the Don to the Ural; and particularly along the

Banks of the Volga. Their cultivation requires but little trouble. They thrive in the open air, only to the 52d degree of north latitude. The melon gardens, from their size, might rather be called fields; they are inclosed with a slight fence, just sufficient to keep off cattle, and are divided into long beds, between which, in the oriental style, little canals are cut in the soil for watering the plants. For this purpose, the gardens are always laid out contiguous to a pool, or to a streamlet of running water. The melon comes early forward, and is, with little pains, brought to a large size. They are treated with little more care than the most common field fruits; and yet, in every plantation of them, melons are to be found weighing thirty pounds, and which, in point of succulence, and mild flavour, cannot be excelled. The plant sends out a very luxuriant crop of dark green coloured fresh looking leaves, and also long juicy pale coloured shoots, or tendrils, of considerable thickness, which extend to a great distance, creeping along the surface of the soil. The fruit is of a rich, dark green, variegated colour, sometimes spotted, of an oval shape, and grows to a large size. When ripe, and cut into, it appears pure white, of a spongy looking structure, and contains at the heart large dark coloured seeds, surrounded with a pale pink tint, colouring the pulpy substance on which they are contained, and gradually losing itself in the white. When eaten, it is remarkably juicy, resembling cold spring water, and is well adapted as a refrigerant for allaying thirst, and other disagreeable effects of a warm climate. It may be used either raw, with powdered sugar, or ginger, or salted in the same manner as the cucumber. The water-melon also possesses the advantages of keeping in its fresh state for a considerable period; and, from the firmness of its texture, it will bear without injury removal to a great distance.

Water-melons, although they are annually sent to the great towns of St Petersburg and Moscow, in abundance, and at a cheap rate, from the southern parts of the empire, are also brought to maturity by forcing under glass frames, in considerable quantity, at an early period of the season, in the northern parts of Russia, but chiefly in the neighbourhood of the principal towns. What is principally necessary during their cultivation in this manner, is to take particular care not to injure the very strong and creeping shoots, which the plant sends out during its progress, as already described, but either to raise the frames, and allow them to spread out into an adjoining one, or to keep them, by bending, entirely within its own, which, in that case, would require to be long and roomy. The former way I would prefer. It is to neglecting this, that the gardeners in Russia attribute the general failure in the cultivation of the water-melon in Great Britain. If the shoots are, in any way checked, or injured, during their growth, the plant is observed to suffer considerably, and the future progress of the fruit towards maturity is either interrupted or totally destroyed. Attention to this circumstance, is of much more consequence than heat, as is satisfactorily and daily proved in the northern parts of Russia. It is also well known, that the water-melon plant, propagated by artificial heat, produced by glass frames, will flourish and the fruit reach its full size, at the same temperature at which any of the common species of melon will do. My friend, Mr Booker, has them every season growing in great perfection among other melons, in his garden at Cronstadt; and merely from paying attention to this, Mr Cole has the same at the Taurida Palace-Garden near St Petersburg. As the plants are remarkably strong and luxuriant, and send out very large and bushy shoots, one plant is quite sufficient to fill a large sized glass-frame.

Water-melons are known to be ripe, not by the smell but by the peculiar sensation which they communicate when struck, a knowledge of which can only be acquired by experience. If they are allowed to remain adhering to the plant, until the seeds shake within them, they will be found good for nothing, excepting future propagation from the seed. When the extremely tough skin, covering the water-melon, is removed, and they are cut into slices, they may be eaten in the raw state with salt, in the manner of celery. The arbouse, when eaten in quantity, I am told, acts as a diuretic; and when in Russia, I was informed by a physician of a remarkable case of obstinate gonorrhoea being cured by it.

The Cucumber.

Cucumbers are made use of in large quantities by the native Russians, and by foreigners settled in the country; both during the summer, in their fresh state, and during the winter, when artificially preserved. The plant is cultivated in great profusion in the fields, wholly in the open air, during the short but warm summer of Russia. In general, it is planted in long rows, along with cabbage; a cabbage and cucumber plant alternately constituting the rows. It is also to be met with in abundance in the gardens of the better class of peasantry throughout the interior. In the gardens of the higher orders, an early crop is sometimes raised under glazed frames. Glass is remarkably cheap in Russia, as it pays little or no duty.

The Russian cucumber differs in some respects from that which is common in Britain. The leaf and plant are considerably smaller, and contracted; the first, when it has attained its full growth, is short, thick, containing a large proportion of juice and pulpy matter; and, from these last mentioned qualities, is much better adapted for salting (the only mode in which the cucumber is preserved during the winter throughout Russia), than the common cucumber of this country. It may be unnecessary for me to mention here, that the cucumber plant requires a rich soil, or ground well dunged, for its cultivation. The Russians of all classes pay particular attention to this, covering the root of each plant with a small heap of horse or cow dung. For winter use, the cucumber is preserved in salt, as already noticed; and prepared in that way, it forms an excellent cooling article of food, which is used in great quantities. Before these are eaten, their green outer skin is removed by the knife; when the pulp is found remarkably juicy, and pleasant to the taste. The liquid which is charged with the salt, and with the soluble portion of the vegetable matter, and which fills the cask in which the cucumbers are preserved, is not unpleasant to the taste; and is used by the native Russians as a gentle cooling laxative in fever, about a tumbler to a dose. A cask of Russian pickled cucumbers was procured last winter by a distinguished member of the Horticultural Society in this city; and the cucumbers were much admired for being well preserved and of fine flavour.

As the seed of the Russian cucumber has found its way into Britain, and has been cultivated in Scotland with success, I shall subjoin here a very accurate receipt for the preparation and salting of cucumbers. This was procured for me by the kindness of Mrs Dr Crichton, from one of the most experienced cucumber salters in St Petersburg; and I am not without hopes, that it may form a useful and salutary addition to our British cookery. " Take 1000 cucumbers, weigh out 7 lb. English of salt, which has been previously well purified, and dried. Mix the salt well with a quantity of cold soft water, sufficient to cover the cucumbers, 500 of which may be put into one small light made cask. Have ready plenty of the following leaves, which have been gathered when the weather was dry; oak leaves, black-currant leaves, cherry leaves, dill leaves and heads: mix them well together, and place a layer of them at the bottom of the cask; then a layer of cucumbers, and thus alternately until the cask be completely filled: then pour on the salt and water till it rise to the brim, and close the cask tightly. Some people add a small bottle of vinegar, and a very small bit of garlick to each cask." In two or three months the cucumbers are fit for use. They are brought to table entire, floating among the juice and leaves which cover them while in the cask. In Russia, they seldom appear at table until the month of November or December, when the winter has completely set in, as they must remain in the cask for two or three months, in order that the salt and water may have sufficient time to act upon the vegetable matter of the cucumber, and of the various species of leaves employed in their preparation. However some prefer them, from the time they are first subjected to the salt, until it has completely penetrated them; when they are said to be half salted, and known by a correspondent appellation in the Russian language. A Russian will often eat several cucumbers salted in the above mentioned manner during a meal, and no bad effect is ever known to arise from their use.

Whether the cucumber of this country would answer for salting in the above mentioned manner, I have not yet put to experiment. The objection, as appears to me, would be, its containing much fibrous matter, and too little pulp and juice. Although they possess our common variety of cucumber in great abundance in Russia, I never met with it salted.

While visiting the hot-houses of the Taurida Palace garden, St Petersburg, under the direction of Mr Cole, a native of this country, intelligent and experienced in the art of Horticulture, I saw the branches of a number of cucumber plants, both of the Russian kind, and of that common to Britain, tied up to wooden rafters or palings in the manner of vines. The plants treated in this way appeared to be remarkably strong, and the fruit was very large.

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*Notice respecting the Presence of a Rudimentary Spur in the Female Echidna of New Holland.** By R. Knox, M. D., F. R. S. E., M. W. S., Conservator of the Museum of the Royal College of Surgeons. Communicated by the Author.

In the beginning of the year 1823, Professor Jameson put into my hands a specimen of the duck-billed animal of New Holland, the male Ornithorynchus paradoxus. It had been sent to him by the governor of Australasia, the Honourable Sir Thomas Brisbane; and, aware that I was continually engaged in anatomical inquiries, he requested me to dissect this paradoxical animal, and to lay the results before the Wernerian Society. At that time the only accounts in existence relative to the anatomy of the spur, a remarkable appendage found in the male of the Ornithorynchus and Echidna, were, 1*st*, An account of the spur, drawn up by a distinguished English anatomist, and published in the Philosophical Transactions, describing the organ to be solid, and to be an instrument of prehension; 2*d*, A statement made by Rudolphi, in a German journal, affirming the spur to be solid; 3*d*, A notice by Sir John Jamison, in the Linnean Transactions, describing the poisonous nature of wounds, inflicted by this spur of the Ornithorynchus; *lastly*, A short memoir by that most distinguished anatomist M. De Blainville, demonstrating the tubular structure of the spur, and tracing its anatomy as far as the base, or insertion of the spur, into the heel, beyond which the state of the specimen in his possession did not permit him to go.

The discovery of a large poison-gland, situated over the hip-joint, which discovery I had the honour to submit to the Wer-

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* Read before the Wernerian Natural History Society, 27th May 1826.

nerian Society a short time after the dissections were completed, rendered it extremely probable, that the functions heretofore assigned to the spur were purely hypothetical, and that this was really a very formidable instrument of offence and defence, belonging to the male of these different species of animals; but the original opinion relative to the functions of the spur was not to be given up so easily; and accordingly we find, that Sir Everard Home, the original promulgator of the doctrine, still defends the opinion in a very ingenious manner. He observes, in the third volume of his Lectures on Comparative Anatomy, that contrivances of this kind are not uncommon: his words are as follows:—"In the toad and frog, the fore-legs of the male are applied round the belly of the female for that purpose. In the shark there are regular holders, as will be shewn. In the earth-worm it is effected by suction, as will be explained. In the Dytiscus marginalis, an insect that copulates under water, there is an apparatus mentioned in the seventh lecture, more nearly allied than any other to the present apparatus; on the thigh of the male, there are suckers which attach the animal to the female. Having ascertained that a secretion is emitted through the spur, and the parts being so minute as to require glasses of considerable power, I got Mr Bauer to examine the socket of the female; and, after overcoming considerable difficulties, the parts being very much corrugated, and yet retaining their elasticity, he made out the form of this socket, which corresponds exactly in shape with the spur itself, so that, when completely introduced, it must be so grasped, that the male would not be able to withdraw it, when the coitus was over; in this respect resembling the effect of suction. The male, it would appear, at least this is the best conjecture I can make by reasoning from analogy, there being no facts to guide us, by throwing some of the secretion of the gland of the thigh into the socket, dilates it, and releases the spur. The liquor injected being acrimonious, will also irritate the female, and make her use efforts to escape. This is exactly similar to what is performed in the cupping-glass apparatus by muscular action, to let in the air."

A single fact, however, respecting the anatomy of the female echidna, renders this very ingenious theory almost inadmissible: for the opportunity of making this discovery, we are again indebted to the kindness and attention of Sir Thomas Brisbane, who some time ago transmitted to Professor Jameson, for the Royal Museum of the University, a female echidna, which was put into my hands for examination. On the heels of the female echidna, exactly in the situation of the spur in the male, there is found what I shall venture to call a rudimentary spur, similar in many respects to that of the male, which it in some measure represents in miniature. It is placed in the bottom of a little cavity, not quite deep enough to conceal it from view: its base may be about half the size of the male spur, but it suddenly tapers to a point, so that altogether it may not be much larger than a fourth, or probably a fifth part of a full grown male spur. It is of the same horny texture, and seems altogether quite analogous with that of the male.

The physiological anatomist can have no difficulty in comprehending that this organ must bear to the male spur the same relation that the human male breast does to the female. In the one case we have an organ fully developed, and capable of performing its functions, in the other a rudimentary and imperfect organ. The rest of the poison apparatus found in the male, and first described by me in the Wernerian Transactions (vol. v. p. 1.) seem to be wanting in the female.

Observations on Philadelpheæ and Granateæ, two new Families of Plants. By Mr David Don, Libr. L. S. Corresponding Member of the Wernerian Society, &c. (Communicated by the Author.)

Although the genera which I now propose to separate as distinct Natural Families, have been cultivated in our gardens from almost time immemorial, yet no plants have been less understood in regard to their botanical characters, or to the station they ought to occupy in the Natural System; affording a striking confirmation of the justness of a common remark, and which applies equally well in botany, that what we have daily before our eyes we most frequently overlook as unworthy our regard. The genera *Philadelphus* and *Punica*, which form the subject of this paper, constitute two very natural groups. They have been placed by the illustrious Jussieu among the *Myrtaceæ*, and I am not aware that any one has questioned the propriety of this classification. That they can neither be grouped with the *Myrtaceæ*, nor with any other family hitherto established, I trust I shall be enabled satisfactorily to shew in the sequel. It may be proper here to observe, that the whole of the *Myrtaceæ*, require a thorough revision, as at present they comprise plants which have but little general affinity. The true *Myrtaceæ* are distinguished by their perfectly entire leaves, furnished with numerous pellucid dots, which, when bruised, emit a camphoriferous or spicy scent, and by the seeds being destitute of albumen, although Gærtner has attributed a fleshy albumen to the seeds of *Bæckia*. This I found, however, to be quite erroneous, Gærtner having evidently mistaken the embryo for the albumen; for in the seeds of several species of *Bæckia*, which I carefully examined, I was unable to trace the least vestige of this substance. Whether it is present in the seeds of *Imbricaria* (the *Jungia* of Gærtner), I have not had an opportunity of determining; but, if it is really present, as Gærtner affirms, it would alone be sufficient to remove the genus from the *Myrtaceæ*, as in those families in all of whose genera its presence is not uniformly constant, traces of it may still in general be detected in all of them, on a careful examination. Before I proceed farther, I shall add a description of the *Philadelpheæ*.

PHILADELPHEÆ.

Genus Myrtacearum, *Juss.*

Calyx turbinatus, limbo 4-fido (raro 5-fido), persistens. *Petala* 4 (raro 5), calycinis laciniis alterna, in æstivatione convoluto-imbricata. *Stamina* 20–40, duplici serie disposita, fauci calycinæ inserta. *Styli* 4, raro 5, infernè sæpiùs coaliti. *Stigmata* longa, divaricata, obtusa, latere interiore puberula, nunc spiraliter torta. *Capsula* semi-infera, sublignosa, 4- (raro 5-) locularis, polysperma, apice quadrifariàm loculicido-dehiscens. *Semina* scobiformia, subulata, lævia, angulis placentæ tetragonæ cumulatim adnata, arillo laxo membranaceo, ad umbilicum foramine fimbriâ laceratâ aperto, nucleo seminis triplo longiore instructa: *testa* tenuissima, membranacea, nucleum arctè vestiens: *albumen* ovoideum, carnosum, album. *Embryo* inversus, lacteus, ferè albuminis longitudine: *cotyledones* ovales, obtusæ, planiusculæ: *radicula* teretiuscula, cotyledonibus plurimùm longior, supera, recta, obtusa.

Frutices (Europæ, Asiæ, et Americæ, temporatis communes) *erecti, decidui*. Folia *opposita, nervosa, dentata, impunctata.* Flores *oppositè axillares, terminales, subracemosi, albi.*

It will be seen by the above description, in how few characters this family agrees with *Myrtaceæ*, which differ not only in their simple style, in the absence of albumen, and in having the leaves perfectly entire, evergreen, with pellucid dots, but in their seeds being destitute of an arillus, in the structure and position of their embryo. In the mean time, I am disposed to place this family near to *Saxifrageæ*, as they agree in the æstivation of the corolla, in the petals alternating with the laciniæ of the calyx, in the half-inferior ovarium, in the plurality of styles, in the presence of albumen, and in the structure of their anthers; and they correspond well with *Hydrangea* in habit, in their opposite, toothed leaves, and in the structure of their buds and young shoots.

I shall now proceed to give the characters of the second family, which I have denominated *Granateæ*, and conclude with remarks on it.

GRANATEÆ.

Genus Myrtacearum, *Juss.*

Calyx tubulosus, crassus: *limbo* erecto, 5–10-lobo, persistente. *Petala* 5, rariùs plura, lobis calycinis alterna, obovato-rotundata, caduca. *Stamina* indefinitè numerosa, fauci incrassatæ calycis inserta. *Antheræ* ferè orbiculatæ, peltatæ, biloculares, duplici rimâ longitudinaliter dehiscentes. *Ovarium* tubo calycis accretum, apice liberum, multiloculare. *Stylus* brevis, crassus, teres. *Stigma* indivisum, capitatum. *Bacca* pomiformis, limbo tubuloso dentato calycino, nunc contracto, coronata: *cortex* crassissimus, extùs cuticulâ lævi rubicundâ punctatâ lucidâ vestitus, intùs spongioso-carnosus, albus, dein, maturâ baccâ, fissurâ irregulariter rumpens. *Placenta* cortici baccæ substantiâ simillima, at magis carnosa et succulenta, baccam omninò replens, in loculis numerosis polyspermis inæqualibus reticulatim atque interruptè excavata. *Dissepimenta vera* nulla: *spuria* tamen adsunt, quæ e substantiâ placentæ orta, valdè sunt fragilia, et crassitie variâ. *Semina* crebra, excavationibus placentæ passim inserta, obovato-cuneato, angulata, baccata! *testa* membranacea, pellucida, pulpam aquosam involvens: *putamen* osseum, angulatum: *albumen* nullum. *Embryo* cavitati putaminis conformis, rectus, lacteus: *cotyledones* foliaceæ, carnosæ, orbiculato-cordatæ, spiraliter convolutæ: *radicula* teres, recta crassiuscula, infera, basi obtusa, cotyledonibus duplò brevior, vaga.

Frutices (Africæ borealis) *decidui, erecti, ramosissimi, inermes v. spinosi.* Folia *exstipulata, petiolata, integerrima, impunctata, inodora, opposita v. rariùs terna aut sparsa.* Flores *magni, laterales, solitarii, sessiles, punicei, pulcherrimi.* Bacca *magna, ampullaceo-*

sphærica, extùs sanguineo-rubra, nitida. Semina *pulpâ sanguineâ, grati acidi eduli.*

The real structure of the fruit of the pomegranate appears to have been overlooked by all authors * I have consulted on the subject, and even the distinguished Gærtner has fallen into error both in his description and figure. It is in reality a fleshy receptacle, formed by the tube of the calyx into a unilocular berry, filled with a spongy placenta, which is hollowed out into a number of irregular cells, in which the seeds are placed; the dissepiments being nothing more than thin portions of the placenta. If we could conceive the fruit of *Rosa* to be filled up with an interrupted pulpy matter, it would be exactly of the same structure as the pomegranate. The affinities of *Granateæ* are yet to be ascertained. In the structure of the embryo, it agrees well with the true *Malvaceæ*, and with *Pomaceæ* in its flowers; but the total absence of stipules, together with the presence of some important characters, lead me to suspect that the comparison is merely analogical, and that it has no real affinity with either of these families.

Account of a rare Fish (Sciæna Aquila) found in the Shetland Seas†. By P. Neill, Esq. F. R. S. E., F. L. S., & Sec. W. S., (Communicated by the Author.)

So long ago as the autumn of the year 1820, I received from my friend Mr Robert Strong of Leith, a specimen of a large and very uncommon fish, belonging to the Spinous class, and of the order Thoracici, which had been sent to him from Shetland, along with a cargo of the dried fish of that country. The specimen had been *split* and *cured* much in the way practised by the Shetland fishers on the cod, ling and tusk, which they send to market. The head, however, remained attached to the body, and was pretty entire. All the fins likewise remained, but were

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* I must except, however, the learned Dr F. Nees von Esenbeck, whose views respecting the structure of the fruit of *Punica* appear to coincide entirely with mine.—Vide *Nova Acta Acad. Cæs. Nat. Cur.* tom. 11. p. 110, et seq.

† Read before the Wernerian Natural History Society, 27th May 1826.

more or less mutilated. Although the muscular parts had been thoroughly salted, and were in general well preserved, yet the heat of the summer had rendered the fatter portions soft, and somewhat rancid; and a good deal of oil exuded from these parts. The flesh, where free of the oil, tasted not unlike ling; where tainted with the oil, it had the flavour of herring. Many large scales had already dropt, as evinced by the scars left; and in attempting to dry the skin, the greater part of the remainder of the body-scales fell away, those upon the head and opercula only continuing firmly attached. An attempt to make a preparation of the fish not having succeeded, and it having been seen by Professor Jameson, Dr Fleming, and other naturalists, I did not think of troubling the Society with any account of it. As, however, it is an animal not well understood, and has not yet been admitted into the British Fauna, it has been suggested to me that some notice of it should be put upon record.

I shall therefore, first, state the general characters and dimensions, from notes taken in August 1820, when the specimen came into my hands; then give some particulars regarding the capture of the fish, and its appearance when fresh, from information derived from Shetland; and, lastly, I shall briefly advert to the principal ichthyological writers who have described and classified the animal.

1. The total *length* of the fish, in a straight line, from the tip of the snout to the extremity of the tail, was 5 feet 4 inches. The depth of the body, in a straight line taken opposite to the centre of the first dorsal fin (the fin being included, but not in its expanded state), was 1 foot and ½ inch. The depth, in a straight line taken in front of the anal fin, was 9½ inches; and the depth at the lower end of the second dorsal fin was 4¾ inches.

The *head* was large in proportion to the body. The length, in a straight line, from the tip of the snout to the posterior extremity of the operculum or gill-cover, was 1 foot 4 inches nearly; the depth, in a straight line, taken at the centre of the opercula, was 10 inches. The circumference at the centre of the opercula, the sides of the head being laid loosely together, was 2 feet 4 inches.

When the dried sides of the body were laid loosely together, the *circumference*, at the centre of the first dorsal fin, was about

3 feet; but had the animal been entire, this measurement must necessarily have been several inches more. The circumference at the base of the second dorsal fin was about 1 foot. At the lower end of this second dorsal fin, the back was flattened on the upper surface; and the breadth of this flattened part was nearly 2 inches.

The dimensions as to length and circumference now given, will convey some general idea of the tapering of the body.

There was a distinct *lateral line*, situate somewhat nearer the ridge of the back than of the belly. This line commenced two or three inches back from the gill-cover, and extended, nearly in a straight line, to the middle of the tail, where it terminated, in forming a strong central scaly ray in that organ.

The *eye* remained in the socket, but was completely dried up and shrunk. It evidently must have been, proportionally, of large size. The orbit was oval, with the longest diameter pointing upwards: in this direction its length was $1\frac{5}{8}$ inch; its breadth being $1\frac{2}{8}$ inch. There was a crescent-shaped opening in front of the orbit, capable of admitting a small pea; and still in front of this opening was a small round pore, having a slightly elevated ring around its edge, of a yellowish-brown colour.

The *jaws* could not be laid together, owing to the rigidity they had acquired in drying; but they were evidently nearly equal; and each was furnished with a row of small slightly hooked teeth, and an indistinct interior row of still smaller straight teeth.

The *scales* on the upper part of the back and sides were large; some of those which first fell off being about 3 inches in circumference. These large scales were of an irregular trapezoidal form, and so deeply imbricated that only about a third part of each scale was exposed while it remained *in situ;* the covered part was divided into three compartments, having radii or slight grooves diverging in three directions. These large scales had a thin pellucid membranous covering, like an epidermis; and when they had been immersed for a short time in water they became somewhat opalescent. The scales on the opercula, and all about the head, were in general much smaller, varying from an inch to half an inch in circumference, or even less. They likewise were of trapezoidal forms, but often approaching to squares: these small scales were grouped very closely together, and so firmly fixed that it required some force to detach them. All the scales were set on obliquely to the axis of the body of the fish; but this obliquity was particularly remarkable in the large body-scales.

The body, while still covered with the scales, was in general of a lead *colour*, somewhat darker above the lateral line; the head, however, was of a fine silvery hue.

Fins.—The first dorsal fin was situate in a distinct sulcus or groove, within which the animal had evidently possessed the power of retracting this fin at pleasure. The length of this fin was about 10 inches; but as it had dried in its retracted state, it was impossible to count the rays.—The second or longest dorsal fin arose immediately behind the first, and was also placed in a kind of groove; but this groove was shallow, and its margins were less distinct, being compressed and covered with small scales. The length of this fin was 1 foot 10½ inches; and 26 rays could be numbered.—The pectoral fins were each 9 inches in length, with 14 or 15 rays. The ventral fin was 7 inches, with 6 rays; and the anal fin also 7 inches, with 9 rays.—The caudal fin consisted of 16 branched rays, with the central scaly ray, already mentioned as the termination of the lateral line. The breadth of this organ, at the broadest part, and when not stretched, was 9 inches. In form it was nearly rectangular, or only very slightly rounded at the extremity, and on the upper and under edges.

2. Having communicated to Mr Strong some queries relative to the capture of the fish,—the appearance of the scales and fins when it was alive or newly dead,—the contents of the stomach,—the structure of the sound or swimming-bladder, &c.—he obligingly transmitted them to Mr Laurence Sinclair, his correspondent in the islands; and the following particulars I extract from a letter from that gentleman, dated North Roe, 2d April 1821:—" *Answers to Mr Neill's inquiries respecting the Zetland fish.*—The fish was caught off Uyea, on the north-west coast of Northmavine, in November 1819. It was first seen from the land at Uyea, in contention with a seal, or rather endeavouring to escape. Some men went off in a boat, and took it without any difficulty, as it was then so exhausted as scarcely

to be able to swim. No hurt appeared on it, except the mark of a bite over the gip (gape). It recovered a little in the boat, and was brought on shore alive. It made a buzzing sort of noise in the boat. It had a long struggle with the seal, as the men who took it first saw it from a hill at a distance, and a good deal of time elapsed before they reached the shore, put off their boat, and arrived at the spot where it was." Its fins were of a beautiful dark red colour, and inflated in the same manner as the fishermen remark the fins of the ling to be, when they are emigrating. The skin was coloured like mother-of-pearl, with very large scales on it. Its flesh had a whitish painted appearance, and was very soft. There was very little in the stomach, and the contents did not exhibit any strange particular. No person here remembers to have seen any fish of the kind. When it was brought to me, I had it put in salt pickle; in which it remained till summer, and consequently its beautiful appearance was by that time much impaired." No particular attention had been paid to the swimming-bladder; and, of course, no remarkable structure was observed in that organ.

3. The description above given of the dried fish, and the particulars now detailed regarding its appearance when fresh, leave not a doubt that our fish is the species of *Sciæna* called by the French *Maigre*, or *Aigle-de-mer*, and excellently described by Baron Cuvier in the first volume of the new series of the "Mémoires du Museum d'Histoire Naturelle," 1815. So far as the descriptions are parallel, or can be compared, they completely agree *.

In the dried fish, indeed, the fins were destitute of colour, except that a tinge of red was perceptible at the base of the rays of the first dorsal, when moistened and raised out of the sulcus. This loss of colour was not to be wondered at, considering that the bright colours of fishes are generally fugacious, and that this individual had been first pickled and then dried. Cuvier men-

* An accurate drawing was made by Mr P. Syme, painter to the Wernerian Society; but as figures of the fish have long ago been published, and a correct outline has been given by Baron Cuvier in the work above mentioned, it seems unnecessary to engrave it.

tions that the first dorsal, the pectorals, and the ventral are red; the others reddish-brown: And Mr Sinclair notices, that, in the fresh fish, the "fins were of a beautiful dark red colour." It is also remarkable that Mr Sinclair reports, that the fish "made a buzzing sort of noise in the boat;" and that Cuvier mentions the "mugissement" of the maigre as being louder than that of the gurnard, and adds, that some of the French fishermen (like the Shetlanders) described it as a "bourdonnement sourd."

Much confusion has prevailed among ichthyological writers regarding this species of Sciæna. Baron Cuvier remarks, that it was well known to the older naturalists, and was described and figured by several of them. Belon, Rondelet, and Salvien, all take notice of it. Willughby, so clear and accurate whenever he describes from actual observation, had not met with any specimen; and both he and Ray, therefore, speak of the Sciæna in a confused way. The work of Willughby, it is farther remarked by Cuvier, served as the foundation for that of Artedi; who, in his turn, was copied by Linnæus. In his Systema, Linnæus confounded, under the title of *Sciæna umbra*, *two* species;—the *corb* of Rondelet, or Sciæna nigra of Bloch,—and the *maigre* or *aigle-de-mer* of the French, which is our fish. His Sciæna umbra has black fins instead of red, (being those of the corb or Sciæna nigra); while the rest of his description is applicable to our fish. In this way a good species came to be discarded, for a long time, from the systems of ichthyology. The maigre, it seems, was formerly a well known and much esteemed fish in the French market, but had disappeared for a long course of years. In the year 1813, however, the fishermen of Dieppe took several specimens of the maigre, and gave it, from tradition, the name of *aigle*. The late M. Noel de la Moriniere (distinguished for his accurate researches regarding the French fisheries) transmitted a description to the Count de La Cepede, who, in the Supplement to his great work on Fishes, noticed the species under the title of *Cheilodiptere aigle*;—not a fortunate one, as the mouth does not in reality exhibit the essential character of his genus Cheilodipterus.

From Dr Cloquet's notice in the "Dictionnaire des Sciences naturelles," art. *Cheilodiptere*, it would appear, that Baron Cuvier at first adopted the name of Sciæna *Aquila* for this species. In his paper in the "Memoires du Museum," he adopts the trivial name *Umbra:* but the former seems decidedly preferable; for the latter would certainly tend to perpetuate the confusion introduced by the mistake of Linnæus.

It may be added, that M. Risso, in his Ichthyology, gives a figure and description of our fish, as a new species of Perca (a genus to which it is nearly allied), calling it *P. Vanloo*, after a painter at Nice.

On the Transparency of Space. By Dr Olbers of Bremen. *

Greatness and smallness in space are relative ideas: we can imagine beings to whom a grain of sand would be as large as the whole terrestrial globe is to us, just as we can represent to ourselves an order of things, in which bodies, surpassing in magnitude the planets and the sun, would be what the grain of sand is to us. From this very circumstance, it is natural to man to judge of greatness or smallness by means of a scale, the immediate or mediate basis of which is found in the dimensions of his own body, or of the bodies which surround him, and which he compares with his own. It is only by the aid of such a procedure, that man can estimate magnitudes, and it is thus easily understood why he must consider with astonishment the immense proportions of those regions of the universe which gradually unveil themselves to his eye, armed with the instruments of art. The distance of the sun from the earth is so great, that, to render it capable of being conceived, it has been attempted to calculate the time that a cannon ball would take in traversing this vast space. But every fixed star is a sun, and the nearest of these stars is at so great a distance from us, that the distance of our globe from the sun dwindles almost into nothing beside it. An innumerable multitude of similar stars, of very different sizes, shew themselves to our unarmed view, from the brilliant Sirius, to the stars of sixth or seventh magnitude; the presence of which is scarcely detected by the most penetrating eye in the clearest night. Without doubt, a great number of these small stars appear to us inferior to the others in size, because in fact they are so; but the greater part look so small, only on account of their

* Bibliotheque Universelle, February 1826.

great distance; and thus we perceive, with the naked eye, stars which are probably twelve or fifteen times more remote than those of the first magnitude. The more perfect our instruments are, the more stars do we count in the heavens, and the more do we discover of small ones, so that, although it may be difficult to imagine, our reason must conceive distances and spaces so vast, that Herschel, armed with his gigantic telescopes, might place in them bodies 1500 or several thousands of times more distant from us than Sirius or Arcturus.

But has the keen search of Herschel penetrated to the limits of the universe? or, Has he only sensibly approached them? Who could think it? Is not space infinite? Can boundaries be assigned to it? Can it be supposed that creating Omnipotence has left void those interminable regions? Let us hear what the celebrated Kant says on this subject; "Where will creation cease?" says he; "We immediately see that, to remain in relation with the power of the infinite Being, it ought to have no limit. We do not approach nearer the infinity of the creative power of God, when we extend the space in which it is manifested into a sphere engendered by the radius of the Milky Way, than when we confine it to a globe an inch in diameter. Whatever is finite, whatever has limits, and a determinate relation to an unity, is equally distant from infinity. It would, therefore, be equally absurd to restrict the divinity to an infinitely small part of his creative energy, as to suppose that this measureless power could remain eternally in a state of inaction. Is it not more rational, or, to speak more correctly, is it not necessary, to look upon creation as a representation of that power which cannot be estimated by any scale? According to this view, the field of the manifestation of the divine perfections is as infinite as these perfections themselves. Eternity does not suffice to render testimony of the supreme being, if it is not connected with the infinity of space."

So reasoned Kant. It is therefore probable, that not only the portion of space which our eye has penetrated with the aid of instruments, or may yet penetrate, but infinite space itself, is sprinkled over with suns, each accompanied with its train of planets and comets. I say, that this is very probable, for our limited reason is unable to procure for us any certainty on the subject. Other regions of space may contain other creations than suns, planets, comets and light; creations of which we can have no idea. Halley has laboured to produce a proof of the innumerable multitude of suns. "If their number were not infinite," says he, "there would be found in the space which they occupy, a point which would be the centre of gravity of the general system, and towards which all the bodies of the universe would necessarily be precipitated, with a continually increasing motion. It is only because the universe is infinite, that every thing remains in equilibrium." Halley seems to have only had gravitation in view here, and he says nothing of the power of projection. However, the very motion which appears to be proper to these stars, would tend to demonstrate that they are animated with a power of projection. This itself would suffice to shew the insufficiency of the reasoning employed by Halley, against whom there are besides many other charges.

However, it remains not the less probable, that the beautiful order which we observe extending as far as our faculty of sight can penetrate, reigns equally through all space; and we have only to search if there exist other reasons in nature to induce us to abandon this opinion. Here a very important objection presents itself. If there really be suns in the whole of space, and to infinity, and if they are placed at equal distances from each other, or grouped into systems like that of the Milky Way, their number must be infinite, and the whole vault of heaven should appear as bright as the sun; for every line which may be supposed to emanate from our eye towards the sky, would necessarily meet a fixed star, and thus every point of the sky would bring to us a ray of sideral, or which is the same thing, of solar light.

There is no need of saying that observation contradicts such a deduction. Halley denies this consequence of the infinite number of fixed stars, but for reasons which are altogether erroneous. He evidently confounds the apparent magnitudes with the real magnitudes; and it is only thus that he can advance that the number of the fixed stars increases, it is true, as the square of their distances, but that the intervals which separate them increase as the double of this square. This is an error. Supposing the stars uniformly diffused over the sky; if we represent by unity the radius of the sphere formed by the mean distance of the stars of the first magnitude from our sun by δ, the mean diameter of these stars, and by n, their number at this distance; the portion of the celestial vault which they will occupy to our eyes, will be equal to $\frac{n\pi\delta^2}{4}$. At a distance from the sun equal to 2, the apparent diameter of the stars will be $\frac{\delta}{2}$; but their number will be $4n$: they will thus also occupy a space $\frac{n\pi\delta^2}{4}$ upon the sphere. Thus at distances 1, 2, 3, 4, 5, ... m, the stars will always cover the same portion of the celestial vault; the space $\frac{n\pi\delta^2}{4} + \frac{n\pi\delta^2}{4} = m\frac{n\pi\delta^2}{4}$ will become infinitely great, when m will become so itself, since $\frac{\delta^2}{4}$, however small this quantity may be, remains always an infinite magnitude. Consequently, not only will the whole celestial vault be covered with stars, but they will, moreover, be placed one behind another, in infinite series, mutually covering each other. It is evident that the same conclusions will be obtained, on supposing the stars not only uniformly diffused in space, but distributed in systems, separated from each other by great intervals.

Fortunately for us, nature has disposed things otherwise; fortunately each point of the celestial vault does not send to the earth a light like that of the sun. I say nothing of the brightness and heat that would result from such an arrangement; for then, whatever would have been that brightness and that heat, the Omnipotent would have put our globe and its whole organism in a condition to resist them. I would only speak of the state of imperfection in which our astronomical knowledge must then have remained. We would know nothing of the fixed stars; we should scarcely be able to discover our own sun, by means of its spots; the moon and planets would only be distinguished as more or less obscure disks, detached from a shining ground of a solar brightness.

But because the celestial vault has not, in all its points, the lustre of the sun, must we reject the infinity of the stellar system? Must we restrict this system to a confined portion of limitless space? By no means. In the reasoning, by means of which we arrived at the inference of the infinite number of the stars, we have supposed that space was absolutely transparent, or that the light composed of parallel rays was not impaired, as it removed to a distance from the bodies from which it emanated. Now, not only is this absolute transparency of space not demonstrated, but, moreover, it is altogether improbable. What though the planets, bodies possessed of great density, experience no sensible resistance in their courses, there is nothing that can oblige us to consider the space in which they move as perfectly void. What may be presumed on the subject of comets and their tails, would rather tend to make us suppose the existence of something material in the regions which they traverse. The very matter of the tails of comets, which gradually dissipates, and that of the zodiacal light, necessarily have their abode in this space; and, besides, supposing it absolutely void, the rays of light, in crossing, might and must intercept each other. This latter point may not only be demonstrated *a priori*, by the hypotheses of Newton and Huygens, regarding the nature of light, but may also be experimentally confirmed by the comparison of the telescopes of Cassegrain and Gregory, and the relative density before and behind the focus of a spherical mirror *.

Space is not, therefore, absolutely transparent. But the slightest defect in its transparency is sufficient to annihilate that consequence of the infinite number of the fixed stars, so contrary to observation, namely, that the whole heaven should

* *Philosophical Transactions for* 1813 *and* 1814. In the calculation of the relative density of the light before and behind the focus of a concave mirror, Captain Kater appears not to have reflected, that the focus cannot be considered as a physical point, but that it is only the place of the image of the sun, or of the flame of a candle. This consideration ought to introduce some corrections into the calculations, but it does not affect the result that the light undergoes a loss in passing through the focus. It would be desirable that these interesting experiments, which perhaps might be directed in a manner better adapted to the object in view, were repeated with great care.

blaze upon us with solar brightness. If we suppose, for example, that the degree of transparency be such, that of 800 rays which emanate from Sirius, 799 attain the distance at which we are placed from that planet, this would suffice, and more than suffice, to make us see the system of fixed stars such as we actually see it.

Since rays proceed in all directions from every point of the surface of luminous bodies, we may represent to ourselves this light as composed of cylindrical fasciculi, themselves formed of parallel rays. The lustre of the radiating bodies will be proportional to the density of the light in these fasciculi. According to the law of the diminution of the light which traverses homogeneous substances, not entirely transparent, the diminution of the density of this light for each infinitely small degree of its progress, is proportional to this very density. Let y, then, be the density of light at the distance x from the radiating body; for every space d x which it traverses in its passage from the body, it undergoes a diminution d y, and we have d $y = -a\, y$ d x, or integrating, $\log y = \text{const} - a\, x$. The constant quantity will be determined by remarking, that $y = \text{A}$, for example, when $x = o$; and we shall thus obtain the equation. $\text{Log}\ \frac{y}{\text{A}} = - a\, x$; or $\log \frac{y}{\text{A}}$ is a natural logarithm, a, the measure of the defect of the transparency of space; $\frac{1}{a}$, the subtangent of the logarithmic curve, of which the decreasing ordinates measure the diminution of brightness which the luminous object undergoes when its distance increases. Besides, in the calculation, we may employ for $\log \frac{y}{\text{A}}$ the artificial logarithm, keeping in mind, that then a, multiplied by 0.43429448, is the measure of the opacity.

Let us now find what will be the value of a, on the supposition (entirely arbitrary) that the light of a star, placed at the distance of Sirius, becomes weakened in the proportion of $\frac{799}{800}$ in coming to us. Let r be the distance of Sirius,

$$\text{Log } 799 = 2.9025467793$$
$$\text{Log } 800 = 2.9030899870$$
$$a = 0.0005432077$$

Therefore $\log a = 6.7349604 - 10$.

It is easy, again, to calculate the diminution of brightness of stars for more considerable distances.

Let us now suppose the lustre A of a star, such as our sun, but placed at the distance of Sirius, which we took a little ago for unity, itself equal to 1; the lustre of this star will be,

$\frac{9}{10}$	at a distance equal to 84.23 times that of Sirius.
$\frac{8}{10}$	178.40
$\frac{7}{10}$	285.16
$\frac{6}{10}$	408.41
$\frac{5}{10}$	554.13

We see, therefore, that, at the extreme distances at which our armed eye can still distinguish isolated stars, the lustre is diminished by one-half. The absolute brightness of stars may establish between them differences equally remarkable and still greater.

The lustre must not be confounded with the intensity of the light.

This intensity is the lustre multiplied by the apparent magnitude: it is directly proportional to the lustre, and, inversely, the square of the distance. Thus, a star 554 times more distant from us than Sirius, has still the half of the lustre, but only $\frac{1}{610000}$th of the luminous intensity of that star.

The lustre diminishes considerably at greater distances. At a distance equal to 1842.9 times that of Sirius, it is only $\frac{1}{10}$th of the lustre of that star; at the distance of 3681.8 it is not more than $\frac{1}{100}$; and at that of 5522.7, it is $\frac{1}{1000}$, and so in proportion.

At what distance would the light of a fixed star still have the lustre of the full moon, supposing this lustre to be $\frac{1}{300000}$ of that of the sun? As we have, then *,

* Here $\frac{y}{A} = \frac{1}{300000}$ is substituted in the equation, $\log \frac{y}{A} = -a\,x$, or $\log x = \log\left(\log \frac{y}{A}\right) - \log a$.

$$\text{Log}\,\frac{1}{300000} = -\,5.4771213$$

The logarithm of which is $= 0.7385524$

$$\text{Log} \quad a = 6.7349604 - 10$$

$$\text{Log} \quad x = 4.0035920$$
$$x = 10083.05$$

It is therefore at a distance equal to 10000 times that of Sirius. Thus, a certain quantity of stars situated at this distance would require to be accumulated close to one another, before, in a clear and moonless night, our most perfect telescopes could render this group visible as a pale nebulosity.

Our atmosphere, illuminated by the full moon, has not even $\frac{1}{90000}$ of its lustre, and this light suffices to render invisible to the naked eye all the stars which are under the fourth or fifth magnitudes. The following calculation shews at what distance the stars have still a lustre equal to that of the ground of the sky, in a night illuminated by the full moon.

We have then,

$$\text{Log}\,(300000 \times 90000) = 10.4313638$$

The log of which is $= 1.0183410$

$$\text{Log}\; a = 6.7349604{-}10$$

$$\text{Log}\; x = 4.2833806$$

Therefore $x = 19203.5$

Let us still calculate the lustre of a star, which is placed at 30,000 times the distance of Sirius; then

$$\text{Log}\; x = 4{,}4771213$$
$$\text{Log}\; a = 6{,}7349604{-}10$$

$$\text{Log}\; a\,x = 1.2120817$$

The number of which is 16.29602

Therefore $\log \frac{y}{A} = -\,16.29602$

The number of which is 1977100000 millions, and expresses how many times the absolute lustre of the star is weakened at this distance. To form a conception of this relation the more easily, it may be remarked, that the lustre then preserved by the star is 6500 millions of times weaker than that of the full moon, or 732250 times weaker than that of the celestial vault in a clear night, lightened by the full moon. Now, this last shade may be considered as perfectly dark.

We may therefore admit, that, with the degree of non-transparency, which we have supposed to exist in space, the stars, which are 30000 times farther from us than Sirius, do not contribute to light the celestial vault. The ground of the sky would therefore appear to us black, had not our own atmosphere, lightened only by the stars, itself a feeble lustre, which suffices to colour this ground of a bluish tint.

A circumstance which proves that the ground of the sky would be entirely black, did we not see it through our atmosphere, which is lighted by the glimmer of the stars, exists in what we observe regarding the planet Venus. The portion of its disk, which is not lighted by the sun, is sometimes distinguished from the sky by a peculiar or phosphorescent light, but never as being darker than the ground which it covers. The same is also remarked in the planet Mars, when it is not light all over. Those who have had occasion to observe the starry sky on high mountains, have seen that it was dark, and even absolutely black, although the greatest part of our atmosphere was still interposed.

I do not know if I am deceived, but it has often seemed to me, that, among the small stars, of the same luminous intensity (the intensity is the lustre multiplied by the apparent magnitude), some had a mobile and scintillating light, others a tranquil light. If this be not an illusion, I would be induced to think that the former are smaller and nearer, the others larger and more distant, in such a manner that the light of these latter, weakened by the defect of transparency in space, has no longer the density necessary for sparkling.

The supposition that the light, independently of its divergence, is weakened $\frac{1}{800}$ in coming from Sirius to us, is entirely arbitrary. My object was to demonstrate that this loss, and even a still less at these enormous distances, was sufficient to render the appearance of the heavens such as we observe it, although the stars should yet exist in infinite number in space. It is not without reflection that I have assigned this degree of opacity to space, and I do not imagine it to be very wide of the truth.

It is therefore with equal wisdom and goodness, that creative Omnipotence has given to space a high degree of translucidity, without, however, rendering this translucidity perfect, and that it has thus limited the range of our vision to a determinate part of this space. In consequence of this arrangement, we are placed in a condition to acquire some knowledge of the structure and arrangement of the universe, of which we should scarcely know any thing, had the most distant suns sent us a light which underwent no diminution.—*Bibliotheque Universelle, Feb.* 1826.

Observations on the Spontaneous Motions of the Ova of the Campanularia dichotoma, Gorgonia verrucosa, Caryophyllea calycularis, Spongia panicea, Sp. papillaris, cristata, tomentosa, and Plumularia falcata. By Robert E. Grant, M. D. F. R. S. E., F. L. S., M. W. S., &c *. (Communicated by the Author.)

That acute and indefatigable zoologist Mr Ellis, first observed in 1755 the spontaneous motions exhibited by the *ova* of the *Campanularia dichotoma* Lam., (*Sertularia dichotoma* Lin.), for some time after their separation from the parent. Although this interesting fact is one of the most important and best established which has yet been discovered, connected with the generation of zoophytes, and one of very general occurrence in these animals, it has attracted so little attention for half a century past, that we find not the slightest allusion to it in the writings of Lamarck, Lamouroux, Cuvier, or almost any other modern zoologist. When in company with Dr Schlosser and Mr Ehret, on the coast of Sussex, Mr Ellis examined the *Campanularia dichotoma* alive, and found several vesicles on it, some of which contained ova attached to an umbilical cord. This cord was distinctly seen through the transparent coats of the vesicle, to take its origin from the fleshy central part of the stem. "In other vesicles (he observes) we discovered these ova beginning to exhi-

* Read before the Wernerian Natural History Society, 27th May 1826.

bit signs of life; they appeared to us to be evidently young living polypi, which extended in a circular order, the tentacula proceeding from their head, as in other polypi. While examining them, some of the ova, after detaching themselves, fell to the bottom of the glass of water in which we had placed them; they then began to move and stretch themselves out like fresh water polypi;" (Ellis, Hist. Nat. des Cor., p. 116). This statement of Mr Ellis, though not altogether correct in its detail, is satisfactory as to the motions of the ova which he saw escape from the vesicles. As this species of *Campanularia* occurs abundantly on Leith rocks, and, at this time (May) presents the ova in a state of maturity, I have examined their singular motions under the microscope, in presence of some friends conversant with the structure of these animals. The moving ova which Mr Ellis observed, were not, as he supposed, the same with the polypi-like bodies he has represented (Pl. xxxviii. Fig. 3. B, B, B,) hanging from the mouths of the vesicles, but were ova which had fallen from these polypi-like bodies. The polypi-like bodies, viewed under the microscope, are found to be thin, transparent, motionless capsules, containing each three distinct ova, and presenting at their free extremities several stiff, straight, diverging pointed processes, which Mr Ellis mistook for the tentacula of a young polypus; and was thus led to believe, that the polypus is the first formed part of a young zoophyte, which I have found by experiment to be contrary to fact. This mode of generation in *Sertulariæ*, by the detachment of numerous capsules, containing ova enveloped in a viscid matter, was known to Cavolini, who, forty years ago, detected the fallacy of Mr Ellis's statement regarding the polypi-like bodies, and suspected that the true ova contained in these exterior capsules, would be found to exhibit the same kind of motions which he had observed in the ova of other zoophytes; but he did not succeed in obtaining the ova after their expulsion from the capsules, so as to verify or refute his conjecture. As I had already observed through the transparent vesicles of the *Plumularia falcata* the motions, and even the ciliæ, of the ova contained in them, I placed one of the polypi-like capsules hanging by umbilical cords, from the vesicles of the *Camp. dichotoma* entire under the microscope, and I could distinctly perceive the vortex-like currents along the surface of the contained ova, and that particular vibrating zone immediately around them, which we always observe along a ciliated surface, when the ciliæ are in too rapid motion to be distinctly seen. On allowing the three ova to escape into the water of the watch-glass, by tearing open the capsule with two needles, they immediately began to glide to and fro along the bottom, and I could now perceive the ciliæ vibrating on their surface as they moved forward. The ova of this minute zoophyte are very numerous, amounting to twenty or thirty in each vesicle, which is probably the reason of the polypi-like capsules, to allow so many ova sufficient space to develope themselves on the outside of the vesicles. I have never observed more than two ova in a vesicle of the *Plumularia falcata*, and they have space to arrive at full maturity within that vesicle. The ova of the *Camp. dichotoma* are very minute, regularly formed oval bodies of a semiopaque milk-white colour ; the ciliæ distributed over their surface, propel them only in one direction ; their motions and general appearance, like those of other ova, are so peculiar, that they are easily distinguished from animalcules, by any person who has once examined the mature vesicles of a zoophyte. The *ciliæ* on the surface of these and other ova are minute filaments, which may be compared to the small hairs covering the human body ; they do not add to the internal organization of the ovum, nor render it as complex as that of the adult animal which possesses highly organized polypi ; they are organs which exist in the adult zoophyte, and in the simplest known forms of animal matter, the motions of the simplest gelatinous animalcules being performed by them ; and they are necessary to prevent the ova from falling by their own gravity like the seeds of plants, to be buried in the ever-moving sands.

Cavolini prosecuted for two successive years, 1784–5, his researches into the structure and economy of the *Gorgonia verrucosa* Lam., particularly with reference to the spontaneous motions and the development of its ova ; and his observations on this animal form a model of patient and scientific inquiry, which has no equal in the history of zoophytology. He examined the position of the ovaria at the base of each polypus, watched the manner in which the ova were discharged through eight small oviducts, opening between the bases of the eight tentacula, and has given enlarged representations of the forms which the ova assumed while swimming to and fro, and of their appearance when laid open. He observed, that the ova were all somewhat egg-shaped; that they passed through the oviduct with their tapering end pointed forward; and that, as soon as discharged, they turned up their rounded thick extremity, and continued to swim about with that extremity always forward (Cavolini, Abhand. uber Pflanzen-thiere, p. 48). On cutting off a small portion of the outer covering from the base of a polypus, he generally observed five ova of a flesh-red colour, like those he saw passing out through the oviducts. In the month of June, he observed the polypi of the *Gorgonia* in the act of discharging their ova; a portion of this zoophyte, only six inches high, discharged ninety ova in the space of an hour. The ova first mounted in a spiral direction to the surface of the water, then swam in a horizontal direction to the margin, without changing their forms. Under the microscope, he repeatedly observed the ovum change its lengthened form to that of a sphere, and when the microscope was perfectly steady, he was surprised to see the ovum bound off with rapidity from the place where it lay, and keep itself in a constant quick motion as long as he watched it (Abh. p. 48). "On looking again at the vessel in which the *Gorgonia* lay (he says) I found that all the ova had arranged themselves round the margin, with their rounded thick ends applied to the sides of the vessel, like a swarm of wood-lice on a branch; and when I pushed them off with a needle, they changed their forms in an extraordinary manner, while they continued to swim about in all directions."

In the *Caryophyllia calycularis* Lam. (*Madrepora calycularis* Lin.), Cavolini observed that the ova were, like those of the Gorgonia, in a state of maturity in spring, and were discharged, in the same manner, through small distinct openings between each of the tentacula. They were seen through the transparent sides of the polypi to occupy a similar situation at their base; they had the same ovoidal shape, but were of a darker red colour than those of the gorgonia, and somewhat larger. They exhibited the same singular phenomena; they glided about in the water; swam to the surface; changed their forms, in a variety of ways, on the slightest irritation; and, when torn under the microscope, they exhibited the same granular structure (Cav. Abhand. p. 50.) The detailed account which Cavolini has given of the spontaneous motions of the ova in these two zoophytes, agrees so remarkably with what I have observed in other genera, that I have not the least doubt that they are produced in the same manner, by the rapid vibration of minute *ciliæ* distributed over their surface ; and that the ciliæ have escaped his observation, and that of Mr Ellis (in the *Campanularia*) only from their not employing the high magnifying powers necessary to render them distinct.

In a memoir on the Structure and Functions of the Sponge, read to the Wernerian Society, in March 1825, I described the singular motions which I had observed in the ova of the *Spongia panicea* Lam., *Sp. papillaris*, *cristata*, *tomentosa*, between the time of their expulsion from the fecal orifices, and that of their permanently fixing themselves to develope on the surface of watch-glasses, and represented the appearance of the ciliæ which I had discovered by the aid of the microscope, vibrating on the surface of the ova as they moved about in the water, and even for a short time after they had fixed themselves (see Edin. Phil. Journ. vol. xiii. p. 382.) The details connected with the formation and detachment of these ova, their structure at the time of expulsion, and the changes they undergo during the fixing and developing of their bodies, are reserved for the continuation of my memoir on that animal ; but, with reference to their spontaneous motions, I may here observe, that they are all somewhat egg-shaped, the ciliæ cover every part of their surface, excepting their posterior tapering extremity, where I have never distinctly perceived them. In swimming, they always carry their broadest extremity forward. They have a granular structure, and a rough surface, like the ova of the gorgonia ; but spicula are distinctly discernible in those of the Spongia panicea, at the time of their expulsion. They do not change their forms, while swimming, like the ova of many other zoophytes, but glide along with a regular and smooth motion. After remaining some time in the water, they generally come to the surface, and collect round the margin. When one of them is placed in a drop of water, under the microscope, we often see the motions of the ciliæ gradually cease, and become again suddenly revived, without the ovum undergoing the least change of form; on cutting an ovum of the Sp. papillaris transversely through the middle, its anterior half continued the motions of its ciliæ for 24 hours. The form of the ovum, and its general appearance, vary with the species, and are as easily distinguishable as those of the adult. Having now examined these ova during two successive years, and having varied my experiments in every possible manner, I consider the spontaneous motions of the ova in the above species as sufficiently established by direct observation, and by the analogy of other zoophytes.

The observations which I have lately made on the ova of the *Plumularia falcata* Lam., have not been less satisfactory than those so often repeated on the ova of the sponge. I have taken the mature ova from the vesicles of the plumularia, and examined their spontaneous motions, under the microscope, in the presence of experienced naturalists; and I now present to the Wernerian Society eight of these ova growing and branching on the side of a glass vessel, after their having remained three weeks in that situation. This species is very common in the deeper parts of the Frith of Forth; its vesicles are very numerous, and its ova are in full maturity at the beginning of May. The ova are large, of a light brown colour, semi-opaque, nearly spherical, composed of minute transparent granules, ciliated on the surface, and distinctly irritable. There are only two ova in each vesicle; so that they do not require any external capsules, like those of the campanularia, to allow them sufficient space to come to maturity. On placing an entire vesicle, with its two ova, under the microscope, we perceive, through the transparent sides, the ciliæ vibrating on the surface of the contained ova, and the currents produced in the fluid within by their motion. When we open the vesicle with two needles, in a drop of sea-water, the ova glide to and fro through the water, at first slowly, but afterwards more quickly, and their ciliæ propel them with the same part always forward. They are highly irritable, and frequently contract their bodies so as to exhibit those singular changes of form spoken of by Cavolini. These contractions are particularly observed when they come in contact with a hair, a filament of conferva, a grain of sand, or any minute object; and they are likewise frequent and remarkable at the time when the ovum is busied in attaching its body permanently to the surface of the glass. After they have fixed, they become flat and circular, and the more opàque parts of the ova assume a radiated appearance; so that they now appear, even to the naked eye, like so many minute grey coloured stars, having the interstices between the rays filled with a colourless transparent matter, which seems to harden into horn. The grey matter swells in the centre, where the rays meet, and rises perpendicularly upwards, surrounded by the transparent horny matter, so as to form the trunk of the future zoophyte. The rays first formed are obviously the fleshy central substance of the roots, and the portion of that substance which grows perpendicularly upwards, forms the fleshy central part of the stem. As early as I could observe the stem, it was open at the top; and, when it bifurcated to form two branches, both were open at their extremities, but the fleshy central matter had nowhere developed itself as yet into the form of a polypus. Polypi, therefore, are not the first formed parts of this zoophyte, but are organs which appear long after the formation of the root and stem, as the leaves and flowers of a plant.

From these observations it appears that the so-named *ova* of many zoophytes, when newly detached from the parent, have the power of buoying themselves up in the water, by the rapid motions of ciliæ placed on their surface, till they are carried by the waves, or by their own spontaneous efforts, to a place favourable for their growth, where they fix their body in the particular position best suited for the future development of its parts. How far this law is general with zoophytes, must be determined by future observation.

On the Noises that sometimes accompany the Aurora Borealis.

Having, many years ago, both in this country and in the Shetland Islands, heard very distinctly noises proceeding from the polar lights, we have always given full credit to the statements of those observers who have published accounts of this fact. It is true, that late observers, particularly our friends and former pupils

Scoresby * and Richardson †, never heard such noises, although they have seen many polar lights. But their observations were made during a minimum period of this meteoric phenomenon, while those striking instances of which accounts are published, occurred during a period when the energy of the polar lights was great, or in a maximum state. Muschenbroek says, that the Greenland fishers, in his time, assured him that they had frequently heard noises proceeding from the aurora borealis. Mr Nairne is confident that he has heard a hissing and whizzing noise when the polar lights were very bright; and Mr Cavallo affirms that he more than once heard a crackling noise from polar lights. Giesecke, who resided so long in West or Old Greenland, says, "The Polar lights sometimes appear very low, and then they are much agitated, and a crashing and crackling sound is heard, like that of an electric spark, or the falling of hail." Professor Parrot of Dorpat, describes a magnificent polar light he witnessed, on 22d October 1804, from which a crackling and rustling noise proceeded. We learn from the inhabitants, says Captain Brooke, in his interesting travels through Norway, with respect to the polar or northern lights, that they had frequently heard the noise that sometimes attends them, which they describe like that of a rushing wind. At Hammerfest, they said they were violent, and descended so low that it would appear almost possible to touch them. In a letter from Mr Ramm, of Tonset in Norway, addressed to Professor Hansteen, and published in the *Magazin fur Naturwidenskaberne*, Christiana 1825, st. 1., we are told that he several times heard a quick whispering noise, simultaneously with the motion of the beams of the polar lights. In the same journal Professor Hansteen remarks, "The polar regions being, in reality, the native country of the polar light, we ought to be peculiarly interested in obtaining any additional information on the natural history of this remarkable phenomenon; and we have so many certain accounts of the noise attending it, that the negative experience of southern nations cannot be brought in opposition to

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* Arctic Regions and Journal of a Voyage to the Northern Whale Fishery.

† "Remarks on the Aurora Borealis" in Franklin and Richardson's Journey to the Shores of the Polar Sea.

our positive knowledge. Unfortunately, we live, since the beginning of this century, in one of the great pauses of this phenomenon; so that the present generation knows but little of it from personal observation. It would, therefore, be very agreeable to receive, from older people, observations of this kind, made in their youth, when the aurora borealis shewed itself in its full splendour. It can be proved mathematically, that the rays of the northern lights ascend from the surface of the earth, in a direction inclining towards the south (an inclination which, with us, forms an angle of about 73°.) If, then, this light occupies the whole northern sky, rising more than 17° above the zenith, the rays must proceed from under the feet of the observer, although they do not receive their reflecting power till they have reached a considerable elevation, perhaps beyond our atmosphere. It is therefore conceivable, why we should frequently hear a noise attending the northern lights, when the *inhabitants of southern countries*, who see these phenomena at a distance of many hundred miles, hear no report whatever. Wargentin, in the fifteenth volume of the *Transactions of the Swedish Academy*, says, that Dr Gisler and Mr Hellant, who had resided for some time in the north of Sweden, made, at the request of the Academy, a report of their observations on the *aurora borealis*."

The following extract is given by Hansteen from Dr Gisler's account:—" The most remarkable circumstance attending the northern lights is, that, although they seem to be very high in the air, perhaps higher than our common clouds, there are yet convincing proofs that they are connected with the atmosphere, and *often descend so low in it, that, at times, they seem to touch the earth itself; and, on the highest mountains, they produce an effect like a wind round the face of the traveller*." He also says, that he himself, as well as other credible persons, " had often heard the rushing of them, just as if a strong wind had been blowing (although there was a perfect calm all the time), or like the whizzing heard in the decomposition of certain bodies during a chemical process." It also seemed to him, that he noticed ' *a smell of smoke or burnt salt*."—" I must yet add," says Gisler, " that people who had travelled in Norway, informed me they have sometimes been overtaken, on the top of mountains, by a thin fog, very similar to northern lights, and which set the air in motion: they called it Sildebleket (Häring's Lightning), and said that it was attended by a piercing cold, and impeded respiration." Dr Gisler also asserts that he often heard '*of a whitish-grey cold fog, of a greenish tinge, which, though it did not prevent the mountains from being seen, yet somewhat obscured the sky*, rising from the earth, and changing itself at last into an aurora; at least, such a fog was frequently the forerunner of this phenomenon." To these observations, Professor Hansteen adds, that Captain Abrahamson, in the *Transactions of the Scandinavian Literary Society*, has given an account *of several observations* of noises that were heard along with the northern lights. The Professor concludes with the observation, that he himself knows several persons that have heard the same sounds, and expresses his surprise that a fact so well established should be called in question; and relates, with some sharpness, a conversation he had on this subject with an Englishman, who remarked that the Norwegian tales of noises from polar lights were akin to the ghost stories of this country;—every one, he said, had heard of ghosts, but no person had ever seen one.

On the presence of Iodine in the Mineral Spring of Bonnington, near Leith. By Edward Turner, M. D. F. R. S. E. &c. In a Letter to Professor Jameson.

Dear Sir,

I have the pleasure to inform you that the Bonnington mineral water which you lately sent me for examination, contains Iodine in addition to the other substances hitherto discovered in it. The iodine was first detected by my pupil Mr W. Copland, to whom I gave the water for analysis, with directions to examine it for the presence of that substance; and I have since found it myself in several portions of the same water purposely brought at different times from the spring, so that it may be regarded as a regular constituent. The iodine may be readily detected by the following method:—Evaporate a pint of the water to dryness; take up the soluble parts in a drachm or two of a diluted solution of starch, quite cold, and add a few drops of concentrated sulphuric acid; the characteristic blue colour will then make its appearance. I prefer the use of sulphuric to nitric acid or chlorine for decomposing the hydriodic acid; for it effects that object with certainty, and does not decompose the iodide of starch, or prevent its formation, as the two last are apt to do.

The greater part of the iron in the Bonnington water is under the form of the carbonate of iron, which is held in solution by free carbonic acid. It also contains the muriatic and sulphuric acids, in combination with lime, magnesia, and soda, the last of which is the predominating base. Potash is also present, and forms the hydriodate of potash with the hydriodic acid. Its quantity, however, is more than sufficient for saturating that acid; for the residual salts still contain it, after the hydriodate of potash has been removed by alcohol.

I have examined portions of water from the springs of Harrowgate, Moffat, and Pitcaithly, but could discover in them no trace of iodine. I remain, dear Sir, yours most faithfully,

EDWARD TURNER.

Addition by the EDITOR.

Since the discovery of Iodine in some marine plants by Curtois, it has been found by Krüger and Fuchs in small quantity in the salt-springs of Sulzer and Halle; more lately in minute quantity in the salt-springs of Rosenheim by Vogel of Munich, and by Professor Liebig in the salt-springs of Darmstadt. Angelini and Cantu have detected this curious substance in some mineral waters in Italy; and Vogel, as far as we know, was the first who ascertained its presence in the mineral waters of Germany. Being informed that the mineral waters of Heilbrunn, in the circle of Isar, in Bavaria, were used by the inhabitants as a specific against diseases in the glandular system, especially the goitre, Vogel was led to suspect the presence of iodine, which he soon detected by means of the usual re-agents. The iodine was in the state of hydriodate of soda.

We take this opportunity of recommending the analysis of the mineral waters of this country to the attention of naturalists; and we do this in the conviction, that a knowledge of the contents of mineral and other waters is intimately connected, not only with many important changes perpetually taking place in the solid strata of the globe, but also with the chemical composition of mountain rocks, and of the materials of their beds and veins. The gazeous matters associated with natural waters, are also worthy of the attention of the naturalist; the more especially, as they are often connected with those aëriform substances which are perpetually rising through the fissures and strata-seams of rocks. These aëriform emanations from rocks, are announced by the sulphureous, empyreumatic, acid or other odours, perceived over the outgoing and in the body of the fissures; also, by their sometimes extinguishing lights, when placed in or over fissures; in other cases, by the emanating air taking fire.

Intelligence from the Land Arctic Expedition, under Captain Franklin and Dr Richardson.

IN the Edinburgh Philosophical Journal, we gave an account of the early progress of the Land Arctic Expedition, under Captain Franklin and Dr Richardson. The following contains an interesting statement of its progress, up to September last, which is the latest information from the travellers.

" We have travelled incessantly since we left Lake Superior. We overtook our boats, which, with their crews, left England in June 1824, eight months before us, about half way to this place, or four or five days march to the southward of Mathye Portage. We embarked in them at Chepewyn, on the 20th July, and arrived in Mackenzie's River on the 31st. At Fort Normans, Dr Richardson separated from the rest of the party. Captain Franklin and Mr Kendale went down the river to the sea in one boat, whilst Dr Richardson brought the others and their cargoes up Bear Lake River, which falls into the Mackenzie a few miles below Fort Normans. Franklin made a prosperous voyage, and on the 16th of August, exactly six months from the day he sailed from Liverpool, had an extensive view from the summit of Garry's Island, of the open sea, clear of ice, with many black whales, belugas, and seals, playing about. The water at Whale Island is, as Mackenzie states in his chart, fresh, but a few miles from Garry's Island, which is 30 miles to seaward, and out of sight of the other, it changes its colour and taste. The mighty volume of waters which rolls down the Mackenzie, carries shoals of sand and a brackish stream a long way out. Captain Franklin did not join Dr Richardson and his party before the 5th September last, at Port Franklin, in Bear Lake, the navigation up the river being tedious, from the strength of the current. The Sharpeyes or Quarrellers of Mackenzie, who inhabit the lower parts of the river, resemble the Esquimaux a good deal in their manners and language, and that part of the tribe who live nearest the sea, were partially understood by our Esquimaux interpreter. The Esquimaux being at this season inland hunting the rein deer, were not seen, but the Sharpeyes have promised to give them notice of our intended voyage next year. Every thing at present promises success to our future operations. The boats sent out from England answer admirably, and we are well provided with stores for the voyage. During Captain Franklin's absence, Dr Richardson surveyed this lake, which is about 150 miles long, extending from Lat. 65° 10′ Long. 123° 32′, where Fort Franklin is built, to Lat. 67° Long. 119°, within 70 miles of the nearest bend of the Coppermine River, and about 85 miles from its mouth. Garry's Island lies in Lat. 69° 29′ Long. 135° 42′, about 450 miles from the mouth of the Coppermine, and about 600 from Icy Cape, distances which may easily be accomplished, even during the short period that the arctic sea is navigable for boats, if no greater obstacles occur than were visible from the mouth of Mackenzie's River. A canoe is to be deposited at the North Eastern arm of this lake, by which the eastern party will save 200 miles of land journey on their return.—But a very cursory view of the rocks was taken in the voyage down the river, as was to be expected from the rapidity with which the party travelled. The oldest rocks met with were in the portions of the Rocky Mountains which skirt the river, and which are composed of transition limestone. From that there is a very complete series of formations down to the new red sandstone, exposed in various parts. The rocks of the coal formation are particularly interesting, from the strong resemblance the organic remains found in the sandstone slate, and bituminous shale, have to those seen in England. They met with several *lepidodendra*, compressed like the English ones, also impressions of ferns and reeds. They had not, however, found any beds of coal belonging to this formation, but large deposits of a new bituminous wood-coal, mixed with layers of mineral pitch. This is found in various parts of the river, and on Garry's Island, at its mouth, sometimes deposited on the fixed rocks, but never, as far as could be ascertained, under any of them. It is generally associated with a rich earthy loam, and seems to derive its origin from great deposits of timber, compressed under alluvial, or, to speak in a newer language, *diluvial* matters, and impregnated with the bitumen, exuding in immense quantities from the carboniferous limestone, which exists in enormous masses in this country, constituting whole districts and ridges of mountains. The shells and corallines of the limestone are very fine and perfect. The fibrous structure, and, indeed, the shape of the trees, may still be clearly traced in the coal. From the twisted state of the woody layers, I suspect that a great portion of the coal has been formed from roots, or from trees that have grown in a climate equally severe with this; the resemblance being very perfect to the wood of the spruce-fir, which grows in the surrounding country."

Additional Information.

We have read another letter, dated Fort Franklin, from which the following is extracted:

"*Fort Franklin, Great Bear Lake,*
September 6. 1825.

"My Dear Friend,

"Here I am once more housed for the winter.

'Hebrum prospiciens, et nive candidam
Thracem, ac pede barbaro
Lustratam Rhodopen.'

After six months of constant travelling, our winter residence is pleasantly situated on the banks of a lake 150 miles long, deep and abounding in fish, its shores well wooded, considering the high latitude, and frequented by moose deer, musk oxen, and rein deer. We have abundant stores for next year's voyage, but our party is large, and we depend on the fishery and chase for support during the winter, yet hope to fare well. In our excursion of three weeks along the lake, which I made since my arrival, I obtained a boat-load of excellent venison, and our nets have occasionally given us 50 or 60 trout in a-day, weighing each from 20 lb. to 50 lb., besides 200 to 300 of a smaller fish called fresh-water herrings. Notwithstanding all these comforts, the wiser part of us live in some fear; for any sudden amelioration of the climate, produced by the approach of a comet to the earth, or any other of the commotions amongst the heavenly orbs dreaded by astronomers, might cause us to be swept into the lake, as, our fort being built on an iceberg, a thaw might prove fatal to its stability. The ground, although it produces trees of considerable size, is constantly frozen; the mud with which our house is plastered was dug out by the aid of fires last month, and now, at the close of the summer, the excavation under our hall-floor, which we intended to convert into a cellar, has been worked only to the depth of three feet, its walls of clay being frozen as firm, and harder, than a rock. I hope, however, we shall escape such a catastrophe, as Moore, in his almanack, says nothing about it; unless, indeed he means to give us a hint, when he says 'About this time, before or after, certain northern powers will make some stir in the waters.'

"I have had no fly-fishing for want of proper tackle. The gigantic trout of this lake would disdain such a mosquito as we were wont to fish with, and I see no pleasure in bobbing for them with a cod hook and cable. One of the monsters might take a fancy to drag the fisherman to his sublacustrine abodes.

Captain Franklin and Mr Kendall have been to the sea, which they found in Lat. 69° 29′, quite clear of ice, on the 16th of August. Mackenzie was very near it in his voyage down the river, which bears his name, but did not reach the salt water, by about thirty miles. They left letters for Captain Parry and his officers from their friends in England, buried at the foot of a pole, on which they suspended a flag. They returned only yesterday, and the dispatch, by which I send this, sets out to-morrow with intelligence of their proceedings to Government.

" Mr or at all events Mrs H. will rejoice to hear that we have a Highland piper, and a crew of hardy and hearty sons of the mist, who foot it every night after the labours of the day to the sound of their native music. We lack only a little of the mountain dew to invigorate the dance. For my part I think water a more wholesome beverage; but there is a great deal in the name, and prejudices are difficult to be overcome."

In a letter from Captain Franklin to a friend in London, and published in the Courier Newspaper, is the following statement.

" I do most heartily congratulate you on the prospect we had from Garry's Island, of a perfectly open sea, without a particle of ice, as it is another step gained in confirmation of your much contested hypothesis. We saw nothing to stop the ships, but, on the contrary, every thing around us strengthened my hope of their effecting the passage. The Indians, indeed, have a report, that, between the Mackenzie and Copper Mine River, there is a point which stretches far to the north, which is generally surrounded with ice. If this be true, the ships may perhaps be checked in their progress for a time; but I think they will not be altogether stopt, providing they have been enabled to get to the main shore, to the eastward of Regent's Inlet. No Indian, however, with whom I had spoken in my recent visit to the sea, can speak of this point, or of the obstruction, from his own observation; and the report seems, like many others current among them, to have passed from generation to generation, which at the first had but little ground to stand upon."

Franklin has thus, in our opinion, succeeded in realising, to a certain extent, the views of the learned and distinguished Secretary Barrow. We ardently hope and trust, that the honour of effecting the North-west Passage, will not be allowed to pass from us, and that Captain Parry will be again dispatched to finish this grand nautical enterprise. The Congress of the United States are, we are informed, at this moment considering a proposal laid before them for the discovery of the North-west Passage, which, from the known activity of that body, may be agreed too, and thus, in all probability, we shall hear of the American flag traversing the Polar Sea, and doubling Icy Cape. The Americans, by this achievement, would secure to themselves and deservedly, a splendid name in the annals of geographical discovery,—a name that ought to be ours, and which would add another and enduring laurel to the wreath of glory which surrounds the maritime honour of this nation.

Remarks on the Structure of some Calcareous Sponges. By ROBERT E. GRANT, M. D., F. R. S. E., F. L. S., M. W. S., &c. Communicated by the Author.

THE *Spongia compressa* Fabr. Gmel. Lamouroux, (*S. foliacea*, Montagu), affords a good example of a species in which the axis is composed entirely of *calcareous* spicula. This is a small white tubular compressed species, generally about an inch in length; it hangs from the under surface of rocks by a thick short peduncle; it is entirely hollow, and opens by one or more marginal apertures at its pendent extremity; its parietes are of equal thickness throughout, nearly as thin as writing paper, and every where pierced with minute openings, which are visible to the naked eye on the external and internal surface, and its currents are distinctly visible, both those passing in through the pores, and those issuing from the large pendent orifices. It is a hardy species, growing in very exposed situations, and in cold climates. Fabricius observed it on the coast of Greenland, Professor Jameson and Dr Fleming on the shores of the Shetland Islands, Montagu on the coast of Devonshire, and I have found it very abundant in the Frith of Forth. They hang like small white leaves from the surface of rocks, at low-water mark, being always in a collapsed state, and their opposite sides in contact during the retreat of the tide; but, when suspended for a short time in pure sea water, their parietes separate, and they become like small distended bags pouring forth a continued and obvious current. The pores pass through their parietes in a direction a little oblique, from below upwards, and the margins of the fecal orifices are surrounded with the projecting extremities of minute shining spicula. To the naked eye their external surface appears even and villous, and on tearing them open, their internal surface appears more compact, and the terminations of the pores are wider. On tearing a portion of this sponge into minute fragments, and examining them under the microscope, we find, in place of the *horny* tubular fibres of the *S. communis*, which Mr Ellis has compared to fine filaments of catgut, the whole axis composed of slender, shining, transparent spicula of regular and constant forms. Two forms of spicula are observed in this species, the one is tri-radiate, consisting of three rays of the same form and size, united at one point, and forming equal angles by their union; the rays are thickest at their point of divergence, and taper slightly to near their free extremities, where they are brought suddenly to a point. The rays of the tri-radiate spiculum are hollow within, shut at their free extremities, and have no superficial openings; but their internal cavities communicate freely at their point of junction, and form there a small central reservoir. These spicula vary much in size in the same individual, but their general length is about the sixth of a line, from the extremity of one ray to the extremity of another; and I have not observed any difference in their magnitude taken from specimens, one of which was ten times the size of the other. The other spiculum of the *compressa* is the clavate, which is broadest and rounded at one end, from which it tapers regularly to a point at the other; it is quite straight for two-thirds of its length from the pointed end, but the remaining thick part is bent so as to describe the fourth part of a circle. This spiculum is distinctly tubular, and shut at both extremities. The very small straight spicula, which we always observe along with these two, appear to be only broken rays of minute tri-radiate spicula. These spicula consist of carbonate of lime, and exhibit no trace of phosphate of lime, on employing the usual agents to detect its presence. When we examine with the microscope the arrangement of these spicula in the *compressa*, we observe two rays of the tri-radiate spicula contribute to form the polygonal pores, while the third ray serves to defend and maintain a space between the pores for the lodgment of the soft parts and ova of this animal; the curved ends of the clavate spicula hang over and converge around the entrances of the pores, and seem to have a relation to that function. As these tubular spicula have no external opening, they cannot be the cells of polypi, or contribute in any way to produce the currents of this sponge.

The *Spongia nivea*, Gr. is a small sessile flat spreading species, of a pure white colour, which I have only found on the under surface of sheltered rocks at Prestonpans Bay, during the ebb of stream-tides: it is not very uncommon there; it appears like patches of mineral agaric, or rock-milk, on the roofs of small caves, is about two lines in thickness, spreads to the extent of one or two inches in diameter, and is smooth on the surface. Its pores are just visible to the naked eye, and its fecal orifices are regularly and beautifully constructed; there is a gentle rise of the surface to the margins of the fecal orifices, the margins are quite circular, and have thin transparent terminations; the orifices are never produced so far as to form distinct papillæ, and their currents are directed perpendicularly downwards, in the natural position of the animal. When the *nivea* is checked in its growth, and prevented from spreading by the crowding of other animals around it, its surface becomes waved, and in many places presents elevated sharp ridges, which allow a greater space for the distribution of the pores. (See specimens in the Museum of the University, *S. nivea*, Gr.) The axis of this sponge is composed almost entirely of large tri-radiate spicula, some of which are more than half a line in length, and thick in proportion; their forms are seen by the naked eye. These triradiate spicula occur of different sizes, to the minuteness of the fiftieth of a line in length, their rays taper regularly from their place of junction to their sharp-pointed extremities, their internal cavities are very distinctly seen in the large spicula. The second form of spiculum in the *S. nivea* is the most remarkable, though the rarest; it consists of a straight line, with two opposite lateral projections in its middle, which are generally a little curved. When these lateral processes are large and straight, it becomes a regular quadriradiate spiculum, but they are generally much shorter than the other two rays; and when they are placed near one extremity of the spiculum, it appears under the microscope like a small dagger with a handle. The quadriradiate spicula are generally very minute, and in number about one to a hundred of the triradiate. The third kind of spiculum in this species, is a very minute straight equally thick spiculum, obtuse at both ends, and generally about the fiftieth of a line in length; this form is very abundant, and may possibly be derived from the broken rays of very small triradiate spicula, as in the *compressa*. These three kinds of spicula are likewise calcareous, and dissolve with rapid effervescence on being touched with diluted nitric acid. On looking closely into the surface of the *S. nivea*, with a single lens, we perceive that the large triradiate spicula lie parallel with the surface, and contribute to form and protect the pores.

In a portion of the *Spongia complicata* of Montagu, sent me, along with fragments of nearly thirty other species of British sponges, by the Rev. Dr Fleming of Flisk, who has collected and studied the British zoophytes for upwards of twenty years, I observe the axis to consist entirely of very minute triradiate spicula, which dissolve rapidly with effervescence, when touched with nitric acid. Dr Fleming mentions this species as an inhabitant of the Frith of Forth, and considers it a variety of the *S. botryoides* of most authors. The triradiate spiculum not only occurs alone, and very small, in this species, but is quite peculiar and very imperfect in its form; the rays are very short and disproportionally thick; they often diverge at unequal angles, and, on viewing the spiculum sideways, they are seldom found to lie in the same plain. This sponge has a white colour, like the other calcareous species, and, when dry, the spicula on its surface have the same shining silvery lustre. The triradiate spicula of the *S. botryoides* were figured and described by Mr Ellis, and have been mentioned by most writers since his time. Montagu and Lamouroux have very judiciously introduced the forms of the spicula into their definitions of this species; and in order to distinguish them from the triradiate spicula of the *S. complicata*, Montagu mentions that they are more than four times as large as those of the latter sponge. From having invariably found the triradiate spiculum present, either alone or combined with other forms, in calcareous sponges, I have no doubt that the true *S. botryoides*, if distinct from *S. complicata*, will be found to have a calcareous axis. A portion of another species, presented me by Dr Fleming, under the name of *S. pulverulenta*, presents two kinds of spicula, both of which effervesce and dissolve quickly in nitric acid; one of these forms is a triradiate spiculum with long and very slender rays diverging at equal angles; the other is a very long straight needle-shaped spiculum, pointed acutely at one end, and obtuse at the other. This calcareous species agrees with the others in its white colour, and the silvery lustre of its spicula, when dry. The *Spongia coronata* is the most minute and the most perfectly constructed of all the calcareous sponges I have yet met with. It has two kinds of spicula, the one triradiate, and the other needle-shaped, both of which dissolve quickly with effervescence in diluted acids. The triradiate spicula are more equal in size than in the other species, and are models of this form for their symmetry and proportions; the rays are straight, slender, and diverge equally; they are cylindrical, transparent, and acutely pointed. The needle-shaped spicula are about twice as long as the triradiate, slender, transparent, cylindrical, rounded at one end, and pointed acutely at the other. This sponge is almost microscopic; several entire specimens of it, presented me by Dr Fleming, are not half a line in length; they agree with the others in their colour, and the lustre of their spicula. The long needle-shaped spicula cover the whole surface, like filaments of white silk, and are obviously destined to defend the pores and the fecal orifice, which is proportionably large. On removing these projecting needle-shaped spicula from the surface, which may be compared with the clavate spicula of the *S. compressa*, we observe that the triradiate spicula are entirely devoted to the formation of the pores and passages leading into this animated tube.

There are thus at least six well marked species of British sponge, in which the spicula consist entirely of carbonate of lime, which forms an important character of distinction between these species, and those containing a horny or a siliceous axis, and shows an approximation in this obscure genus to the more solid polypiferous corals, which, so far as I know, has hitherto escaped notice.

List of Rare Plants which have Flowered in the Royal Botanic Garden, Edinburgh, during the last three months; with Descriptions of several New Plants. Communicated by Professor GRAHAM.

June 10. 1826.

Arum triphyllum (*a*) zebrinum.
Bot. Mag. t. 950.

Baptisia nepalensis.
Hook. Exot. Fl. t. 131.

Caprifolium pubescens.

Conospermum tenuifolium.
Never having seen the *C. tenuifolium* of Brown, I have referred our plant to that species with some hesitation, as it seems to agree with the essential character.

Conospermum acinacifolium.
SPEC. CHAR.—*C. acinacifolium*; laciniis perianthii acutis, tubum vix æquantibus; foliis aveniis, lineari-acinaciformibus, mucronatis, basi attenuatis; corymbis laxis.

DESCRIPTION.—*Shrub* erect. *Leaves* scattered, narrow, long (2–3 inches), harsh, slightly hollowed on one side, rounded on the other, bent towards one edge, occasionally tortile, especially in the upper part of the branches, mucronate, veinless, middle rib indistinct. *Corymbs* axillary, collected near the top of the branches, subdivided in their upper half. *Flowers* white, sessile in the axil of a pointed, blue, pubescent bractea; *perianth* pubescent on the outer side, especially of the tube, segments of the lower lip somewhat spreading, the central rather the smallest; *stigma* applied to the upper lip of the perianth, above the stamens; *style* club-shaped, passing in front of the central stamens, bent at the base of the lower lip; *germen* silky; *pappus* silky, unequal.

When the upper and lower lips of the perianth are drawn asunder, or when the style is touched at the joint, it starts forward, and lies along the lower lip of the perianth, the lateral stamens at the same time separating, and exposing those in the centre. This elasticity of the style, attended with the same separation of the anthers, I have also observed in the *C. tenuifolium*. The flowers of both are perfumed like hawthorn blossom, but those of the *C. acinacifolium* by much the most powerfully. The seeds both of this species and the last were received from Mr Fraser from New Holland under the name of *C. erectum*, a name which I have thought could scarcely be retained in this genus. The plants have been kept in the greenhouse.

Dryandra formosa.

Epidendrum ellipticum.
Hook. Exot. Flor. t. 207.
SPEC. CHAR.—*E. ellipticum*; foliis alternis, subellipticis, succulentis; pedunculis terminalibus, elongatis; labello perianthio æquali, tripartito, fimbriato, lobo intermedio minore, lineari.

DESCRIPTION.—*Roots* long, round, fleshy, many pushed downwards from the origin of the branch, green above, yellow below the soil. *Stem* jointed, branched. *Branches* simple, round, slightly flexuose, green, spotted with dull brown. *Leaves* alternate, distichous, spreading, varying on different branches from ovato-elliptical and slightly concave above to elliptico-linear and nearly flat, occasionally slightly notched at the apex, fleshy, very obscurely marked with numerous minute parallel nerves, green, occasionally faintly spotted like the stem, arising from the joints by very thin sheaths, which enclose the stem, and are in some branches as long as its joints, in others much shorter; for about a foot at the upper part of the branch, and generally for a little way at the bottom, there are sheaths only, which are there pointed, persisting, whitish, and withered, brown and striated in their upper part. *Inflorescence* a crowded, short, terminal spike. *Rachis* toothed, and gradually elongated during the flowering. *Flowers* spreading, continue many days expanded, each having a small, pointed, marcescent bractea. *Perianth* rose-coloured, obscurely veined, 3 outer segments rather the largest, obovato-lanceolate, entire, pointed, 2 inner lanceolate, slightly serrulated towards the apex. *Labellum* erect, 5-toothed in front, two teeth being in a line on each side, and one above and between the upper pair, which are the largest, 3-cleft, segments spreading, fimbriated, 2 lateral ones by much the longest, semicircular, central segment linear, and nearly entire on its sides, all deep rose-colour when expanding, but afterwards, especially the lateral segments, which have a few small dots of deep rose-colour, becoming very pale. *Anther-case* conical, pale yellowish-green, occasionally reddish at its base. *Pollen-masses* 4, yellow, oblong, remain attached to the hollow at the top of the column, after the case is removed; four filaments, of greater length than them, and deeper yellow, arise from their lower ends, are in contact, reflected along the pollen-masses, and connected to each other at their extremities. *Germen* an inch long, furrowed, enlarging upwards, pink.

The mode of growth of this plant is curious, and analogous to that of other genera among the Orchideæ. A bud forms immediately above a joint, from this one or more flowering branches push, and from the origin of these many roots arise; branches with roots in like manner proceed from these, and others from these again, each after flowering appearing gradually to decay. Perhaps the plant, therefore, would be more correctly described as having a simple stem, the only portion possessing in activity the powers of life being what for convenience I have called a branch. This mode of propagation occurs chiefly at the lowest joints, or immediately below the flower. The species certainly approaches nearly to the *E. elongatum*, Bot. Mag. t. 611. and the flower greatly resembles it, but is distinguished by the form and size of the central lobe of the labellum, and the form of the leaves, which are never pointed, as well as by their more fleshy texture.

I am indebted for the plant to M. Harris at Rio de Janeiro, and to Captain Graham of H. M. Packet Service, who brought it to Europe in 1824. It has been kept in the stove, and grows freely among pieces of bark.

Eucrosia bicolor.

The specimen in the Botanic Garden differed from the plant figured in the Bot. Mag. t. 2490. in having the involucre of many nearly equal segments, the corolla of nearly an uniform red-orange colour; in there being six flowers in the umbel; in its much more vigorous growth; in the filaments being united for a very little way only; and in the leaf appearing along with the flower. I cannot doubt, however, that the species is the same. A figure from our specimen is given in Hooker's Exotic Flora, t. 209. from the accurate pencil of Dr Greville. A second plant which flowered with us, resembled this in all respects, excepting in the involucre, which had 3 large undulated segments, and several smaller; in the appearance of two leaves at a time; and in the occurrence of several small abortive flowers which expanded before the others.

The collection at the Garden is indebted for these plants to P. Neill, Esq. who received them from Mr Jameson, surgeon, Chili.

Grevillea pubescens.

Spec. Char.—*G. pubescens;* foliis elliptico-linearibus integerrimis mucronatis, pedicellis recurvis, floribus superioribus præcocioribus, stylo pubescenti.

Descript.—*Branches* erect, round, pubescent. *Leaves* scattered, elliptico-linear, entire, when young revolute at the edges, mucronate, pubescent, pubescence harsh on the upper surface, softer beneath, midrib distinct, veins obscure. *Flowers* in abrupt, terminal, secund racemes. *Pedicels* ascending, straight, (½ inch long). *Perianth* pale yellow, tomentose immediately above the nectarium, becoming brown in withering, its segments remaining united. *Germen* nearly round, subsessile, green; *style* rather longer and much stouter than the pedicel, oblique, pubescent, flat in front, of nearly the same colour as the perianth; *stigma* oblique, flat, with a projecting point in the centre, shining, green.

The seeds were sent by Mr Fraser from New Holland in 1824; the plants were raised last year, and have already flowered freely in the greenhouse. The species belongs to Section B. PTYCHOCARPA of Brown, Linn. Soc. Trans. vol. x. p. 172. and so nearly agrees with the description of *G. arenaria*, that I should have hesitated in considering it distinct, had it not been for the recollection of Mr Macnab, the excellent Curator of the Royal Botanic Garden, who assured me that it was different from the plant which he once knew at Kew under that name,—an observation the truth of which has since been confirmed by Dr Hooker, from a comparison with a specimen of *G. arenaria* in his possession. The early period at which this shrub flowers, after being raised from seed, suggested the specific name of *præcox*; but Dr Hooker having sent to the engraver, under the name of *G. pubescens*, a drawing kindly supplied by Dr Greville, I have adopted this designation.

Habenaria fimbriata.

This very splendid species, along with many other rare American plants, I had the honour to receive from the Countess of Dalhousie, before her return to Canada last autumn; and magnificent specimens 2 feet high, are now in flower in a cold frame.

Heliophila arabioides.

Laurus Cassia.

Lobelia crispa.

SPEC. CHAR.—*L. crispa*; spica terminali, foliosa, foliis crispis, dentato-serratis, sessilibus, superioribus linearibus, acuminatis, inferioribus lanceolato-spathulatis.

DESCRIPT.—*Root* fibrous (annual?). *Stem* erect (5 feet high), generally simple, angled, proper juice milky. *Leaves* scattered, sessile, sub-amplexicaul, veined, indistinctly pubescent, deeply tooth-serrated, serratures occasionally toothed, upper leaves linear, pointed, gradually diminishing to the extremity of the spike, crisped; lower leaves lanceolato-spathulate, and less crisped. *Spike* very long. *Flowers* solitary, in the axils of the bracteæ. *Peduncles* equal in length to the germen. *Calyx* segments pointed, nearly as long as the tube of the corolla, ciliated, serrated, at first reflexed, afterwards spreading at right angles, persisting, and becoming larger. *Corolla* marcescent, limb lilac, faux and tube white, 2 upper segments small, linear, pointed, reflexed, 3 lower larger, obovate, acuminate, spreading, the central lobe rather the smallest; *tube* bent down, straight, nearly cylindrical, wheu beginning to fade, cleft in its whole length above, and from its base nearly to the faux on each side. *Filaments* flat, unconnected, hairy on their outer surface, white, with a slight tinge of purple on the outside. *Anthers* connected throughout, deep purple, hard. *Pollen* yellow. *Germen* green, partly superior, obovate, bilocular. *Style* compressed, thickening upwards. *Stigma* oblique, cleft transversely, pubescent round its base, segments revolute. *Seeds* very numerous, receptacle large, and attached to the centre of the dissepiments.

Native of Mexico. Has been cultivated in the stove, but suffers from great heat. Seeds were received both from Lord Napier and Mr Mair in 1825.

Magnolia conspicua.

Flowered well against the open wall in a sheltered situation towards the end of March, and its fine large flowers bore without injury continued and very cold weather.

Maxillaria aromatica.

GEN. CHAR.—Bot. Reg. fol. 897.

SPEC. CHAR.—*M. aromatica*; bulbo ovato compresso, foliis numerosis æquitantibus, scapis radicalibus, unifloris, labello semicylindraceo, lobo medio majore denticulato, labello interno integerrimo angustiori.

Description.—*Roots* fleshy, cylindrical. *Bulb* ovate, much compressed, green, with two indistinct rounded angles on each side. *Leaves* numerous, equitant, lanceolate, acuminate, bright green and shining, rising from the base of the old bulb, and before any distinct bulb is formed at their origin. *Scapes* several from the base of the bulb, slender, round, jointed, having a marcescent brown sheath at each joint. *Flowers* solitary. *Perianth*, 3 outer segments spreading, greenish-yellow, acuminate, pubescent on the inside near the base, especially the upper one, which is lanceolate, the others ovate, dilated downwards, covering laterally the rounded base of the lip, but scarcely involute, and here quite unconnected with each other; 2 inner segments lanceolate, pointed, reflected at the apex, entire. *Lip* semicylindrical, fleshy (as is the whole perianth, though in a smaller degree), pubescent within, parallel with the column, and loosely articulated with its elongated base; lateral lobes small, their upper edges somewhat involute, their apices turned a little down; middle lobe nearly as long as the inner segments of the perianth, reflexed, rounded at its apex, and edged with minute teeth, attenuated at the base, inserted into the back of a broader internal lobe, which is quite entire, reflected at the margin, and ascends in a point at each side, so as nearly to touch the lateral lobes towards their extremities; labellum and inner segments of perianth orange-yellow, sprinkled on the inside with red dots. *Column* linear, pubescent in front, especially towards the top, beaked above the stigma. *Anther* terminal; pollen-masses 2, yellow, rounded, scarcely flattened, each furrowed in the outer side, attached by very short partial pedicels to the summit of a flat white common pedicel, which is rather longer than the pollen-masses, and is reflected under the anther-case from the beak of the column, to which it is attached by a round flat scale; anther-case blunt. *Germen* 6-furrowed.

The flowers are perfumed very like to Cinnamon, from which circumstance I have taken the trivial name.

This very pretty parasite is a native of Mexico, where the bulbs were procured by Lord Napier, and obligingly communicated to the Royal Botanic Garden at Edinburgh in 1825.

Medeola virginica.

Has flowered very freely and in large quantity in a cold frame.

Phlox nivalis.

Pogonia ophioglossoides.

This plant having been presented in large quantity by the Countess of Dalhousie, forms a turf, and flowers most freely in a cold frame.

Pyrola umbellata.

Protea melaleuca.

Puschkinia scilloides.

Pyrethrum diversifolium.

Stem herbaceous, pale green, and covered with lax hairs which decrease upwards, leading shoot erect, many others arising in a circle from its base, diverging, branching, and exceeding the leading shoot in height. *Leaves* linear, ciliated, but otherwise less pubescent than the stem, pinnatifid in more than the upper half, pinnæ incised; nearly the lower half entire, ovate, semi-amplexicaul; pinnatifid portion gradually diminishes upwards, and is entirely awanting in several of the uppermost leaves, which are quite entire, ovate and acuminate. *Flowers* terminal. *Calyx* semi-globular, imbricated in two rows, the scales of equal length, at their edges, and especially at their rounded extremities, membranaceous, transparent, colourless (though reddish in the bud), every where else, like every part of the plant, except the flower, pale green; membranous terminations spread upon the back of the ray. *Florets of the Ray* spreading, at length revolute, entire at the apex, pointed, white, tinged with red along the centre of the outside while in bud. *Disk* rounded, yellow, florets funnel-shaped, tube nearly half as long as the limb;

limb divided to a third of its length into five equal, acute segments. *Filaments* inserted at the throat of the tube. *Seeds* angular, angles blunt. *Pappus* simple, placed obliquely on the top of the seed, which is more than double its length. *Style* rather longer than the limb in the tubular florets, and projecting nearly as much beyond the tube of the ligulated florets. *Stigma* cleft, segments projecting, converging. Style and stigma awanting in many of the florets. The florets of the ray seem also generally barren, and in them the stigma is small, and the segments diverging. *Receptacle* pitted, hispid, and having a few long soft hairs. The seeds were received from Mr Fraser, New Holland.

Renealmia grandiflora.

Sweet's British Flower Garden, t. 64.

Stylidium adnatum.

——— graminæfolium.

Viola hederacea.

Roots branching. *Stem* very short (½ inch), tapering, leafy, producing many very long, filiform, jointed stolons, joints sending down a perpendicular branched root, and forming crowns from which other stolons proceed. *Leaves* petiolate, kidney-shaped, at first cucullate, afterwards convex on their upper surface, nerved, smooth, but not shining, crenate or sinuato-dentate, (1–1½ inch broad). *Petioles* (2–4 inches long) grooved, and having a ridge in the centre of the groove. *Stipules* generally two between the joints of the stolons, lanceolate, acuminate, toothed. *Peduncles* axillary, erect, having one indistinct groove, generally longer than the petioles, procumbent, and somewhat rolled when in fruit. *Bracteæ* 2, slender, awl-shaped, nearly opposite, placed in the middle of the peduncle. *Calyx* persisting, leaflets awl-shaped, with very short spurs. *Corolla* inodorous, resupinate, lowest petal the largest, ovate, concave, emarginate, blue and beautifully veined, white at the apex, green at the base, 2 side petals nearly linear, twisted, pubescent on the upper and lower half of the inner surface, blue from the base to the middle on the inside, nearly to the apex without, veined; upper petals spathulate, reflected, blue to near the middle in front, almost to the apex behind. *Anthers* nearly sessile, large, membranous appendage pointed (cleft?) brown. *Pollen* yellow. *Germen* obovate. *Seeds* numerous, obovate, attached to the centre of the valves, black when ripe. *Style* white, bent at its base, filiform. *Stigma* white, tapering from the style, cleft, nearly straight.

The seeds of this plant were sent by Mr Fraser, colonial botanist at Sydney, New Holland, in 1824, and first raised last season. We were not told in what part of the country the plant is native. It has been cultivated in the stove, but is injured by great heat, and is doing well in a cool frame, and no doubt will thrive in the greenhouse. It produces abundance of stolons as well as seeds.

Celestial Phenomena from July 1. *to October* 1. 1826, *calculated for the Meridian of Edinburgh, Mean Time.* By Mr George Innes, Aberdeen.

The times are inserted according to the Civil reckoning, the day beginning at midnight. —The Conjunctions of the Moon with the Stars are given in *Right Ascension.*

JULY.

D.	H.	′	″	
1.	21	10	52	☌ ☽ A ♉
2.	6	52	34	☌ ☽ 2 κ ♉
3.	0	21	23	☌ ☽ ι ♉
3.	16	10	40	☌ ☽ ζ ♉
4.	2	32	30	☌ ☽ ♄
5.	7	27	38	● New Moon.
6.	10	41	54	☌ ☽ ☿
7.	11	27	32	☌ ☽ 1 α ♋
7.	12	39	13	☌ ☽ 2 α ♋
7.	21	4	51	☌ ☽ ♀
8.	17	59	40	☌ ☽ π ♌
9.	17	43	40	☌ ☽ ♃
9.	21	16	31	Em. I. sat. ♃
12.	13	16	53	☽ First Quarter.
12.	17	57	11	☌ ☽ i ♍
14.	0	45	13	☌ ☽ ♂
15.	1	47	29	☌ ☽ κ ♎
15.	4	45	–	☍ ☽ ♅
15.	6	15	28	☌ ☽ λ ♎
15.	10	59	0	☌ ☽ 1 β ♏
15.	11	0	20	☌ ☽ 2 β ♏
16.	16	9	50	☌ ☽ ρ Oph.
17.	6	50	–	☌ ♀ α ♌
17.	12	36	17	☌ ☽ 1 μ ♐
17.	13	11	–	☌ ☽ 2 μ ♐
18.	14	3	25	☌ ☽ d ♐
19.	0	16	30	☌ ☽ ♅
19.	7	5	10	○ Full Moon.
19.	16	39	49	☌ ☽ β ♑
23.	11	28	16	☉ enters ♌
25.	7	40	–	☌ ☿ α ♌
26.	20	56	52	☾ Last Quarter.
28.	3	28	41	☌ ☽ δ ♈
29.	14	33	43	☌ ☽ 2 κ ♉
30.	8	5	35	☌ ☽ ι ♉
30.	23	57	57	☌ ☽ ζ ♉
31.	16	54	42	☌ ☽ ♄
31.	23	18	56	☌ ☽ ν ♊

AUGUST.

D.	H.	′	″	
1.	8	35	34	♀ very near ♃ *
1.				☿ greatest elong.
3.	19	14	22	● New Moon.
4.	15	37	46	☌ ☽ ο ♌
5.	0	33	28	☌ ☽ π ♌
5.	22	32	50	☌ ☽ ☿
6.	10	24	6	☌ ☽ ♃
6.	18	10	7	☌ ☽ ♀
8.	22	29	54	☌ ☽ α ♍
8.	23	9	20	☌ ☽ i ♍
9.	17	0	–	♀ very near β ♍
10.	18	6	30	☽ First Quarter.
11.	2	9	7	☌ ☽ ♂
11.	7	34	10	☌ ☽ κ ♎
11.	12	7	2	☌ ☽ λ ♎
11.	16	57	22	☌ ☽ 1 β ♏
11.	16	58	46	☌ ☽ 2 β ♏
12.	22	51	53	☌ ☽ ρ Oph.
13.	19	52	9	☌ ☽ 1 μ ♐
13.	20	27	48	☌ ☽ 2 μ ♐
14.	21	57	30	☌ ☽ d ♐
15.	6	33	20	☌ ☽ ♅
16.	1	4	40	☌ ☽ β ♑
17.	2	4	–	♀ near μ ♊
17.	17	5	21	○ Full Moon.
23.	17	51	41	☉ enters ♍
24.	11	11	35	☌ ☽ δ ♈
25.	14	58	34	☾ Last Quarter.
26.	16	16	25	☌ ☽ ι ♉
27.	8	18	36	☌ ☽ ζ ♉
28.	6	25	40	☌ ☽ ♄
28.	7	54	46	☌ ☽ ν ♊
30.	14	10	–	Inf. ☌ ☉ ☿
31.	3	24	14	☌ ☽ 1 α ♋
31.	4	34	18	☌ ☽ 2 α ♋

* At the true time of conjunction of Venus and Jupiter on the 1st day of August, their geocentric longitude will be 164° 53′ 24″; their elongation 36° 22′ 54″; the geocentric latitude of Venus 1° 7′ 24″,6; and of Jupiter 1° 5′ 49″,2, both north; logarithm of the distance of Venus from the earth 0,0858477; and of Jupiter, 0,7940647. This will be an interesting phenomenon, as, owing to the effect of Venus's parallax in latitude, she will *probably* be in contact with Jupiter.

SEPTEMBER.

D.	H. ′ ″		D.	H. ′ ″	
1.	9 3 –	☌ ☽ π ♌	11.	4 1 0	☌ ☽ d ♐
1.	21 52 30	☌ ☽ ☿	11.	11 24 40	☌ ☽ ♅
2.	5 29 10	● New Moon.	12.	7 39 27	☌ ☽ β ♑
3.	2 25 30	☌ ☽ ♃	16.	5 39 16	○ Full Moon.
5.	4 47 20	☌ ☽ α ♍	18.	8 50 –	☌ ☉ ♃
5.	5 24 49	☌ ☽ i ♍	21.	10 5 –	☌ ♂ A Oph.
5.	11 56 50	☌ ☽ ♀	23.	0 8 29	☌ ☽ ι ♉
7.	12 54 42	☌ ☽ κ ♎	23.	14 19 10	☉ enters ♎
7.	17 26 48	☌ ☽ λ ♎	23.	16 23 –	☌ ☽ ζ ♉
7.	22 15 10	☌ ☽ 1 β ♏	24.	9 11 30	☾ Last Quarter.
7.	22 16 34	☌ ☽ 2 β ♏	24.	16 21 23	☌ ☽ ν ♊
8.	0 53 6	☌ ☽ ν ♏	25.	18 43 46	☌ ☽ ♄
8.	12 10 30	☌ ☽ ♂	27.	13 4 8	☌ ☽ 1 α ♋
8.	23 29 35	☾ First Quarter.	27.	14 15 10	☌ ☽ 2 α ♋
9.	4 13 43	☌ ☽ ρ Oph.	27.	18 59 14	☌ ☽ π ♌
10.		☿ greatest elong.	30.	19 32 13	☌ ☽ ♃
10.	1 27 51	☌ ☽ 1 μ ♐	30.	22 4 10	☌ ☽ ♃
10.	2 4 0	☌ ☽ 2 μ ♐	30.	22 48 15	☌ ☽ ☿

Times of the Planets passing the Meridian.

	Mercury.	Venus.	Mars.	Jupiter.	Saturn.	Georgian.
JULY.						
D.	H. ′	H. ′	H. ′	H. ′	H. ′	H. ′
1	12 39	14 8	19 39	16 9	11 13	1 5
5	12 58	14 12	19 27	15 56	10 59	0 48
10	13 18	14 16	19 13	15 41	10 42	0 28
15	13 32	14 19	18 59	15 22	10 25	0 3
20	13 43	14 23	18 47	15 6	10 8	23 41
25	13 49	14 25	18 35	14 50	9 51	23 21
AUGUST.						
D.	H. ′	H. ′	H. ′	H. ′	H. ′	H. ′
1	13 51	14 28	18 21	14 28	9 27	22 52
5	13 48	14 30	18 13	14 15	9 14	22 36
10	13 39	14 31	18 3	14 4	8 56	22 16
15	13 23	14 32	17 54	13 43	8 38	21 54
20	13 1	14 33	17 46	13 27	8 21	21 34
25	12 29	14 35	17 39	13 11	8 4	21 14
SEPTEMBER.						
D.	H. ′	H. ′	H. ′	H. ′	H. ′	H. ′
1	11 41	14 36	17 29	12 49	7 42	20 47
5	11 17	14 37	17 24	12 37	7 24	20 31
10	10 55	14 38	17 17	12 20	7 5	20 10
15	10 50	14 36	17 12	12 4	6 47	19 50
20	10 55	14 42	17 7	11 50	6 29	19 31
25	11 4	14 43	17 2	11 34	6 10	19 12

Proceedings of the Royal Society of Edinburgh.

Feb. 6. 1826.—There was read a Notice respecting the late severe cold in Inverness-shire and Aberdeen, as communicated to Dr Brewster in Two Letters from J. P. Grant, Esq. M. P., and George Fairholme, Esq.

Feb. 20.—Mr Bald read a Notice on a Fine Sand found near Allca fit for making Flint Glass. There was also read a Letter from Professsr Moll of Utrecht to Dr Brewster, on a New Island in the Pacific.

March 6.—A paper by Dr Brewster was read, on the Refractive Power and other properties of the Two New Fluids in Minerals.

March 20.—A paper by Mr Stark was read, on Two Species of Pholas found on the Coast in the Neighbourhood of Edinburgh. And Dr Knox read a paper on the Size of the Teeth of the Shark.

April 3.—There was read a paper on a Singular Phenomenon in Vision, by Mr Thomas Smith, Surgeon, Kingussie. And a Notice by Dr Brewster was read on the Advantages of making Simultaneous Meteorological Observations in different parts of the Kingdom, on one or more days of every year.

April 17.—There was read a Description of a New Register Thermometer, without any Index, by H. H. Blackadder, Esq.

May 1.—Mr H. H. Blackadder read a paper, entitled, Observations on the colour and constitution of Flame. (This paper is printed in the present Number, p. 52 *et seq.*) At the same meeting, Dr Brewster exhibited to the Society a new Monochromatic Lamp. And a new Safety Gas-burner, invented by Mr W. Warden, was also exhibited.

The Society adjourned till December.

Proceedings of the Wernerian Natural History Society.

1826, *Feb.* 11.—Professor Jameson communicated a note of low temperatures, observed by Mr Grant, at his seat of Rothiemurchus, in the Highlands of Scotland, during the late severe frost of January; the lowest being 6° below 0, and this extreme cold continuing for several hours.

The Professor also gave an account of the occurrence of phosphate of lime, in balls or concretions, in the bituminous shale of the coal formation.

Dr R. E. Grant then read a paper on the structure and nature of the *Spongilla friabilis*, and exhibited recent specimens from the rocks and stakes on the east side of Lochend, near Edinburgh. (This paper is printed in the Edinburgh Philosophical Journal, vol. xiv. p. 113, *et seq.*)

There was exhibited to the meeting a collection of magnificent specimens of doubly refracting spar from Iceland, the property of Mr Witham, and collected, last summer, by Mr Rose and Mr Brown, from a great vein, about fourteen feet wide, traversing trap-rock of the nature of amygdaloid.

Feb. 25.—The Secretary read Mr William Scott's Observations on the Climate of Shetland, &c., and laid before the meeting a Meteorological Journal, kept at Unst, by Mr Scott. He likewise read a notice, communicated by Mr Trevelyan, relative to the numerous teeth of the rhinoceros lately discovered in the cave near Kent's Hole, and also regarding the teeth of an unknown quadruped found in the same cave.

Professor Jameson then read the first part of a paper, entitled, " Remarks tending to explain the Geological Theory of the Earth."

March 11.—Professor Jameson read the concluding part of the Observations on the Theory of the Earth.

The Secretary read an extract of a letter from Prof. Buckland of Oxford to Mr Jameson, regarding the lately discovered cave near Torquay, which has been considered as an antediluvian hyena's den. Specimens of the bones, supposed to have been gnawed by the hyenas, were exhibited; and several members gave it as their opinion, that these bones had been gnawed by some quadruped; while others remarked, that, in some cases, the erosion in the middle of a bone was so great, that it must have snapped through, had such erosion been produced by forcible gnawing.

The President exhibited to the meeting several large flower-buds of the *Rafflesia Arnoldi* of Sumatra, with a coloured engraving representing the flower when fully expanded. It was mentioned by Mr Arnott, that Mr R. Brown had lately procured some seeds of this remarkable plant, in a state fit for the examination of their structure, though not for germination. (It has been hitherto supposed to belong, along with Cytinus and Nepenthes, to the natural order Cytineæ.)

Dr R. E. Grant then opened a small mummy-case in presence of the Society: the case was brought from a catacomb in Upper Egypt, and had one end formed into the resemblance of the head of a cat. A few bones only remained; and Dr Grant was of opinion that they might be those of a small domestic cat.

March 25.—There was read a paper by the Rev. Dr Fleming of Flisk, entitled, "The Geological Deluge, as interpreted by Baron Cuvier and Professor Buckland, shewn to be inconsistent with the testimony of Moses and the phenomena of nature." (Printed in the Edin. Phil. Journ. vol. xiv. p. 205. *et seq.*)

Professor Jameson exhibited and gave a general account of several gigantic specimens of the vase-shaped sponge, commonly known by the name of Pateræ or Neptune's cups; these splendid specimens having been brought from the neighbourhood of the Mauritius.

A very excellent stuffed specimen of the Crocodile of the Nile, 12½ feet long, was also shewn to the meeting.

April 8.—There was read a notice of a shower of young herrings, which fell on the coast of Argyleshire, contained in a letter from the Rev. Colin Smith of Appin to Professor Jameson. (Printed in the present number of this Journal, p. 186.)

Dr Grant then read an account of a new zoophyte from the Frith of Forth, forming a genus which connects Spongia and Alcyonium, and which he proposed to call Cliona; the species found on old oyster-shells in our frith being Cliona celata of Dr Grant. (Printed in the present Number, p. 78.)

Mr Stark exhibited four drawers, containing a very complete and beautiful suite of the numerous varieties of Ortrea opercularis found in the Frith of Forth. And Mr Bald gave an interesting account of the great coal-field of South Wales, and laid before the meeting several very uncommon specimens of coal, ironstone, Welch-rock (a sort of micaceous sandstone-flag), and ore of titanium.

At this meeting, the following new members were admitted:

RESIDENT.

John Geddes, Esq. mining-engineer, Edinburgh.

George Lees, Esq. teacher of mathematics to the Military Academy.

NON-RESIDENT.

Geo. Edw. Frere, Esq. of the Clydach Ironworks, Brecknockshire.

Thomas Buchanan, Esq. Hull, author of "Acoustic Surgery."

Joseph Carne, Esq. Cornwall, author of "Mineralogy of Cornwall."

Geo. Cuming Scott, Esq. master of the Anglo-Mexican Mint at Guanaxato.

H. Stirling, Esq. Captain in the Hon. East India Company's service.

FOREIGN.

M. Adrien de Jussieu, Paris.

M. John Roeper of Göttingen.

M. Achille Richard, Paris.

April 22.—The Secretary read a memoir on the arrangement and nomenclature of Univalve Shells, and on the structure of the animals, by Charles Collier, Esq. Staff-surgeon, Ceylon. He also read the introductory part, and gave a general account, of an elaborate and learned monograph of the genus Allium, comprehending 133 species, by Mr George Don, A. L. S.—Professor Jameson then read a communication on the Snakes of Southern Africa, by Dr Andrew Smith, assistant-surgeon 98th Regiment, and superintendant of the South African Museum.

May 27.—The Secretary read an Account of a rare fish, the Sciæna Aquila, taken in the Shetland Seas. (This is printed in the present number, p. 135. *et seq.*)

Dr Knox read a Notice respecting the presence of a rudimentary spur in the female Echidna of New Holland. (Printed in the present number, p. 130.)

Dr Grant read an Account of the motions of the ova of Campanularia dichotoma, Gorgonia verrucosa, Caryophyllea calycularis, Spongia panicea, papillaris, cristata, and of Plumularia falcata; and stated, that, in all these zoophytes, the motions seem to be produced by ciliæ distributed over their surface. (This paper is likewise printed in the present number, p. 150. *et seq.*)

There was read at the same meeting an Account, illustrated by coloured drawings, of the Holothuria tubulosa, by Dr Collier, staff-surgeon.—The Society then adjourned for the season.

SCIENTIFIC INTELLIGENCE.

NATURAL PHILOSOPHY.

1. *Lieutenant Drummond on the means of facilitating the Observations of Distant Stations on Geodesical Operations.*—There was lately read to the Royal Society of London, a paper on the means of facilitating the observations of Distant Stations in geodesical operations, by a highly accomplished engineer, our friend and former pupil, Lieutenant T. Drummond, Royal Engineers. A committee of the House of Commons having recommended to his Majesty's Government, in 1824, the accomplishment of a new survey of Ireland, the author was entrusted by Lieutenant-Colonel Colby with the contrivance of means for obviating the delay which usually occurs, in connecting the stations in triangulation in this country, from the frequently unfavourable state of the weather not permitting the ordinary signals to be seen from distant stations. To remove this inconvenience, as far as day observations were concerned, Lieutenant Drummond had recourse, in preliminary trials, to *tin-plates*, as substitutes for regular heliostats; and the advantages derived, from applying, even in this rough way, the principle of reflection, as suggested by Professor Gauss, led to the invention of an instrument described in the paper, which was used with much benefit last season in the survey of Ireland. It was also desirable to have some method of connecting the stations during the night. For this purpose, Bengal and white lights had formerly been employed by General Roy, but the use of them had given way to that of Argand lamps, their light being concentrated, and reflected towards the observers, by a parabolic mirror. These, however, had been found to answer but imperfectly; and Colonel Colby and Captain Kater, when connecting the meridians of Greenwich and Paris, in 1821, with MM. Matthieu and Arago, employed the light of an Argand lamp, with four concentric wicks, concentrated by a lens. This apparatus, however, was found to be, in many respects, objectionable; and the para-

bolic reflector still appeared to be the most eligible means of concentrating the light. With the view of obtaining a powerful light, Lieutenant Drummond first tried various pyrotechnical preparations, and afterwards the combustion of phosphorus in oxygen gas; but he found, in all these, that the light was ill defined, and otherwise unsuited to the object in view. He then had recourse to the light emitted by some of the earths and metallic oxides, when ignited by the flame of alcohol, urged by oxygen gas. Taking the light of the brightest part of the flame of an Argand lamp as unity, and effecting the comparison by the method of shadows, he found the light given out by quicklime, when under this treatment, to be equal to 37; that emitted by zircon, 31; and that by magnesia, 16. The best kind of lime for the purpose, is chalk-lime, which admits of being turned readily into small balls, having a stem, and to which the regularity and truth of surface can be given, which are essential to the production of the well-defined image, necessary for the perfect use of the contrivance in geodesical operations. This lime, when the experiment is most successful, emits a light exceeding 83 times that of the brightest part of the flame of an argand lamp. In the focus of the parabolic reflector, at the distance of 40 feet, it is almost too dazzling to look at. From the perfect success which attended the employment of this mode of illumination, on one occasion in Ireland last year, it is expected that it will enable the officers to complete the connection of distant stations with celerity, and in the most satisfactory manner. Various applications of it are contemplated; among others, the connection of the meridian of the Edinburgh Observatory with that of Dublin, taking Benlomond as an intermediate station.

METEOROLOGY.

2 *Deception occasioned by Fog.*—"When at San Blas, a port at the entrance of the Gulf of California, in January 1821, I had occasion, in company with several of the officers of the ship in which I then served, to visit the town of Sepic, situated about fifty miles inland. The first eighteen or twenty miles of our journey was over a low, swampy, flat, covered thickly with trees, so as to obstruct the view in every direction. Afterwards, we began to ascend the mountainous tract that terminates the low

land stretching along the coast. On reaching the top of the nearest ridge, which was clear of trees, we stopped to look around us, and, to our astonishment, we perceived, as we thought, the sea lashing the base of the hill on which we stood. As we had calculated on having accomplished upwards of one-third of our journey, we were bewildered at this unexpected circumstance, and so convinced were some of my companions, that it was the sea they saw stretched out before them, that they insisted our guide had mistaken the road, and led us along the beach, instead of taking a direction directly inland. The line of the horizon appeared distinctly marked, and the vapour seemed to roll on the beach like the gentle motions of the waves, when slightly urged by light and variable winds. Indeed, so striking was the deception, that it was not before I had examined the phenomenon steadily, for some time, and reflected on the impossibility of the sea being so near, from the direction we had taken at the outset of our journey, that I became convinced of the whole being an illusion, caused by the reflection of the sun's rays, from a dense mist that hovered over the plain we had passed ; but our guide (an English resident at San Blas) had great difficulty in convincing one or two of my companions, that their eyes had deceived them, and that the ocean they were observing was an ocean of vapour instead of water. A heavy rain had fallen the evening before, and the moisture, suddenly converted into vapour, by the powerful action of a tropical sun, we conjectured to be the cause of this remarkable appearance. The vapour appeared to hover close over the tops of the trees ; as, on observing it steadily for some time, we saw one or two of the taller trees breaking through it, having the appearance of distant islands in the ocean."

3. *Apparent nearness of Objects.*—" The deception of distance in these plains is even more remarkable than it is upon water, there are so few objects wherewith to measure space, that the eye is bewildered, and quite put to fault. I remember, upon looking from the caravanserai at Moschacoor, from whence points in the vicinity of the next stage (Soo) are to be seen, I should have judged a small water reservoir on the road to be but two miles distance ; it was twelve in reality : and a small knob upon the shoulder of a hill somewhat further, (four miles I should

have said,) turned out to be twenty. On leaving the caravanserai at Muxood-beggee, we clearly discerned the walls of Komaishah, elevated by refraction; and though the real distance was full twenty-five miles, it did not appear to be five: instances even more remarkable, particularly when looking from a height, might be quoted. This deception has a more unpleasant effect than can be conceived; for the weariness of the body and mind, harassed by the dull unvarying scene, is exasperated by prolonged disappointment; as the same objects, never altering in size or propinquity, seem to the jaded traveller to recede rather than advance, as he slowly winds along."—*Fraser's Travels.*

4. *Mirage in Persia.*—" The wonderful effects of the mirage, and the phenomena it produces, have frequently been the theme of admiration with travellers; but it is almost impossible to conceive the extent to which these prevail upon the wide and level plains of these countries, when the air, in a state of rapid undulation, causes every object near the surface to tremble into forms as uncertain and evanescent as the eddies that produce them. A distant mountain, in the space of a minute, will assume, first, perhaps, the form of a lofty peak; this, after rising to what appears a prodigious elevation, will thicken at the top, and spread into that of a large mushroom, with a slender stalk; the top will then split into several spires, and then all will join into a solid table shape. This is extremely puzzling to a surveyor, who depends upon the peaks of mountains as objects from which to form his triangles; for he may be thrown many degrees out of the true line, by trusting to an observation under such circumstances. In other instances, a mud-bank, furrowed by the rain, will exhibit the appearance of a magnificent city, with columns, domes, minarets, and pyramids, all of which flit as you approach; till, to your utter confusion, they dwindle into a heap of earth, perhaps not ten feet high. Numberless have been the mistakes made of asses with boys on them, for elephants and giants, or well mounted troops of cavalry; sheep and goats for camels and dromedaries; and the smallest bushes for fine forest-trees. There is sometimes great beauty, and much that is amusing, in the variety of phenomena produced, but they not unfrequently involve the weary traveller in great disappointment."—*Fraser's Travels.*

5. *Shower of Fishes in Argyleshire.*—" The rare occurrence of such falls renders them so remarkable, as to be remembered after long intervals of time, and even after every circumstance connected with them is forgotten. When any phenomenon is not considered in its relation to any particular cause, few will attend to its possible relations to preceding events; and fewer still will esteem it of such importance as to treasure up the observations which they might have happened to make, even although these might be of great importance, in illustrating the nature and causes of the circumstance observed.

It is thus, that, though the testimony of many has enabled me to ascertain, that a shower of herring-fry fell in Lorn, about the year 1796, yet I have not met with any who could inform me of the particulars concerning it.

In the same district, and near the same place, on a small eminence above Melford House, a shower of herring fell in 1821, in every respect so large and good, that the tenants by whom they were found were induced to send some of them to their landlord, then residing in Edinburgh. In regard to the state of the weather, I could learn no more than that it was exceedingly boisterous; while the hill on which they were found is exposed to the south-west wind, which blows along Loch Melford, an arm of the sea in which herrings are frequently found; and, as far as I know, the only one in this quarter in which the fly is commonly and successfully used in fishing them.

In the month of March 1817, strong gales of wind from the north were experienced in Appin. Upon the evening of the second day of their continuance, rain fell in abundance; and next day being very warm and sultry, some children observed a large quantity of herring-fry scattered over a moss a little to the north-east of the ferry of Shien. There might have been about three barrels or more of these, and measuring from $1\frac{1}{2}$ to 3 inches in length. Now, the place in which they were found is only about 300 yards north of Lochreran, an arm of the sea running east and west, from which severals supposed the fry must have been raised. The wind, however, being from the north, renders this a seeming impossibility; and it may, perhaps, be more safely concluded, that they must have been ejected from the Linnhe Loch, another arm of the sea, extending south-west and north-east, about three miles north of the place in which they were found. A range of moorland, about 300 feet above the level of the sea, intervenes; but it is easier to suppose the cause which originally elevated these fry to be so powerful as to carry them this height and distance, than that they should obtain a course contrary to the general body of the air. They exhibited no appearance of being bruised by the fall, nor was there any thing which could induce them to believe that water had fallen at the same time."—*Letter Rev. Colin Smith of Appin to the Editor.*

6. *Shower of Herrings in Galloway.* — " Macchirmore, or the Head of the Macchirs *, for indeed there is not much white ground above it, pertains to Dunbar of Macchirmore. It is situate upon the east side of the river of Cree, one mile distant to the south from the town of Monnygaffe; and here is the first ford of the water of Cree, except that betwixt Kirkmabreck and Wigton, of which more hereafter. This ford is five miles, or thereby, *in recta linea*, to the northward distant from Wigton. In the moors of this parish of Monnygaffe, not many years since, at a place called La Spraig, not far distant from the water of Munnach, but sixteen miles distant from the sea, there fell a shower of herring, which were seen by creditable persons, who related the story to me. Some of the said herring were, as I am informed, taken to the Earl of Galloway's house, and shown to him."—*Andrew Symson's Large Description of Galloway,* 1684. *Edinb.* 1823, p. 31.

7. *Shower of Herrings in Kinross-shire.*—Mr Arnot informs me, that, about a year ago, a shower of herrings fell near Loch Leven; it came in the direction of the Frith of Forth, and the herring are conjectured to have been blown out of the water of the Frith, and carried by the wind across Fifeshire, to the place where they were found, in the vicinity of Loch Leven.

8. *Shower of Shells in Ireland.* — " I send you another instance of a shower of shells, which fell at Monastereen, in the

* Macharmor is not " the Head of the Macchirs," but the Great Machar, or level arable district. The Head of the Machars would be Ceann-a-Mhachair.—Edit.

county of Kildare, a few days ago. At this time the tides were remarkably high, and the sea exhibited marks of unusual disturbance. I regret that I can send one only of these shells."

9. *Colours of Lightning.*—The colours of lightning that accompanies thunder high in the atmosphere, are yellowish white, sometimes reddish, seldom pale green; but in low thunder, the lightning is bluish or pale violet.—*Kastner.*

10. *Meteoric Stones.*—Earthy meteoric stones are compact and grey coloured, and either contain, besides finely disseminated native iron, no other constituent parts, as in those of Ensisheim, Aigle, Lissa, &c.; or they are composed of different mineral substances, arranged in granular concretions, as is the case with the meteoric stones of Stannern and Juvenas. The meteoric stone of Juvenas, according to Mitscherlich, is a granular, crumbly, compound of augite (which also occurs crystallized in cavities of the mass), labradorite (Labrador felspar), a yellow foliated mineral, and a metallic mineral, resembling magnetic pyrites. The resemblance of this meteoric stone to the greenstone (dolerite) of the Meissner Hill in Germany, is very striking; and nct less so to some varieties of greenstone from Hammersfiord in Iceland. That the white mineral in the meteoric stone is not common felspar, is proved by the re-entering angles formed by the cleavages in the twin-crystals.

CHEMISTRY.

11. *Effects of Mineral Substances on Animals.*—From the experiments of Professor Gmelin of Tübingen on the action of mineral substances on animals, it results, 1. That mineral substances, very nearly allied to each other, as baryte and strontian, are yet very different in the effects they produce on the animal body. 2. That, of the different metals injected into the vascular system, three only occasioned coagulation of the blood, viz. muriates of barytes, uranium, aud palladium; which three metals differ very much in their chemical constitution. 3. That, when chromate of potash is introduced, under the skin, into the cellular substance, it affects the bronchial system, occasioning increased secretion of mucus, and also inflammation of

the conjunctiva. 4. That the oxide of osmium occasions more speedy vomiting than any other metal. 5. That sulphate of manganese injected into the vascular system, occasions a powerful action of the liver, causes inflammation of that organ, and increases very much the secretion of the gall, so that the larger vessels become of a yellow colour.

12. *Salts assume different primitive forms, according to the menstruum in which they crystallise.*—We are informed, that a German chemist, Dr Wöllner, has found that one and the same salt assumes different fundamental or primitive forms, according to the nature of the liquor in which the crystals are formed. In illustration of this statement, he says, that, when a small portion of solution of sulphate of iron is poured into a solution of alum, and the whole allowed to crystallise, the sulphate of iron assumes the octahedral form of the alum, although these octahedral crystals contain scarcely a *trace* of alum.

13. *Compound for preserving Substances from Humidity.*—When a mixture of one part of oil and two parts of resin is forced, by the application of a high temperature, to penetrate porous substances, as building-stones, plaster, &c., it renders them perfectly impermeable to moisture.

14. *Inconveniences of the pressure apparatus for Cooking.*—In the military establishment of Carlsruhe, the alimentary substances are cooked in vessels composed of tinned iron, in which the temperature can be augmented by pressure. M. Geiger has detected in all the substances so prepared a small quantity of tin and lead, which varies according to the nature of the substance cooked, and the time it has remained in the apparatus. He thinks that the continual presence of these metals in the food taken by the same persons, although they may exist in but very small proportions, must prove hurtful to their health.

15. *Carbonate of Magnesia.*—According to Bischof 1363 parts of water dissolve 1 part of carbonate of magnesia, which is a larger portion than stated by Dr Fyfe, who found that it required 2632 parts of water to dissolve 1 part of carbonate of magnesia.

16. *Changes that take place in the texture of different solid substances in the course of time.*—Common barley-sugar when

fresh made is transparent, and exhibits no particular structure; but if kept for some time it loses its transparency, and, by a change of the arrangement of its particles, its structure gradually changes from compact into *stellular radiated.* This case is analogous to changes we have observed in minerals, which, although solid, and without any particular structure, in the course of time acquire a particular structure, such as the fibrous, radiated, or foliated.

17. *Constituent parts of Magnesian Limestones from the vicinity of Jedburgh, as ascertained by Mr William Copland.*

Carbonate of Lime, -	45	50	53
Carbonate of Magnesia, -	33	35	15
Carbonate of Iron, -	16	8	27
Alumina, - -	6	7	5
	100	100	100

18. *Analysis of a Powder which is sold in Paris under the name of Colour, and used in giving trinket gold the colour of fine gold.*—Cupidity and ignorance have often issued in commerce, under different names, a multitude of more or less noxious substances, to which extraordinary properties have been attributed; and the credulous public, having no suspicion of the dangerous qualities which these substances often possess in a very high degree, and according to which they exert a specific agency, are frequently exposed to the most serious accidents. Secret preparations of this kind cannot be too well made known, nor can too much publicity be given to their composition, and the analysis that may be made of them, the knowledge of the results of which may be so eminently useful to society. The powder which the trinket-manufacturers used to apply for the purpose of colouring gold, was composed of marine salt, nitrate of potash, and alum; but, for some time back, another substance has been vended, the composition of which is different. This powder is of a dirty white colour, having a tinge of red, its taste is salt, and like that of common sea-salt, but it leaves a disagreeable metallic taste in the mouth; and it sensibly attracts moisture from the air. Its analysis has furnished the following results. Twenty grammes of it have yielded,

Of pure White Oxide of Arsenic,	2.135
Alum with a base of Potash,	4.190
Marine Salt, - - -	13.560
Oxide of Iron and Argil, -	0.115
	20 gr.

If this powder be really used for colouring gold, as I have been assured, the oxide of arsenic, I should think, can have no effect in that way.—*M. J. L. Casaseca.*

Note by M. D'Arcet.—I have several times had occasion to examine the saline composition known under the name of *colour*, which is employed by the toymen for giving to trinket gold the beautiful yellow colour of fine gold. The following is the result of my analysis in round numbers:

Saltpetre,	40
Alum,	25
Sea-salt,	35
	100

I was not aware that any change had been made in the composition of this mixture. If the powder examined by M. Casaseca be now used for colouring gold, it can only have been adopted of late, and since fashion has introduced the taste, and rendered necessary the employment of variously coloured alloys of gold with silver, copper, iron, antimony and platina. M. Casaseca's observations appear to me to be very important, and will, without doubt, induce authorities to adopt measures of administration for obliging the persons who prepare, vend, or employ the new composition in question, to employ all the necessary precautions against the danger arising from the use of a mixture containing so much oxide of arsenic.—*Annales de Chimie et de Physique, Mar.* 1826.

MINERALOGY.

19. *Gay-Lussite.*—A new mineral, under this name, is described, and its analysis given in the Annales de Chimie and de Physique for March 1826. It is a hydrated bicarbonate of lime and soda, the following being its constituent parts: carbonate of lime 32.85; carbonate of soda 34.76; water 32.29=100.00; analysed by J. B. Boussingault. It occurs in crystals dissemina-

ted through a bed of clay, which covers the natural carbonate of soda, called *urao*, at Lagunilla, a small Indian village to the south-east of the town of Merida in Spanish America.

20. *Titanium, a general ingredient in Felspars and Serpentines.*—Peschier, in Ann. de Chem. and de Phys. March 1826, finds, by experiments, 1*st*, That Titanium is a constant constituent part of felspars and serpentines; 2*d*, That serpentines, like felspars, contain an alkaline principle. And he adds, that his researches demonstrate that the greater number of primitive mountain rocks contain titanium, and that the metal is more generally distributed in nature than is commonly supposed. The *glassy felspar* Peschier finds to contain both potash and soda.

21. *Fluids in Cavities of Minerals.*—Many beautiful specimens of amber, containing cavities more or less filled with water and air, are drawn and described in Sendelio's Historia Succinorum. Sokolow, we are informed, on breaking a rock crystal in which a fluid was inclosed, heard an explosive noise, and remarked that the hand-towel in which the specimen was held when breaking it, appeared in several places as if acted on by an acid. (Communicated to Leonhard by Von Struve).

GEOLOGY.

22. *Contested passage in Tacitus.*—In Tacitus Ann. Lib. xiii. c. 57., it is said, "Sed civitas Juhonum socia nobis, malo improviso afflicta est; nam ignes, terra editi, villas, arva passim corripiebant," &c. This passage some consider as an historical proof of volcanic eruptions on the Rhine and in the Eifel,—an opinion not in the least probable. We are disposed, with Nees von Esenbeck and others, to refer the whole to some muir or heath burning that had taken place near Cologne.

23. *Hills formed by Springs.*—The wells of Moses, near to Suez, afford, according to Monge, the remarkable appearance of hills formed by springs. The eight wells of this watering place all occur on the summits of small conical hillocks, having crater-shaped hollows at top, forming basins, in which the water collects, and from which it flows downwards in natural ravines. The highest of these hillocks rises 40 feet above the surrounding country. In it the spring has long ceased to flow. The other

seven springs shew how these elevations are gradually formed. In other countries, especially in Iceland, Trinidad, Kamtschatka, &c. appearances of the same description, but on a large scale, occur. The quantity of matter during the course of even one year, brought from the interior of the earth, and deposited on its surface, by the agency of springs, is truly enormous. What must be the quantity during the course of a few centuries?

24. *On the manner in which Ammoniacal Salts are formed in Volcanoes.*—It is well known, that muriate and sulphate of ammonia are met with incrusting and intermixed with volcanic rocks, thus shewing that, in these situations, they are of volcanic origin. Some geologists have been puzzled for an explanation of the mode of formation of these salts. The following, founded on Mr Faraday's experiments, may be considered as sufficiently plausible. The hot lava, which analysis shews to contain alkaline hydrate and also iron, coming in contact with water, a decomposition takes place; the nascent hydrogen of the water unites with the azote of the atmospherical air, and thus ammonia is formed, and this alkali meeting with muriatic and sulphuric vapours, combines, and forms muriate and sulphate of ammonia.

ZOOLOGY.

25. *Whale killed in the River St Laurence, 600 miles from the Sea.*—" The steam-boat Lady Sherbroke, arrived on Friday from Quebec; the passengers on board reported, that they had been followed to within a few miles of this city, by a large sea monster. Some supposed it to be the famous sea-serpent, while others believed it a whale or grampus; however, all concurred that it was a fish of a very large kind, stating the length to be from thirty-five to eighty feet. In the evening of Friday, the monster rose alongside of the steam ferry-boat, which plies from the Cross (two miles below the city), to Long Guile, and appeared to be nearly the length of the boat. On Saturday morning, two enterprising captains, Brush and Seymour, with a crew of eight men, went down in the long boat belonging to the steam-boat. About three miles below Montreal, they had the satisfaction to see the fish rise and blow. They immediately pulled for his tract, and soon came alongside, when the harpooner fixed the dart into him.—Now a scene took place, which surprised

those who had collected on shore. The current running with great rapidity, it is not common to see a boat propelled up stream with any swiftness; but the whale, for so we must now call him, darted with the boat in tow, up the current, at the rate of ten or twelve miles an hour. The whale, perhaps not wishing to approach too near the city, soon tacked about, and stood down for Long Point, and remained towing the boat, until near 12 o'clock, going where he pleased, and drawing the boat much faster than those in her were accustomed to travel even by steam. Finally, the harpoon gave way, and the whale for the present made his escape. The party, however, are determined to make a second trial to-morrow, when they will be better supplied with proper instruments. Hundreds were assembled on the shore to witness the attack and chase, and certainly it was a novel one to see a whale 600 miles up from the sea-board. Much credit is due to Captains Brush and Seymour for the promptness and energy employed on this occasion. Captain Bunker, of your city, who commands the Malsham steam-boat, will be up to-morrow, and by him we may hear something farther.—Montreal is about 120 miles above the termination of the tides, and about 300 miles from salt water.–*The Whale caught.* On Sunday last a great number of boats were very early on the alert below Grant's island, watching the motions of the whale. He was repeatedly seen very near the boats, but not sufficiently to allow them an opportunity of striking him. At about 9 or 10 o'clock, the steam-boat Laprairie, with several persons on board, came down the current, and it is thought, by those who were present, frightened him, and occasioned his running up the river, passing several boats, until, from some cause, he was induced to slacken his progress, and to drop backward down the river, until he struck the boat navigated by Captain Brush, Mr Young, and some other persons. Mr Young then seized the opportunity and thrust a harpoon with main force into his body, directly behind the first fin. Never was a thrust more effectual. Mr Young, as it were, stood over him when the wound was made. He immediately veered about, and went down the stream with great rapidity. Shortly after he turned and proceeded up the current St Marie, and taking the southern channel through which the

Laprairie steam-boats are navigated, he dashed about in the breakers opposite the town for nearly two hours. The movements of the boat could be plainly seen from the harbour ; and we seldom ever beheld a concourse of people equal to that which crowded the embankments. The whale then proceeded further up the river, and would in all probability have visited Laprairie had not the shallowness of the water prevented. During all this time the persons in the boat were enabled to wound him with lances continually. At last, exhausted and unable to resist the stream, he again took the direction towards the foot of the current, and continued his course to Bocherville Islands, where he was killed and sunk in three fathoms water. Yesterday morning the New Swiftsure towed the carcase to this place ; and we understand that he will be exhibited this day in a building constructed for the purpose. We are pleased that Captain Brush and Mr Young were the successful competitors in this sport ; as their former exertions and perseverance seemed to entitle them to be the favourites of Fortune. The dimensions of this creature are 42 feet 8 inches in length, 6 feet across the back, and 7 feet through from the back to the belly. He is of the species called by the whalers *Finners*."—*Extract of a Letter from Montreal, dated September* 13. 1823.

26. *On the Siliceous Spicula of two Zoophytes from Shetland.*—"On examining the siliceous axis of two zoophytes lately presented to me by Dr Fleming, and discovered by him on the coast of Shetland, I have found that their spicula agree exactly in form and arrangement with those represented by Donati, as occurring in the *Alcyonium primum Dioscoridis*, and *Tethya sphærica*, of that author. The spicula of both are siliceous, as stated by Pallas, who compares them to asbestus and to pumice ; the same was observed by Montagu, who generally terms such spicula asbestine. In the one of these species, named by Dr Fleming *Cydonium Mulleri*, we observe the interior composed of two forms of spicula ; one slender, long, and fusiform ; the other thick, and branched at one end, into three short curved rays ; and the outer covering of the zoophyte is composed of regular minute siliceous balls, precisely as figured and described by Donati, in the *Alcy. pr. Dios.*, (Donati. mar. Adriat., Pl. IX). In the other species, named by Montagu *Spongia pilosa*, and by Dr Fleming *Tethya*

pilosa, the axis consists solely of radiating fasciculi of slender fusiform spicula, as very accurately represented by Donati (Pl. X.), in the *Tethya sphærica*. Pallas mentions the former of these zoophytes as very common and large on the shores of the Cape of Good Hope; Donati found it common in the Adriatic; the latter zoophyte is likewise mentioned by Pallas as not uncommon at the Cape, and Donati found it adhering to various marine animals in the Mediterranean. Should these two zoophytes from Shetland be found to agree in their recent state, with those described by Donati, to which they have the closest resemblance in the structure of their dried axis, they will afford new and striking proofs of the favoured situation of these remote islands, beyond the 58th degree of north latitude, for the growth of zoophytes, most of the largest British species of which are already known to abound on their indented and rocky shores, (see Wern. Mem. vol. i. p. 560, *et seq.)*; and the occurrence of these two inhabitants of the Cape of Good Hope and of the Mediterranean, would lead us to suppose, that the temperature of the Shetland seas is much influenced by the heated waters of the great gulf stream from the Equator. Had Donati's example been followed by succeeding naturalists, in describing and delineating the forms and arrangement of the ultimate spicula, particularly in zoophytes, like our present species, which have never exhibited any trace of polypi, much of the present uncertainty would have been removed from the natural history of the species, and much more light would now have been thrown on the nature of these mysterious beings."—*Communication from Dr Grant.*

27. *Histoire Naturelle des Mammifères.*—Of this work, conducted by Geoffroy St Hilaire and Frederic Cuvier, we have lately been favoured by a perusal of the first number of a 4to edition. The folio edition is nearly completed; and when so, will contain 360 coloured plates, many of which represent objects not before figured. The great size of this edition, and its expence, amounting to about L. 35 at Paris, not suiting private individuals, it has been thought proper to commence a 4to edition at a reduced price; this, when complete, is calculated to cost scarcely more than 20 guineas. We have just been favoured by a perusal of the first number or *cahier*. Betwixt it and the folio

edition we believe there is no material difference. The plates are coloured with the same care, and nothing is suppressed in the text. One slight difference there is, and we believe it must, by all, be considered an improvement; the generic characters constitute each a separate article, placed at the head of the descriptions of the species, in place of, as in the folio edition, being embodied in one of the latter. All the figures (well executed in lithography) are exact, both in the proportions and colours. The first number contains the two genera Orang, (*Pithecus* Cuv.), and Gibbon (*Hylobates* Illiger). The species described and figured are the orang-outang female (*Pithecus satyrus*). The Siamang (*Hylobates syndactylus*), the Wouwou, male and female (*H. agilis*), and the Ounko, male and female (*H. Lar.*)

28. *Cows, Horses and Sheep, fed on Fish in Persia.*—The cows have humps, and resemble those of India; milk, butter and ghee, are very abundant, and good of their kind. This is the more remarkable, as the cattle have but little pasture in the neighbourhood of the town; and it is certain, that one chief article of their food is *dried fish*, a little salted; the cattle become very fond of this, which, with pounded date stones, is all they get to eat for a considerable portion of the year. The natives assert, that, so far from the milk being spoiled when the cattle feed on these things, they drink much more water, which increases both the quantity and quality of the produce. Horses and sheep, as well as cows, are fed on this diet, and thrive equally well upon it.—*Fraser's Travels.*

29. *Swiftness of Animals.*—Trotting match at Anwell, Berks.

	Min.	Sec.		Min.	Sec.
A Horse Three Miles in	13	30	A Mare Three Miles in	12	20
Do.	11	10	Do.	12	25
Do.	11	8	Do.	11	59
Do.	11	12	Do.	12	20
Do.	12	16	Do.	13	2
One Mile	3	50	One Mile	4	2
Sixteen Miles	63	6	Sixteen Miles	66	8

The horse broke into a gallop in the 2d mile, otherwise the 16 miles would have been done within the hour. The mare was beat in the 14th mile. The match took place over 3 miles of ground, each carrying feather weight.

30. *Foot race on Clapham Common.*—The runner, a Yorkshire man ; the distance 10 miles ; a mile was measured off ; there were nine turns, for which 27 seconds were allowed ; and added to an hour.

	Min.	Sec.
1st Two Miles run in	11	33
2d Ditto,	11	32
3d Ditto,	11	36
4th Two Miles run in	11	37
5th Ditto,	11	40
Total	57	58
Winning by	2	29
	60	27

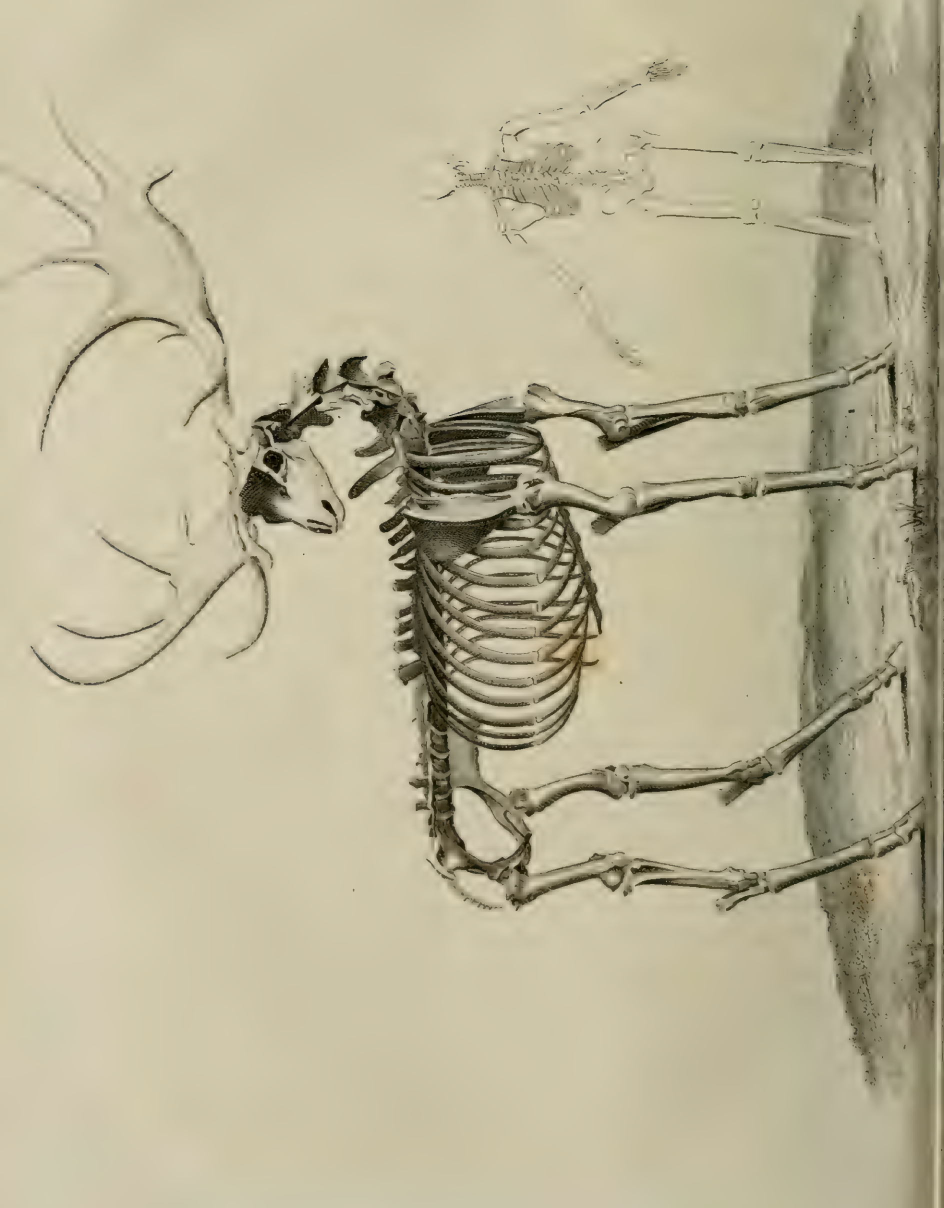
31. *Insects.*—In the same manner that the cochineal insect is cultivated in America and elsewhere, the English have set agoing a cultivation of the gall insect, which produces the lac resin in India. There is another gall insect in China, the *Pé-la*, which also procures a fine wax, of which candles are made.—*Journal de Pharmacie, Mar.* 1826.

32. *Mildew in Barley.*—This affection, which is attributed by M. Decandolle to a fungus, and is considered by many others as a malady resulting from humidity, is regarded by Mr Martin Field as the consequence of the puncture of an insect of the genus *Musca*, when the seed is yet in a pulpy state. This insect does not deposit eggs in the pulp, nor are larvæ in fact found there. It is the irritating fluid poured into the puncture that causes the appearance of this blackish excrescence, and communicates noxious qualities to it.—*Ibid.*

33. *Taming Rattle-snakes.*—Mr Neale, it is said, has succeeded in America in taming rattle-snakes, by means of music, so as to prevent them from doing any harm. This author asserts, that they really possess the power of enchanting animals, or of rendering them motionless through terror : for he says he has seen an example even in his garden. The effluvia of these reptiles has nothing nauseous in it.

34. *Geckoes used for catching Flies.*—In Java, the inhabitants rid themselves of flies in their apartments by means of geckoes, a species of lizard, named from their cry *toké* and *gogok*, which continually pursue these insects for the purpose of feeding upon them.

35. *Heart of the Frog used for Poison.*—The Javanese, it is said, also employ the heart of the frog named *Kadok-kessé*, for



preparing a poison. The blood of other reptiles is also considered as venomous, and is used for poisoning daggers or krisses. It is known that the blood of a frog is employed by the Americans for producing variegated feathers in parrots: some of the feathers are plucked out, and the place where they grew imbued with the blood of the reptile, after which there are produced very beautiful feathers of various colours.—*Journal de Pharmacie, Mar.* 1826.

36. *Marabous.*—The beautiful feathers so much in request for ornaments, under the name of *Marabous*, belong to the tail of certain storks, the *Ciconia Marabou.* These birds are tamed and kept in large flocks in Bengal, and the islands of the great Indian Archipelago, and afford so extensive an article of commerce, that many of the natives subsist by it. The plumes of *Ciconia Argala* in Africa, and those of some other species, are inferior in beauty, and less esteemed.

37. *Irish Elk.*—Many facts prove that the quadruped population of Great Britain, Ireland, and even of some of the neighbouring large islands, was, geologically considered, at a comparatively recent period, very different from what it is at present. But these changes do not appear to have been confined to quadrupeds alone; for particular species of birds, formerly inhabitants of this country, have disappeared, and their fossil remains, we doubt not, will be found in our newer clays, marls, and calcareous tuffas and sinters. These alterations in our native quadrupeds and birds, must, we maintain, have been accompanied by similar changes in the lower classes of animals, and the time is not distant when we shall have enumerated, as occurring in the newer alluvial deposites, fossil amphibia, fossil fishes, and numerous fossil avertebral species, formerly inhabitants of the land and waters of our European empire. It is indeed probable, that not a century passes which is not marked in this country by the loss of some species, not only of animals, but also of plants, and the acquisition of others. An extended view of this subject affords a series of historico-geological facts, that lead to many beautiful views in regard to the history of those changes that have taken place, and are still going on, among the animals and vegetables, and also in the climate, of the earth. The most striking of our recently lost quadrupeds is unquestionably

the *Irish Elk*, the fossil remains of which are found in alluvial deposites of comparatively modern date. Many years ago, skulls and single bones of this gigantic and elegant species were collected and described by naturalists, but it is not more than four or five years since nearly perfect fossil skeletons were met with. Of these, two only have been preserved, the one deposited in the Royal Museum of the University of Edinburgh, the other in the collection of the College of Surgeons in Dublin. As the specimen in the Edinburgh Museum was for a time the only one in any collection, we had a drawing and engraving made from it, and of which a copy is given in the present number of the Journal (Plate II.) It is 6 feet high, 9 feet long, and in height, to the top of the right horn, 9 feet 7½ inches. Remains of this deer have been met with not only in England, Ireland, and the Isle of Man, but also in France, Germany, and Italy; and in all these countries in similar geognostic situations,—thus shewing that the species, in all probability, lived about the same time in Britain, Ireland, and the Continent of Europe.

BOTANY.

38. *Pluvial Trees.*—In the old accounts of travellers in America, related also by Thévet in his Cosmography, mention is made of a tree which attracted the vapours of the atmosphere, and resolved them into rain among the parched deserts. These accounts were regarded as fabulous. In Brazil there has been found of late a tree, the young branches of which exude drops of water, which fall almost like rain. This tree, to which Leander has given the name of *Cubea pluviosa*, is referred by M. Decandolle to the genus *Cæsalpinia*, belonging to the family of Leguminosæ, in his *Prodromus*, vol. ii. p. 483. Other vegetables also, such as *Calamus rotang*, and the climbing lianas, the vine, and other sarmentaceous plants, afford drops of water in abundance, at the period of the sap, especially when they are cut.

39. *Sensitive Tree.*—The genus *Cæsalpinia*, which furnishes the dyewoods of Pernambucca and Sappan, also presents a species, the leaves of which are nearly as sensible to contact, as the sensitive plants of Malabar; it is the *Cæsalpinia mimosoides* of Lamarck.

40. *Poisoning of Plants.*—Vegetables are susceptible of losing their contractile faculty, from the action of the distilled water of rose-laurel, as Carradori observed : Thus, the distilled water, or still more the volatile oil of rose-laurel, destroys the whole power of contraction possessed by the capsules of *Momordica Elaterium*, and *Balsamina hortensis*. M. Marcet of Geneva, on applying an aqueous solution of opium to sensitive plants and others, observed that it also destroyed the action of vegetable life. Whence Carradori concludes, that plants have contractile muscular fibres, and M. Marcet imagines, that vegetables possess something analogous to a nervous system, since the first of these poisons operates upon the contractility, and the second upon the sensibility, in animals as in vegetables.

41. *Leguminosæ.*—By this time, perhaps, the second volume of the *Prodromus Systematis universalis Regni vegetabilis* is in the hands of most botanists in Europe; but few, we believe, will find it an easy task to study it. The arrangement, although founded on the principles developed by Brown our countryman, and Brown in Germany, becomes extremely embarrassing to the student who has not carefully perused these, and other memoirs on this difficult order. To obviate these difficulties, and to explain the various reasons which induced him to change so many of the hitherto almost universally received genera, Prof. De Candolle is engaged at present in publishing a separate work * on the subject ; we allude to the *Memoires sur la famille des Legumineuses*. These memoirs were originally read before the Society of Natural History of Geneva, and were intended to be inserted in the *Memoires du Mus. d'Hist. Naturelle*. Their great extent, and the number of plates (when complete, there will be seventy plates and fourteen memoirs, forming a volume of about 500 pages quarto), prevented such being carried into effect,—fortunately for the botanists who do not find it convenient to take that voluminous and expensive work. We have only yet had a perusal of the six first memoirs. The first is on the general characters of the Leguminosæ, taken from their organs of

* Published by Belin, Rue des Mathurins, S. I. No. 14. Paris.

*vegetation** and fructification. On both of these, Decandolle has presented us with an account of all that has been discovered by others, or by himself. The following is a concise view of what he has said on the first point; and, it must be recollected, that, without the aid of his plates, it is impossible to enter into any details. The roots are nearly all fibrous and branched, but, in some annuals, simple; sometimes they are tuberous, and subject to three different modifications. The stems are exceedingly varied, from a tender annual to a tree of sixty feet high; but the branches are usually either longitudinally striated or angled. The leaves seem to present very striking differences. The first leaves, or lobes of the cotyledons, are either opposite or alternate; but, in maturity, the leaves of nearly all the species of the family are alternate. As to their composition, they are either, (1.) simply pinnated, without an odd one; (2.) simply pinnated, with an odd one; (3.) palmated; (4.) twice or thrice pinnated, which have very rarely an odd leaflet. That the number of times the pinnation takes place is irregular, Decandolle happily illustrates in Plate I. by the genus Gleditsia. M. Decandolle denies that the Leguminosæ have simple leaves, but he enumerates six different ways by which a leaf really compound may be taken at first sight for a simple leaf. It has been long known, that what many take for a simple leaf in this family, is only a dilated petiole, or what Decandolle calls a *phyllodium.* The hairs and glands on the Leguminosæ present few variations; but the spines very many.—On what regards the fructification, we must refer to the book itself. Of the disposition of the flowers, the soldering of the sepals and petals, their regularity or irregularity, the combinations or number of the stamina, we can give no short account; nor shall we enter upon the proofs brought forward that the Leguminosæ, when they have only one carpell, have so only by abortion of some others. The second memoir is on the germination of this family. This memoir is full of interest, and tends to shew that the germination ought to be closely attended to in the classification of these plants; and we are even furnished

* This term, as far as we know, has no other more precise English term; it refers to all the parts of a plant, except those concerned with the flowers and fruit.

by the author with an arrangement which might be derived solely from the germination; in some cases it is artificial, but for the most part natural. The comparison of the Leguminosæ with the families with which they are allied, occupies the third memoir. Their relation with the Terebinthaceæ and Rosaceæ are fully pointed out; but although we have no wish to unite them with either of these two families, it scarcely appears to us that any definite characters are yet pointed out, which can be at all of service to the student of the artificial method. We believe, however, that this will be again taken up in a future memoir. The fourth memoir is on the mutual relations of the Leguminosæ, and their subdivisions. The fifth memoir contains a review of the tribe called Sophoreæ, while the sixth is devoted to that of the Loteæ. These two last, to many, are the most interesting that have yet appeared: each genus is passed under review: the characters of the new or little known genera are developed; and if the old ones are divided, or the species changed to others, the reasons are entered upon. We understand that, in the subsequent memoirs, other tribes will be treated in a similar manner.

ARTS.

42. *On the liability of English Silks and Cottons to become faded; and on the superiority of the Silks of France, and the Cottons of India in that respect.*—The cause why English silks or satins do not retain their colour or whiteness, so long as those of French manufacture, cannot reasonably be attributed to the change of climate, as, in that case, it should equally affect both. Silks or satins of French manufacture will be found as fit for use, after a period of twelve or fifteen months, as when first imported; while those manufactured in England, will have so completely changed, as to be rendered useless for any article of dress. The white will have assumed an unsightly yellow tinge, and the coloured will be found to have faded considerably. It is probable, that the fault originates, in a great measure, from the method used in extracting the varnish or gum from the raw silk: and, perhaps, also from some slight inattention in the process of bleaching it afterwards. It can scarcely be thought that so delicate an article as silk, must not suffer, more or less,

from exposure to the action of sulphurous acid gas, or immersion in acid, according to the degree of strength or purity of the substance used, as well as from the length of time the article is submitted to the action of the gas or acid. The silks manufactured at Madras, are all of an imperfect white, but last much longer than English or French. The coloured silks are scarcely inferior, and stand as well as the best of European manufacture. The scarlet, purple, orange, and other silk shawls, from Bangalore, are really beautiful, and the colours permanently fixed. It is also worthy of remark, that the English long-cloths, muslins, jaconnets, &c. never retain their original whiteness for any length of time, but assume a yellow tinge, which they do not recover by any process of washing. Some pieces, after a few washings, are full of small holes; and it is an incontestible fact, that one piece of good northward 36 Penijum, will wear out three pieces of the best English long-cloth. No chemical process is used for giving their cloth an artificial whiteness: they are delivered from the loom dirty and brown, and when returned from the washerman are as white as snow. The advantages which the English cloths possess, are, that they are much cheaper, and have the threads of a more even texture, and more regular. If some more attention were paid to the mode of bleaching, there is no doubt, then, that they would be of much greater consideration, and in more request than they are at present. The mode in which the bales of cotton for exportation are usually packed, may also in some measure account for the evils above mentioned. It is the general custom to compress a considerable quantity of cotton into a very small compass. This is effected by means of strong, massive iron frames, and powerful screws of the same metal, so that the cotton is found to be almost a solid mass. Although much space may be thus saved on ship-board, it is probable the cotton must be in some way injured. If this be really the case, the natives have decidedly a very material and obvious advantage in the manufacture of cloths.—*Abridged from a communication in Gill's Repository.*

COMMERCE.

43. *Fisheries of Newfoundland and Labrador.*—The *Americans* send about 2000 fishing vessels to Labrador alone. Allow that each vessel takes away 1000 quintals of fish, = 2,000,000 quintals = 100,000 tons; each vessel carries from 12 to 15 men, = 25,000 to 30,000 men; the number of seamen required afterwards to carry this fish to the various markets in the two hemispheres is very considerable. They carry on the fishery extensively at other parts here.—The *French* employ many thousand men in this fishery at Newfoundland; and a proportion of seamen to carry part of their fish to markets.—The *British:* The resident fishermen of Newfoundland are not equal in number to the American fishermen who come to the neighbourhood to fish. About 4000 British seamen are employed to carry the 60,000 tons of fish to market.—*W. E. Cormack, Esq.*

List of Patents sealed in England from 4th February to 8th May 1826.

1826,

Feb. 4. To R. Rigg, Bowstead Hall, Cumberland, for "a new Condensing Apparatus, to be used with the apparatus now employed for making Vinegar."

7. To J. C. Gamble, Dublin, chemist, for "an Apparatus for the Concentration and Crystallisation of Aluminous and other Saline and Crystallisable Solutions, part of which apparatus may be applied to the general purposes of evaporation, distillation, inspissation, and desiccation, and especially to the generation of Steam."

To W. Mayhew, Union Street, Southwark, and W. White, Cheapside, hat-manufacturers, for "an Improvement in the manufacture of Hats."

To H. Evans, harbour-master of the port of Holyhead, North Wales, for "a method of rendering Ships and other Vessels, whether sailing or propelled by steam, more safe in cases of danger by leakage, bilgeing, or letting in water, than as at present constructed."

To B. Cook, Birmingham, brass-founder, for "Improvements in making Files of various descriptions."

11. To W. Warren, Crown Street, Finsbury Square, for "Improvements in the process of extracting from the Peruvian Bark medicinal substances or properties, known by the name of Quinine and Cinchonine, and preparing the various salts to which these substances may serve as a basis."

To J. L. Higgins, Oxford Street, for "Improvements in the construction of the Masts, Yards, Sails, Rigging of Ships, and smaller Vessels, and in the Tackle used for working or navigating the same."

18. To B. Newmarch, Cheltenham, and C. Bonner, Gloucester, brazier, for "a mechanical invention to be applied for the purpose of Suspending and Securing Windows, Gates, Doors, Shutters, Blinds, and other apparatus."

To J. Walter, Luton, Bedfordshire, straw-hat manufacturer, for "Improvements in the manufacture of Straw-plait, for making Bonnets, Hats, and other articles."

To C. Whitlaw, Bayswater Terrace, Paddington, medical botanist, for "Improvements in administering Medicines by the agency of Steam or Vapour."

To A. Buffum, Bridge Street, hat-manufacturer, for "Improvements in the process of making or manufacturing and dyeing Hats."

25. To J. Fraser, Houndsditch, engineer, for "an improved method of constructing Capstans and Windlasses."

To B. Newmarch, Cheltenham, for "certain inventions to preserve Vessels and other bodies from the dangerous effects of external or internal violence on land or water, and other improvements connected with the same.

To B. Newmarch, Cheltenham, for "a Preparation to be used either in solution or otherwise, for preventing decay in timber or other substances, arising from dry-rot or other causes."

Mar. 4. To J. Fraser, Houndsditch, engineer, for "a new and improved method of distilling and rectifying spirits and strong waters."

To R. Midgley, Horsforth, near Leeds, for "a Method, Machine, or Apparatus, for conveying persons and goods over or across rivers or other waters, and over valleys or other places."

To G. Anderton, Chickheaton, Yorkshire, worsted-spinner, for "Improvements in the combing or dressing of Wool and waste Silk."

14. To J. Neville, New Walk, Shad Thames, engineer, for "a new and improved Boiler or Apparatus for generating Steam, with less expenditure of fuel."

To N. H. Manicler, Great Guildford Street, Southwark, chemist, for "a new Preparation of Fatty Substances, and the application thereof to the purposes of affording Light."

April 18. To J. Billingham, Norfolk Street, Strand, civil engineer, for "an improvement or improvements in the Construction of Cooking Apparatus."

To J. Rowbotham, Great Surrey Street, Blackfriars Road, hat-manufacturer, and R. Lloyd, Strand, for "a certain method of preparing, uniting, combining, and putting together, certain materials, substances, or things, for the purpose of being made into hats, caps, bonnets, cloaks, coats, trowsers, and for wearing apparel in general, and various other purposes."

22. To W. Wood, Summer-Hill Grove, Northumberland, for "an apparatus for destroying the inflammable air in mines."

25. To J. P. Gillespie, Grosvenor Street, Newington, for "a new Spring or combination of Springs, for the purpose of forming an elastic resisting medium."

To S. Brown, Eagle Lodge, Old Brompton, for "improvements on an engine for effecting a vacuum, and thus producing powers by which water may be raised, and machinery put in motion."

To F. Halliday, Ham, Surrey, for "an apparatus for preventing the inconvenience arising from Smoke in Chimneys."

27. To J. Williams, Commercial Road, ironmonger and ships' fire-hearth manufacturer, for "improvements on ships' hearths, and apparatus for cooking by steam."

To W. Choice, Strahan Terrace, auctioneer, and R. Gibson, White Conduit Terrace, builder, Islington, for "improvements in machinery for making bricks."

29. To C. Kennedy, Virginia Terrace, Great Dover Road, Surrey, surgeon and apothecary, for "improvements in the apparatus used for cupping."

May 2. To J. Goulding, Cornhill, London, engineer, for "improvements in the machines used for carding, stubbing, silvering, roving, or spinning cotton, waste silk, short stapled hemp and flax, or any other fibrous materials, or mixture thereof."

6. To A. Buffurn, Javin Street, hat-manufacturer, and J. Maccardy, Cecil Street, Strand, for "improvements in steam-engines."

To Sir R. Seppings, Somerset House, for "improvements in the construction of Fids, or apparatus for striking topmasts and top-gallantmasts in ships."

To W. Fenner, Bushell Rents, Wapping, carpenter, for "an improvement in machinery for curing smoky, and cleansing foul chimneys."

To A. Allard de la Court, Great Winchester Street, for "a new instrument, and improvements in certain well-known instruments, applicable to the organ of sight."

To J. Schaller, Regent Street, ladies' shoemaker, for "improvements in the construction or manufacture of clogs, pattens, or substitutes for the same."

8. To E. Heard, St Leonard, Shoreditch, chemist, for "a certain new composition to be used for the purpose of washing in sea and other water."

List of Patents granted in Scotland from 20th March to 26th May 1826.

1826,

Mar. 20. To William Thomson and James Thomson, of Fountainbridge Street, Edinburgh, cabinet-makers and joiners, for an invention of "a Series of Machines, and certain Implements and Tools capable of performing cabinet-makers' work, joiners' work, and carpentry work, and which machines and instruments or tools may be applied with advantage to various similar purposes."

21. To William Erskine Cochrane of Regent Street, in the county of Middlesex, for "an Improvement in certain Cooking Apparatus."

May 6. To Samuel Brown of Eagle Lodge, Old Brompton, in the county of Middlesex, gentleman, for "certain Improvements on his former patent for an Engine or Instrument for effecting a vacuum, and thus producing powers by which waters may be raised and machinery put in motion."

To Henry Richardson Fanshawe, of Addle Street, in the city of London, silk-embosser, for "an Improved Apparatus for spinning, doubling, and twisting or throwing silk."

To John Martineau junior, of the City Road, in the county of Middlesex, engineer, and Henry William Smith, of Laurence, Pountney Place, in the city of London, Esq. for an invention of "certain Improvements in the manufacture of Steel."

9. To William Parr, of Union Place, City Road, in the county of Middlesex, gentleman, for "an Improvement or Improvements in the mode of propelling vessels through the water."

To Joseph Alexander Taylor, of Great St Helens, in the city of London, gentleman, for "a new Polishing Apparatus for household purposes."

20. To Francis Molineux, of Stoke Saint Mary, in the county of Somerset, gentleman, for "an Improvement in Machinery for spinning and twisting silk and wool, and for roving, spinning, and twisting flax, hemp, cotton, and other fibrous substances."

To Alexander Lamb, of Prince's Street Bank, in the city of London, and William Suttill, of Old Brompton, in the county of Middlesex, flax-spinner, for "Improvements in machinery for preparing, drawing, roving, and spinning flax, hemp, and waste silk."

26. To Thomas Shaw Brandreth of Liverpool, in the county of Lancaster, Esq. barrister at law, for "an improved mode of constructing Wheel Carriages to be used on Rail-roads, or for other similar purposes."

To Joseph Eve, of Augustus Georgia, in the United States of America, now residing in Jewin Street, in the city of London, engineer, for "an improved Steam-Engine."

P. Neill, Printer.

THE

EDINBURGH NEW

PHILOSOPHICAL JOURNAL.

Biographical Memoir of the late Christian Smith, *M. D. Naturalist to the Congo Expedition.* By Baron Leopold Von Buch.

Christian Smith, son of a wealthy proprietor in the neighbourhood of Dram in Norway, was born on the 17th October 1785. Under the prudent management of his father, his talents were early unfolded; and in his fourteenth year, he was sent to the school at Kongsberg, which enjoyed a well-merited reputation. Here he made such progress in his knowledge of the ancient languages, that, in a short time, he wrote Latin with almost as much facility as his mother-tongue. As early as 1801, his father sent him to Copenhagen, where the celebrated Vahl, soon finding what a proficient might be made of him, became his counsellor and friend, and determined him to devote himself exclusively to the study of Botany. The knowledge of Mosses and Lichens, so abundant in his native country, had especially attracted his attention, to which he was the more fully determined, by the discovery of some plants, till then unknown, in the neighbourhood of his native city, which were given to the world in the Flora Danica. Not all the advantage he enjoyed for acquiring practical knowledge as a physician, in the management, from the year 1804, of the Frederick's Hospital in

Copenhagen, could prevent him from accompanying his friends Hornemann and Wormskiold on their botanical journey into Norway. They explored some of the most impervious valleys in the country, and made a number of new discoveries; and when, in 1807, the breaking out of the war between Denmark, England and Sweden, obliged the friends to return to Copenhagen, Smith proceeded again into the mountains of Tellemark, and brought from thence so many unknown mosses and lichens, that, from that time, he became known to all the botanists of the north, and his reputation among them was thereby fully established.

Want of scientific resources brought him back to Copenhagen, during the misfortunes of his native country. No sooner, however, was quiet restored, than he hastened again into the mountains of the north, and undertook, in 1812, a most arduous journey through Tellemark and Hallingdal, over the chain of mountains down to the west coast. These mountains were little known, even in the country itself. Their height had never been measured; their productions never been described; and little more was known of them than from the accounts of the fatigues and dangers to which the peasants of Hardanger were exposed, when they proceeded with the productions of their valleys over the range to Kongsberg. Smith, incited in the highest degree, by the striking and comprehensive views of Humboldt regarding the geography of plants, which have had so decided an influence on the researches of botanists, examined these mountains in the capacity both of an attentive naturalist who generalizes and combines, and of an experienced botanist, from whose notice the minutest plant does not escape; and was thereby enabled to give a narrative of this journey, which will ever remain one of the most instructive and remarkable for physical geography *.

In it, he places the mighty influence of the neighbourhood of the sea in a clear light, and the very remarkable distinction thence arising, between the climate of the continent and that of the sea-coast. To the severe winter, on the east side, summer succeeds, in a few weeks, with continual clear and serene wea-

* Topographisk-statistiske Samlinger, udgivne Selskabet fur Norges, vel den Deels 2 det Bind. Christiana, 1817.

ther. The sun of an almost perpetual day calls forth a multitude of leaves and flowers, which would scarcely be expected in so northern a latitude. On the contrary, on the other side of the mountains, the sea always open, moderates the severity of the winter, and the constant winds from the west and south, coming over the ocean, heighten the temperature of the coasts. But they cover them, at the same time, with fogs and clouds, which intercept the genial influence of the sun, and thus permit to the warmth of summer a short duration, and limited effect. Smith shews how much this influence manifests itself, in the productions of vegetation in the different heights at which trees grow, and the limits of perpetual snow. For these, in fact, are much more determined by the warmth of summer than by the cold of winter; and hence, when their various heights are ascertained, we gain a pretty accurate knowledge of the state of the valleys and plains below. Smith first ascended Goustafield in Tellemark, the highest mountain in the south of Norway, and found it 5886 Parisian feet high; and the snow line he ascertained at about 4740. On the great chain which separates Tellemark from Hardanger, the snow line did not reach to 4650 feet; and on Folge Fonden in Hardanger, which is almost surrounded by arms of the sea, it had sunk so low as 4036. A great number of annual plants, however, and such as are able to endure the severity of the winter, but which, at the same time, so soon as the sap has ascended, require uninterrupted warmth, to put forth leaves and flowers, is found on the east side, and wherever the snow line is at a considerable elevation. Such bushes and plants, on the other hand, and all such as retain their leaves in winter, or at least as shed them late in the season, but which require no great warmth in summer for their support, flourish especially in the softer and more uniform climate of the sea-coast. The former enjoy the climate of the plains of Russia, the other of the flats of England and Scotland, of which the appearance of the birch affords a very palpable and striking example. Vigorous enough to set the severity of a Siberian winter at defiance, it requires, however, uninterrupted warmth to put forth its leaves; and when these are unfolded, they are so tender that the slightest return of frost is hurtful, if not altogether destructive to the growth of the tree. Hence the climate of the coast is not well suited to it, and the limits of its growth will sink, on that account, in proportion as the warmth of the summer is diminished. Smith shews this with the barometer in his hand. He found the limits of the birch in 60½° north latitude, to be at the height of 3384 Parisian feet. Some miles farther on, in the direction of the great mountain chain, birches already disappear at the height of 3325. In descending towards the sea, over Ulensvang, its limit is found to be 2803. On the west side of Folge Fonden, it descends to 1837. Lastly, it is found at only 1776, on the Goennequiting, near Tuse, which lies within sight of the ocean. Here the birch can only reach half of its height on the east side. With this warmth of summer, however, disappear the magnificent forests of pine (abies): in the valleys are no longer to be seen the showy flowers of Aconitum Lycoctonum, of Pedicularis sceptrum Carolinum, or of Pedicularis Oederi, otherwise so common on the eastern side of Norway. There is no longer to be found Andromeda hypnoides, Menziesia cœrulea, Primula stricta (Horn.), Lychnis apetala, Viola biflora, Aira subspicata, Carex rotundata, Juncus arcuatus (Vahl), Splachnum serratum, luteum, rubrum, &c. plants which unite the east side of Norway with Russia and Siberia. On the other hand, the vegetation of Scotland appears on the mountains of the west side. These are quite covered with the Scots fir (Pinus sylvestris), while the vales in the neighbourhood of the sea are adorned with the beautiful Digitalis purpurea, which is unknown in other parts of Norway. On the declivities of the hills, Hieracium aurantiacum spreads its golden flower, and Gentiana purpurea is of frequent occurrence, which no one would scarcely have expected to find beyond the Alps. Bunium bulbocastanum, Anthericum ossifragum, Sedum anglicum, Chrysosplenium oppositifolium, Centaurea nigra, Hypericum pulchrum, Erica cinerea, Rosa spinosissima, Lycopodium inundatum, all plants which would be sought in vain where the birch ascends to 3000 feet high, but which are common in the British Isles, are not unfrequent and often quite common in the districts on the sea-coast of Norway. Even Ilex aquifolium and Hedera helix, which cannot survive the winter in a great part of Germany, thrive excellently on the west coast of this country.

After Smith has unfolded with perspicuity circumstances equally instructive for the natural history of the globe, as for the culture of trees and plants in a given climate, he directs his course to the magnificent glaciers of Justedal in Lat. $61\frac{1}{2}°$, and gives almost a complete description of them. Thence he bent his way through the vale of Walders, back to his native city of Dram.

This journey excited attention. The Patriotic Society, convinced of the utility of such undertakings, enabled Smith, in the following year, 1813, to attempt a similar one; and he entered on it with pleasure, because the interests of science appeared to be thereby identified with those of his country. During the greater part of the summer he perambulated the mountains under 62° of latitude, lying between the valleys of Walders, Guldbrandsdal, and Romsdal, which, from their height, extent, and solitariness, had remained so much unknown, even to the nearest inhabitants, that heretofore they, with the valleys they inclose, could be very imperfectly designed upon the maps. The Flora of Norway hereby gained many new species which had not before been observed in this country. In the end of summer he descended into the imposing valleys of Romsdal, to occupy himself with the productions of the sea, in the neighbourhood of Molde; and the advanced period of the season did not prevent him from twice crossing the chain of the Dovrefield, as far as the Nomadic Laplanders. Every where, on these excursions, he collected the inhabitants of the higher valleys, and taught them the distinguishing marks, value, and properties of the lichens that cover their mountains. He shewed them the process how to make a wholesome bread from these lichens, which is at once nutritious and pleasant to the taste, and persuaded them to reject the miserable resource of bread from bark, which supports a wretched existence at the expence of health. The end of the year brought him back to Dram.

The loss of his father, a short while after his return, put him in possession of a small fortune, which, in his opinion, he could not better employ than by seeking to improve himself by foreign travel, either by the study of nature or intercourse with the learned. His nomination as Professor of Botany in the newly instituted University at Christiana, confirmed him in his purpose; for all the fruits of his journey were henceforth devoted to the new botanic garden, which he regarded as his own. No sooner, therefore, had he landed in England at Yarmouth, and reached London in July 1814, than he set about procuring for the garden a well qualified and experienced gardener, and had the good fortune to find one in the person of a countryman of his own, who had been trained in the excellent institution at Kew. This lucky circumstance had a decided influence on all his later researches, for, after the departure of the gardener, he considered the garden as already arranged, and to it all his cares were henceforth directed. Convinced that every thing in Christiana would be carefully attended to, he collected and purchased whatever he considered in the least adapted to it; and all the arrangements of English gardens acquired double value in his eyes, when any part of them seemed to be applicable to his own. The advanced state of the season, however, did not permit him to remain long in London. In August he went to Edinburgh, and a few days thereafter to the Highlands of Scotland, to have an opportunity in particular of examining the mosses peculiar to the country. He visited Loch Tay, ascended Ben Lawers, surveyed the celebrated Shehallien, and penetrated as far as Ben Wyvis in Ross-shire, a place but seldom visited. Then he ascended Ben Nevis, the highest mountain in Scotland, saw the venerable naturalist Dr Stuart at Luss, and returned to Edinburgh after an absence of five weeks. The profound knowledge of cryptogamic plants possessed by Dr Taylor, called him from hence to Dublin. On returning he passed through Carlisle, Cumberland, and Wales; and, after a short stay by Liverpool and Oxford, arrived in London in the month of December 1814.

The Congo expedition, after he had fairly resolved to accompany it, had filled him with the greatest hopes. These appeared to be the more confirmed the farther it proceeded. Captain Tuckey was a man of a scientific education, and of great politeness, whose society afforded him both pleasure and instruction. Willingly would the former have granted him a few days to examine St Jago, one of the Cape Verd Islands, where, on the 9th April 1816, the ship cast anchor for the first time after her departure from England, if his instructions, as well as his own wish, had not made it his duty, to hasten the arrival of the expedition in the Congo. The little, however, which Smith saw, in a single day, on the mountains of the island, forms a considerable addition to our knowledge. In July the ships reached the mouth of the Congo. Captain Tuckey sailed up the river as far as was practicable, but even their progress in boats was soon arrested by rapids; whereupon he determined to advance along the river by land, with a company of forty men. The excellence of the climate facilitated the undertaking, and the vegetation becoming always richer and more beautiful, inflamed the zeal of the indefatigable botanist. "Every thing is new," he wrote in his journal; "one can only collect and behold;" and, truly delighted with the river and the mountains, he was quite confounded when the Captain declared it to be necessary to return. The hope of obtaining sufficient supplies either from the negro inhabitants or from the chace, had entirely failed; the stores they had carried with them did not admit of their advancing farther: it was even too late to return; their provisions no longer sufficed to bring them to the ship's anchorage. Want, anxiety, hunger, fatigue, produced at last a fever, which spread rapidly and consumed their yet remaining strength. Smith sought to maintain himself by liveliness of spirits. Always cheerful, he inspired others also with courage, and wished even to animate them by his example. But this he was no longer able to do. Whenever he had made a few steps he fell down, and at last could no longer raise himself. He was obliged to be carried, and even in this condition he constantly encouraged his remaining companions, always cherishing the best hopes for them all. In this manner he and Captain Tuckey, with a few attendants, reached, on the 17th September, the place where the Congo lay at anchor. On the 18th both were put on board the transport Dorothea, which afforded them greater convenience. Captain Tuckey died soon after. Smith was very much depressed, and very weak. On the 21st, the gardener Lockhart (from the garden at Kew) came to him, and heard him speak much and long in Norwegian, which he did not understand. This was considered to arise from the heat of the fever, and medicines were offered to him. To which he made answer, very distinctly, in the last words he was heard to utter, "I have demanded what could be useful to me, and it has not been given."

On the 22d September, a few moments after the Dorothea had weighed anchor, he died, far from relations and friends, and attended by no sympathising soul. His remains were sunk in the river, with the customary ceremonies, at the place which has been called "The Tall Trees."

His collections and journals have been saved and used to advantage. There could scarcely have been a more splendid monument erected to the memory of this lamented naturalist, than the distinguished memoir of Robert Brown, respecting Smith's collections and observations in Congo. He thereby occupies, as is remarked also by Brown, an honourable place among the band of northern naturalists who now encircle the whole of Africa with their discoveries, from Egypt to the coast of Barbary, through Morocco, Guinea, and the Cape, back again to the Red Sea. For since Smith, by his discoveries in Congo, has filled up the gap which formerly separated Guinea from the Cape, in respect of our knowledge of African plants, the observations of Hasselquist, Vahl, Schousboe, Afzelius, Tonning, Isert, Smith, Sparrmann, Thunberg, and Forskaal appear with increased interest, and, associated with these distinguished naturalists, Smith will always be named with peculiar honour and renown, as one of the martyrs of botanical science *.

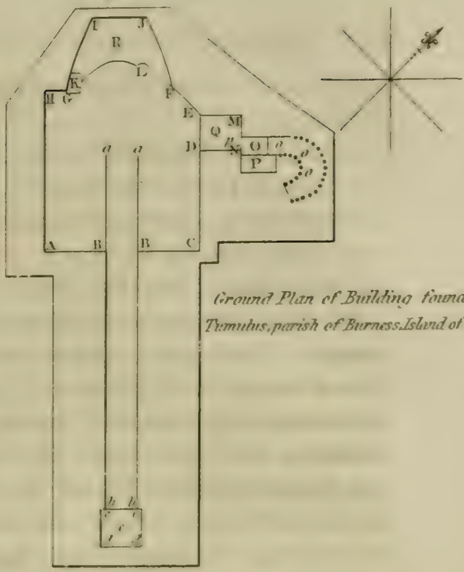
Description of the contents of a Tumulus in the Parish of Burness, Island of Sanday. By WILLIAM WOOD, Esq. Surgeon, Island of Sanday. (Communicated by Dr WILLIAM HOWISON).

THIS tumulus, like many of the same outward appearance, was situated on the slope of a gently rising ground, close at the head of a fresh-water loch, which is commonly dry during the summer months. It was about a mile from the sea, with rising grounds intervening. It was nearly circular at the bottom, and approached gradually to an apex, which appeared as if sunk

* From Leopold Von Buch's "Physicalishe Beschreibung der Canarischen Inseln." 4to. Berlin, 1825.

Edinr. new Phil. Jour. Vol. 1. p. 217

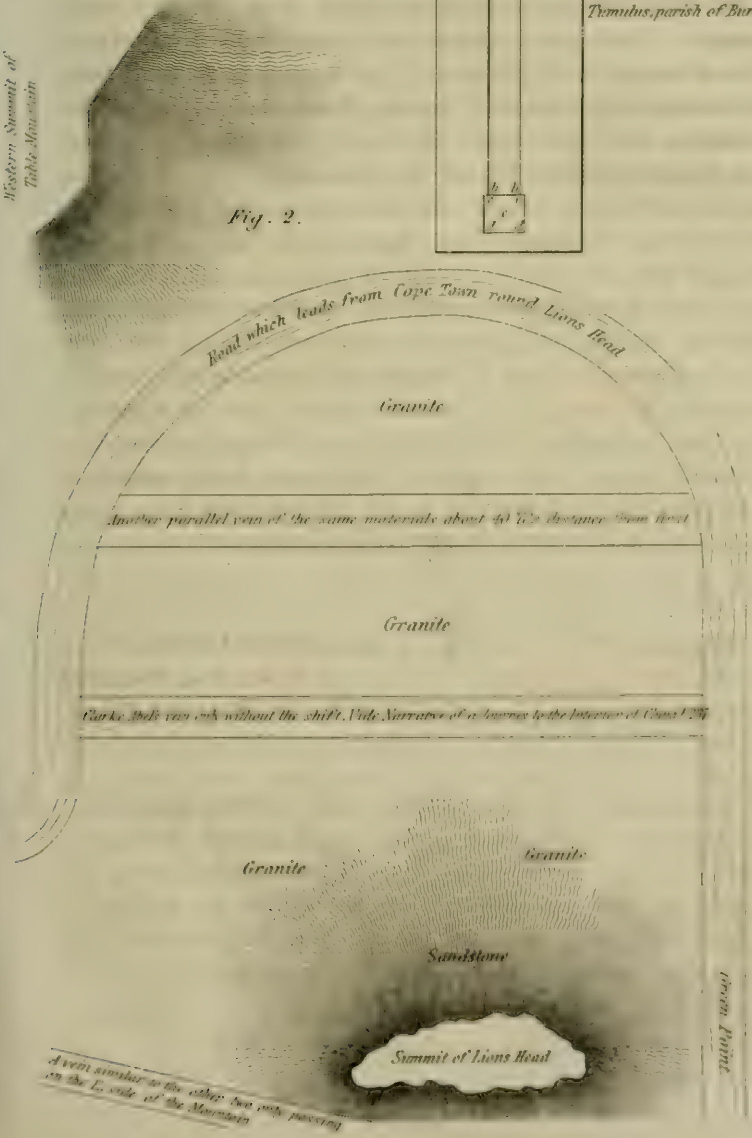
Fig. 1.



Ground Plan of Building found in a Tumulus, parish of Burness, Island of Sanday

A Plan of some veins crossing the Granite forming the base of Lions Head direction nearly N.N.W. that on the Eastern aspect a little more Northerly

Fig. 2.



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about a foot. It measured eighty-five feet across at the base, and not much above six feet in height at the highest part, which was a little removed from the centre, in a northwest direction. It was covered with short grass. One or two more tumuli are in the immediate vicinity. The ground around is mostly barren moor-land.

The cottars in the neighbourhood have, for four or five years past, been occasionally removing earth and stones from the edge of the tumulus,—the earth for improving their little patches of land,—the stones for building and repairing hill dikes. They have never seen any regular building till this summer; nor have they found any thing but what they were in search of—earth and stones. An old man, indeed, some months ago, found, a few feet from the edge of the tumulus, a ring of black earthenware, large enough to go round hisw rist; it was finely polished and very hard, according to his account; he broke it to ascertain its composition, and has since lost it. The same man also describes a vennel or drain running at right angles with the drain we discovered; it was on the south-east of the tumulus.

The tumulus, I have already hinted, was formed of stones and earth. The stones were mostly rounded stones from the sea-shore, and seemed all to have been subjected to the action of fire; the earth was black, and in many places mixed with ashes. After removing many cart-loads of stones and earth, we came to the building, a ground plan of which I have attempted, (Pl. III. Fig. 1.), and which I shall now describe as accurately as I can.

The principal part of the building consisted of one square apartment, in one end of which there was a fire-place R; on the right hand side it communicated with a small cell; a drain *a a* commenced nearly at the fire place, and ran in a south-east direction towards the loch; at the outer extremity of the drain *b b* was another small cell.

The dimensions of the principal apartments may be judged of from the plan. The height of the walls we could not ascertain; they were, when we examined them, about three feet high, and did not appear ever to have been much higher: they were two feet thick, composed of roughly dressed stones, cemented with clay;

in the inside a flat stone, six inches thick, and about three feet broad, reaching from A to H, stood on edge; it was also cemented to the outer wall with clay. All the walls of the principal apartment were thus lined, except at the fire-place.

A space, the breadth of the drain, between B B, was left, evidently for a door; there was no appearance of a window in any part; neither was there any thing like a roof.

The walls at the fire-place were built, like the other walls, from the ground to the height of a foot and a half; when another form of building commenced with large flat stones, without cement; they were so placed, that the one above overlapped the one below an inch or two, thus gradually contracting the vent, till at last, at the height of five feet, only an opening, six or seven inches wide, was left. The vent had only three sides, or rather a back wall and two side walls; it was open next the principal apartment. The fire-place itself was raised a foot from the floor, built of rough stones which had suffered from strong heat: they crumbled down on being rubbed between the fingers. At one side of the fire-place was a large stone K, as if for a table or seat; at the other side a small semicircular recess L. The floor of this apartment was composed of clay, which appears to have been taken from the loch already mentioned, where it abounds.

The drain, which commenced near the fire-place, was only a few inches deep, built with rough stones of various sizes, and covered with flag-stones level with the floor; it contained a considerable quantity of very fetid water At the outer end of the drain there was a small cell (*e*); it had no communication with the drain; the sides of it were formed of four flat stones, about two feet high, set on edge, and not cemented together. The bottom of it was considerably below the level of the drain, and formed of clay.

The cell Q had one side open to the principal apartment; it was lined on all sides, top and bottom, with flag-stones, except the opening, which measured about two feet six inches both ways; the depth of this cell from the level of the floor of the principal apartment to the bottom, was two feet five inches: from the top of the cell to the bottom four feet eleven inches. Outside of the flat stones there was a rough wall, built as in the principal apartment. The flat stone forming the upper half of the back of this cell, was perforated at its lower edge, with a semicircular aperture (*p*), three inches and a half in diameter, which communicated with a passage about a foot square, covered partly with a flat stone (O), and partly open. One side of this passage was formed by a large stone (P) ; the other side was formed by the wall built at the back of the cell. The semicircular part marked in the plan with dots, (....*o o o*) being in a very ruinous state, could not be examined accurately, but there has been some building at this part.

The whole of the inside of the building was filled with black earth, ashes, burnt roots of heath, and burnt stones; two or three pieces of straw were found imbedded in lumps of ashes. An iron nail was found at the fire-place;—it may have fallen from the opening at the top of the vent at a more recent period, but it was imbedded in a solid lump of ashes. Several bones were found at the fire-place, also imbedded in ashes; among them were vertebræ, ribs, and leg-bones of domestic animals, part of the under jaw of a hog, and many teeth. There were no human bones.

The cell Q was filled to the level of the floor of the principal apartment with rounded *unburnt* stones; a deer's horn, and two leg-bones of some of the lower animals were found, about half way down among these stones. There was also, in this cell, a considerable quantity of black, unctuous earth, very wet, and of a fetid odour. The horn was soaked with water, and could not be lifted entire. Above the level of the floor, this cell was filled with burnt stones, &c. as in the rest of the building.

Such is the account of what was seen. I do not hazard even a conjecture as to the use of this relic of antiquity. The building, I consider to be of an older date than its covering, which appears to have been thrown over it at a more recent period, but still ages ago, for some particular purpose, which, with the use of the building itself, I fear, will for ever remain unknown.

Island of Sanday,
27th June 1824.

Observations on the Anatomy of the Corallina opuntia, *and some other species of Corallines.* By Professor Schweigger.

Since the time of Cavolini no writer has examined the structure and economy of zoophytes with more attention than Professor Schweigger of Konigsberg, (Anatomisch-physiologische untersuchungen uber Corallen, Berlin 1819.) He has made himself acquainted with the observations and discoveries of his predecessors and cotemporaries in every European language; he has carefully examined the animals in the living state with the assistance of the microscope, during his extensive travels, particularly during his residence on the shores of the Mediterranean; and he has perused with equal care and minuteness the collections preserved in the Museums of Great Britain, and of the Continent, but more especially those of the late Sir Joseph Banks, and of the Natural History Museum of Paris. The doubtful nature of corallines he has made a subject of particular inquiry. These singularly hard organized substances are regarded as animals by most modern systematic authors, as Cuvier, Lamarck, Bosc, Lamouroux. The experiments, however, and microscopical observations of Schweigger on their internal organization, add great probability to the opinions formerly entertained by Pallas, Spallanzani, Cavolini, and Olivi, who, from their own observations on living corallines, regarded them as plants. Schweigger's observations have been chiefly confined to the *Corallina opuntia*, *C. rubens*, and *C. officinalis*. On the 6th of October he collected a portion of the *C. opuntia* Pal. on the coast of the Mediterranean, between Nice and Villefranche, growing on rocks from 1 to 3 feet under the surface of the sea; the specimens were of a bright green colour, and so very flexible, that one would have taken them at first sight for alcyonia.

The outermost divisions of the branches were for the most part very small, transparent, and almost destitute of calcareous matter; others had a thin white covering, often confined to particular places, and were still flexible, though in a less degree. The lowest portions of the branches appeared the oldest, both externally and by their calcareous interior, and had the leathery texture we generally observe in specimens of the *C. opuntia* preserved in museums. On dividing the green stalks, a number of filaments and a bright green parenchymatous substance could be distinguished with the naked eye. Under the microscope, the filaments appeared as succulent fibres or soft narrow bands interwoven and branched irregularly. In the recent state, the filaments had a great resemblance to the soft fibres of the *Alcyonium bursa*, Linn. (now considered a plant) ; as they became dry however, particularly in the older branches which had hardened by their copious deposit of calcareous matter, the filaments appeared jointed, and this was especially observed in the latter, on removing the lime by means of nitric acid. In this state their resemblance to the filaments of confervæ and the vessels of fuci was obvious. The vegetable nature of the *Cor. opuntia*, appeared still more distinct in its general structure. The outer covering appeared under the microscope, uniform or striated longitudinally, the striæ being composed of short canals or cells ranged above each other in irregular lines. These lines are undoubtedly mere remains of the cellular texture left attached to the inner surface on removing the covering. The structure of the cellular substance distinctly indicates this coralline to belong to the vegetable kingdom. The parenchyma is seen to be composed partly of globular, partly of pentagonal or hexagonal cells, precisely as we find it in the generality of plants, but never in animals. The soft filaments above described are extended between these cells. The younger the branch is, the more distinct is this structure, the cells in the young state being soft and green ; but, after the lime is deposited in the cellular tissue, the cells become almost undistinguishable ; by removing the lime with acids, however, they are brought again into view, more or less distinctly, according to the age of the branch. In young portions we discover a number of minute granules in the cellular texture between the filaments. They are not perceived in older branches ; and, even when the lime is removed, they are still either imperceptible, or are observed in much smaller quantity than in the former. These granules are obviously not calcareous, since they do not disappear when the young branch is immersed in nitric acid. In their general appearance, and in the circumstance of their collecting principally in the youngest portions, they exhibit a striking resemblance to the granular matter observed in the cellular substance of plants, especially in the youngest shoots, but which likewise becomes less as the plants advance in growth. This species of coralline can be regarded therefore only as a marine plant, composed, like many other plants, of distinct articulations, but which gradually assumes the appearance of a coral by the deposition of lime in its interior.

The structure of the other corallines is similar to that of the *C. opuntia*, excepting that, in proportion as the articulated parts become smaller, the cells are less numerous, and the coralline is found to consist almost entirely of filaments and calcareous matter. The *Corallina rubens*, Lam. was frequently examined by Schweigger in the Mediterranean, particularly in the Gulf of Spezzia, where he often collected transparent young specimens. These are distinctly composed of parallel filaments, which extend through the joints and digitations without interruption from one end to the other. The delicacy of these young plants did not admit of their being divided by a longitudinal section, which was likewise unnecessary from the branches being sufficiently transparent when examined singly. No trace of the cells of polypi could be detected, nor any resemblance to the structure of those zoophytes which contain polypi. The whole plant may be considered as a petrified conferva, having gradually become consolidated in the course of its growth. The structure of the *Corallina officinalis*, which abounds in the Mediterranean, is similar to that of the *C. rubens*, but is more difficult to examine, as it becomes consolidated more quickly, and in a higher degree. Schweigger never found this species transparent, but when he immersed it in acids, and examined it under the microscope, it exhibited the same kind of structure as the other corallines, though not so distinctly.

The deposition of calcareous matter in the corallines appears to proceed from the surface inwards. The outer covering is observed opaque at particular places, as if incrusted, while the substance within is green throughout, and contains little lime. The calcareous deposition proceeds more and more towards the interior, the green colour and cellular structure disappear; but, at the commencement of this calcifying process, the vegetable cellular structure can be quickly and distinctly reproduced by means of acids. The deposition of lime begins with the very first appearance of the branches, the minutest stalks of the *Cor. opuntia* were found to contain some lime, the quantity of which increased as the branches grew.

Cavolini observed on the surface of corallines minute fibres filled with granular bodies, which he took for seeds. They were likewise seen by Olivi, who thence inferred that they came chiefly from the joints. It is evident, however, that they are only filaments of confervæ, the ends of which are often covered, and imbedded in the substance of the coralline, and they frequently remain attached to it, even after the lime has been removed by acids. Lamouroux likewise observed these filaments, and found them capable of spontaneous motion. The latter observation reminds us of a similar fact mentioned by Covalini, who observed the *Sertularia fastigiata*, covered with filaments which possessed spontaneous motion. In specimens of the *Cor. opuntia*, which Schweigger had preserved in spirits, he discovered similar filaments, which he had looked for in vain in those recent from the sea. They appeared under the microscope like tubes interrupted by small knots. The knots, however, on applying higher magnifying powers, were found to be tranverse partitions, lying parallel to each other at short distances: the filaments had altogether the appearance of confervæ. Should they be regarded as such, there is nothing remarkable in their spontaneous motions, since similar motions have often been seen in confervæ, and are described by Vaucher and other writers. The mere resemblance, however, is not conclusive as to their being distinct confervæ, since they have likewise the closest resemblance to the filaments within the coralline. They are probably continuations of the inner substance, like those projecting from the *Cellaria cereoides*, upper roots, (*luftwurzeln*, air-roots), appearances presented by confervæ; and the whole coralline consists of cells and conferva-filaments. Ellis observed in the substance of corallines minute vesicles which he supposed to be air-vesicles, destined to preserve the coralline erect in the water. They were likewise seen by Lamouroux; but as he frequently observed round bodies in them, he considered them ovaria. From the foregoing account of the structure of the corallines, there can scarcely be a doubt that these vesicles are only cells which have not been filled with calcareous matter, and that the supposed ova are the usual granular matter of the cellular substance.—*Communication from Dr* GRANT.

On the Constitution of Flame. By H. HOME BLACKADDER, Esq. F. R. S. E. (Communicated by the Author.)

EVEN at the present day, the constitution of an ordinary flame would seem to be but very imperfectly understood; at least the following notice, of a very recent date, would naturally lead to such a conclusion. "It appears, from a series of experiments by Mr Davies of Manchester, that there is considerable foundation for the opinion of Mr Sym, that the flame of a candle is a conical surface, the interior of which is not luminous, a section of the flame being a luminous ring surrounding an obscure disc *." Hence, it would appear, that, within the present year, it has only been considered as probable, that the flame of a candle is a cone of gas or vapour in a state of combustion at its surface; and a determination of this point may well be considered the very first step in a scientific investigation of the subject. Though some may be of opinion that this point does not require determination, I shall describe a very simple method, with which I have long been familiar. For this purpose a blowpipe is all that is necessary; and one made of glass, having a hollow bulb near its distant extremity, is the most suitable. When the point of the instrument is introduced into the centre of a spirit flame, and the operation of suction is performed, the luminous cone is observed to diminish, or contract in proportion to the degree of suction that is applied; and by thus extracting the vapour from the interior of the flame, the latter may readily be extinguished. In performing this suction, even with a short tube, the operator is exposed to no risk, farther than that of inhaling a quantity of alcohol in the state of vapour; and, unless the operation be unnecessarily prolonged or repeated, this is not apt to be followed by any sensible effects. When, after suction

* Journal of Science for 1826.

has been applied, the instrument is removed from the flame, it is found to contain alcoholic vapour, and which, when lighted, on being slowly expelled by the breath, gives a blue flame at the point of the blowpipe. If, instead of performing suction by the mouth, the tube, inserted in the flame, be connected with a vessel full of mercury, and the latter be allowed slowly to escape, any quantity of vapour may be collected from conical flames. When an accurate analysis is to be made of this vapour, it is necessary to fill the tube as well as the vessel with mercury, and to abstract the air that is mixed with the combustible fluid. It is also to be recollected, that a small quantity of air always remains between the surface of the mercury, and the glass vessel. In making use of a blowpipe in the way described, with the flame of a candle or oil lamp, it is preferable, for reasons that will afterwards appear, to perform the suction by means of a syringe, or a bag of elastic gum. In this case, a dense white vapour is observed to fall in a continued stream, into the hollow bulb of the instrument, the flame at the same time contracts, and when the extracted vapour is lighted, it burns with a white flame. When this vapour is in the interior of the flame, it is kept at a high temperature, and is then perfectly transparent, but the instant its temperature is very slightly reduced, as by touching the upper part of the wick with the point of a small wire, it acquires a milky whiteness; and hence, when falling in a stream from a tube, it is so dense as to resemble an opaque liquid. By means of an Argand lamp, without a wick, the burner being made of Reaumeur's porcelain, this vapour may be procured pure and in great abundance; but the following method is more simple, and is abundantly productive. A glass-vessel, having a wide mouth, and a perforation in its bottom, is converted into a lamp with a circular wick. The central canal which supports the wick is made of glass-tube, not less than the eighth of an inch in diameter, and which is left projecting below the body of the lamp. On lighting a lamp of this description, air does not rise through the tube; but, in the course of a few seconds, masses of dense white vapour are seen falling down through it, and these are soon followed by a continued stream, which flows copiously from its lower orifice. On some occasions it is discharged in the form of beautiful rings, or looped curves variously modified, and which proceed from the same cause as the pulsatory motion of the flame. On approaching a flame to this vapour it readily catches fire, and burns with a white flame, which is in an inverted position. The tube may be bent so as to give an upright flame, and by having several tubes in the form of branches, all on the same level, the lamp may thus be surrounded with jets of white flame. This vapour may also be made to protrude from the tube in a cylindrical form, like a white taper, with a flame confined to its upper extremity. As the ambient air is usually agitated, this vapoury taper exhibits singular motions; and as its flame may be tinged successively with various colours, by slight alterations or additions at the wick from which the vapour proceeds, it presents rather an interesting appearance. When a mixture of volatile oil is used to produce this vapour, it affords an opportunity of illustrating the theory of certain meteors supported by M. de Luc and others. Narrow cylindrical masses rise in the air, and when these are inflamed at one of their extremities, they burn rapidly, giving the appearance of luminous balls traversing or descending through the air. On introducing the extremity of the glass-tube into a glass receiver, the vapour falls to the bottom of the vessel, being, as formerly stated, more like a milky liquid than a gaseous body; and any quantity may thus be collected. White light is extricated when it is exploded with atmospheric air; but, when agitated with water, until it is quite transparent, it gives a blue flame. It differs in no respect from the vapour obtained from the centre of the flame in the way formerly described; and when the circular wick is properly adjusted, it appears to consist of carburetted hydrogen, heavily loaded with oil in the state of vapour; but the wick may be so arranged as to cause an admixture of carbonic acid gas, either in very minute quantity, or so great as to render the vapour incombustible, as it issues from the central tube. When oil is burned, the white part of the abstracted vapour condenses into an amber coloured oil; and, when tallow is burned, it is deposited in the form of a white powder, which adheres to the sides of the vessel, or forms a cake on the surface of water. The inhalation of this vapour, even when much diluted, produces an oppressive headache; and hence it is not advisable to abstract it from the interior of a flame by suction with the mouth. It has, besides, a very offensive odour.

It has already been stated, that, when the vapour issues in a full stream, it burns with a white flame similar to that of a candle. When the flow of vapour is gradually increased from the smallest quantity that will maintain combustion to the complete evolution of the flame, the appearances that are successively exhibited are not unworthy of attention.

At first the flame is but slightly convex, and, as viewed from above, there is an exterior ring of a misty blue colour, then a very narrow ring of purple, within that a broad ring of a bright blue colour, and in its centre a circular spot of a sea-green colour, at times very distinct. The green tinge is evidently produced by the commencing extrication of yellow light, which, when first perceived, is faint, and has the appearance of a yellow fluid, in a state of slow ebullition. As the flow of vapour increases, the boiling motion becomes more apparent, then ceases, and as the yellow light rises in a small cone in the centre, the green either disappears, or, for a short time, forms a circle around it. If at this stage of the flame, it be viewed transversely, there is observed a narrow line extending over the yellow cone, which has a very bright purple colour, and which seems to correspond to the broad, dark-blue arch that is observed in the flame of alcohol. By directing a momentary puff of air against the flame of the circular wick, the flame of the vapour is in the course of a few seconds considerably modified. A number of bright yellow lines are seen projecting from the flame, and which proceed from particles of charcoal, that have been formed in the circular flame, being mixed with the descending vapour, and becoming ignited in passing through the flame at the lower orifice of the glass-tube. As these particles pass through the bright purple line above described, they exhibit a beautiful crimson colour. Does the bright purple light derive its origin from the formation and combustion of cyanogen, or is it derived from the carbon, as is observed during the combustion of diamond in oxygen gas? As the flow of vapour increases, the flame expands, but it is still of a yellow colour, nor is the white light extricated, until an interior cone is formed, whose base is above the blue portion of the flame.

The flame of a candle differs but little from that of the vapour, or that of oil burned without a wick. For, after the wick is carbonized, as long as it is completely enveloped by the flame, and is not in contact with it, it undergoes no particular change. The charcoal becomes more consolidated, but none of it seems to escape, or to be carried off by the vapour; and hence, on the present occasion, the wick may be viewed simply as a porous solid, projecting into the centre of the flame. In such a flame as that of a candle, the following parts may be distinguished:

1*st*, A blue portion, which extends from the base to about the middle of the flame. Its extent may, in most cases, be traced by the eye, but its height may always be determined by means of a blowpipe. This may be termed the essential part of the flame, which may exist without the white light, but without which the latter cannot be produced. It is at least principally at this part of the flame that water is formed by the union of hydrogen, with the oxygen of the atmosphere.

2*dly*, An attenuated opaline brush over the whole exterior surface of the blue part of the flame. This brush can readily be distinguished as high as the middle of the flame, where the blue portion terminates; and perhaps, strictly speaking, it does not extend higher. But, from its apparent termination to the apex of the flame, there is a somewhat similar, but extremely attenuated brush, which has a dusky yellow colour, readily distinguished in small flames, but seldom to be observed in large flames, without the aid of opaque skreens. How this opaline brush is produced, or in what it differs from the other parts of the flame, remains perhaps to be determined. From the blue part of the flame, water is very copiously discharged in the form of steam. When a polished piece of metal is approached to it, even at its base, there is a copious and instantaneous deposition of moisture on its surface. It is not improbable, therefore, that the brush is produced mechanically by the steam as it issues from the flame; and this would enable us to account for its becoming nearly invisible above the blue portion of the flame of a candle, and for its presence over the whole surface of a blue flame, such as that of alcohol.

3*dly*, A cone of yellowish white light, commencing on the inner surface, and at a short distance from the base of the blue portion. On the inner surface of the blue portion, this cone is so attenuated, that, on looking at an object, such as a slip of paper, through the middle of the lower half of the flame, it is seen as through glass, or other transparent media. Hence, when the flame is viewed at a distance, an oval space is observed around the wick, which has a dusky or non-luminous appearance; but, when more closely examined, luminous particles of a yellowish white colour are observed on its interior surface, and which appear to move rapidly in parallel lines, and from below upwards. This oval space serves to point out the exact height to which the blüe portion of the flame extends, and the part of the flame which alone contains the white vapour formerly described.

4thly, An interior cone of white light, the base of which is above the upper part of the blue portion. This is the whitest, most luminous, and last evolved part of the flame. When the combustion is moderate, and the wick properly adjusted, the apex of this cone remains within that of the exterior cone; but it almost constantly exhibits a disposition to protrude, and then produces the appearance of a notch or break on each side of the apex of the flame. Beyond a certain extent, however, it cannot thus protrude, without interrupting the process of combustion at the upper part of the flame. More or less charcoal is then discharged, in the form of soot, and which, in becoming partially ignited, gives out light of a brown or reddish yellow colour; and it may be remarked, that it is the exterior cone that first and principally exhibits the effects of this interruption.

In the interior of the upper half of the flame, or in that which, for the sake of distinction might be termed its upper chamber, there is present a vapour of peculiar properties, and which is altogether different from that which is found in the lower chamber, or within the blue portion. When the vapour referred to is collected, it has a misty appearance from the presence of minute particles of charcoal, and even remains slightly obscured, after having been repeatedly agitated with water. No oil or water is deposited from it, and though it has a suffocating odour, it is altogether free of the offensive smell proper to the dense vapour formerly described. It would be desirable to ascertain the exact chemical nature of this vapour, but such an analysis is not unattended with difficulty, and other pursuits of a professional nature, present too many obstacles to such an investigation. When a jet of it is projected above the apex, or on the opaline brush of a blue spirit flame, streaks of reddish brown light make their appearance, if projected through the brush, so as to come into contact with the bright blue part of the flame, light of a golden yellow is extricated; but, when the jet is forced into the interior, so as to strike on the inner surface of the blue flame, the light that is given out is similar to the yellowish-white light of a candle. There cannot be a doubt that these appearances depend on the presence of minute particles of charcoal, which are brought to various degrees of ignition in different parts of the flame; but the relation which the carbon has to the vapour has not been accurately determined. Between the point of the tube, and the place where the yellow light is extricated, there is sometimes observed an attenuated blue flame, and some of the charcoal, is merely in a state of suspension. When projected from a wide orifice at the base of a blue spirit flame, almost the whole surface of the latter appears as if spotted with minute spangles of a brilliant golden colour. In this case, none of the vapour enters at the base of the flame, so as to mix with the cone of alcoholic vapour in the interior; for, in that case, streaks of yellow light would appear at its apex, similar to what was stated to take place with the flame of the white vapour, after a puff of air had been directed against the circular wick. The vapour, however, may be made to enter at the base of a spirit flame, by directing a jet from a small orifice between it and the glass burner. The vapour then rises through the centre of the cone, and streaks of yellow light appear at its apex. To produce this effect, the jet must be small, and urged with considerable force; and we may therefore conclude, that, on ordinary occasions, atmospheric air is not mixed with the vapour in the interior of a flame. This, however, may be otherwise and more accurately determined. A flame is extinguished in the interior of another flame. This may readily be determined by means of a glass burner: thus, pass the glass burner of a lamp through a cork in the bottom of a glass or porcelain vessel, the diameter of which may be one inch, or several inches, but whose depth does not necessarily exceed the fourth of an inch. Fill the vessel with alcohol, or strong ardent spirits, and having lighted the lamp, raise the vessel on the glass burner to about the fourth of an inch from its orifice, when the alcohol will inflame. The flame of the oil that is burned in the lamp will be extinguished; but the flame of the alcohol will evaporate the oil as it issues from the burner, and this vapour, on coming into contact with the inner surface of the blue flame, will undergo combustion, giving out much white light. In such a case, the cone of white light from the combustion of the vapour of oil, keeps distinct from the white light of the flame of the alcoholic vapour.

This experiment has been repeated in a variety of ways, and the result has always been the same; and hence we are necessarily led to the conclusion, that the vapour in the interior of a flame is incapable of supporting combustion. It is certain, however, that some oxygen is always present in that vapour, for oils and alcoholic fluids always contain some air in a state of mechanical admixture; and oxygen is understood to be a constituent part of all of them.

The apex of a spirit flame is the hottest, or is the part at which a solid body is raised to the highest temperature; and partly for this reason, that less heat is carried off by the air with which the solid body is surrounded, than at the other parts of the flame—the vapour discharged from the flame being itself at a very high temperature *. The upper part of the flame of a candle communicates less heat to a solid body than its middle part, where the blue portion terminates. This seems to proceed, in some measure, from the deficiency of hydrogen in the upper and most luminous part of the flame; and hence, at that part a blowpipe, the use of which infers a greater supply of air, has comparatively but a trifling effect.

When the opaque white vapour formerly described is burned, so as to produce a white conical flame, the vapour is observed to project into the interior of the flame like a white wick, tapering to a small point; hence, of a supposed transverse section of a flame, the coldest point would be in the centre. Much heat is consumed at the inferior part of a flame; the burner or wick-holder carries off no inconsiderable quantity, and much is consumed in converting the combustible body into vapour. It is an old observation, that a common lamp will burn in air that will ex-

* In the centre of a conical spirit flame, the heat diminishes from the apex to the mouth of the burner, near which glass acquires what is termed a dark cherry red.

tinguish a candle, and from this it might be inferred, that more heat is consumed in converting tallow into a fluid than is carried off by the wick-holder of a common lamp; but, in a common lamp, much of the heat that is abstracted by the metallic wick holder, is communicated to the oil in the reservoir. A lamp without a wick may readily be extinguished by abstracting heat from the burner.

If a small stream of water, projected from a tube, be directed through the flame of a candle, the stream being made to pass immediately above the wick, the form of the flame is thereby scarcely affected; white light is defective at the spot where the water enters and comes out of the flame, and in this much only is the combustion interrupted. On receiving the water into a vessel, after it has passed through the flame, a film of tallow is observed to form on its surface, and which is derived from the vapour in the interior of the flame; part of which has been carried off and condensed by the water. When the stream is directed through the white part of the flame that is above the oval space formerly mentioned, the effect produced on the flame is similar; no tallow, however, is observed on the surface of the water; but, instead thereof, a considerable quantity of carbon, in the form of soot, is deposited. When the water is made to pass through the flame, near its apex, the combustion is interrupted, and the top of the flame acquires a brown colour. The same effect is produced by a solid body, and likewise by a stream of air; and hence it might appear, that the interruption of the combustion was simply a consequence of the abstraction of heat; but the flame of a spirit-lamp, when propelled on the apex of the flame of a candle, interrupts the combustion, and gives the latter a brown colour. The following facts, illustrative of the extrication of white light, may also be noted. When any solid body is approached to the flame of a candle, so as to be at the distance of about three-tenths of an inch from its surface, the part of the flame that is immediately above, exhibits a sensible increase of white light; but when the solid body is brought to within the tenth of an inch of the opaline brush, the space which formerly presented an increase of white light is now altogether deprived of it, the flame remaining in other respects unchanged. The space that is deprived of white light has a relation to the form and size, but to no other property of the solid body. The flame of a spirit-lamp, and a stream of cold air, from a blowpipe, have the same effect as a solid body, in causing the white light to disappear *. If a solid body, such as the end of a wire, be passed through the opaline brush, so as to come into contact with the part of the flame from which the latter proceeds, there is observed from the point of the wire upwards, a line, in which the quantity of white light is very distinctly increased; but on carrying the point of the wire into the interior of the flame, the line which was in the former instance rendered more luminous, is now rendered transparent, and is altogether deprived of white light; so that on passing the wire quite through the flame, the latter appears as if mechanically divided into two parts. By greatly diminishing the force of the current of air, as it impinges on the lower part of a flame, that part of the latter, which, in ordinary circumstances, is altogether of a blue colour, becomes nearly as luminous as the rest of the flame. This may be illustrated, by causing a small current of air to pass in a transverse direction, and at a small distance, from the base of the flame, or by bringing the extremity of a small tube near to it, and applying suction. The same effect is produced by increasing the supply of vapour at the lower part of the flame. Thus, when a small metallic ball is connected with the orifice of a burner without a wick, or when a double burner, the one within the other, is used, the usual blue light, at the base of the flame, is scarcely perceptible. In both these cases an unusual supply of vapour is produced at the base of the flame.

It was stated on a former occasion, that, when a vessel of water was placed under a blue spirit-flame, and a solid body, nearly at a red heat, was introduced into it, the small particles of water that were thus impelled on the exterior surface of the flame caused an extrication of yellow light. It was also stated, that, when small particles of water, driven by a simple mechanical impulse, impinge on a blue flame, no yellow light was given out. Particles of water may be thus discharged, by giving a whirling motion to a moist body, and in various other ways, without obviously modifying the flame with which they come into

* Hence a lamp, with concentric wicks, as hitherto constructed, is not likely to afford the degree of illumination that might be expected from the increased surface of flame and consumption of oil. It is better adapted to afford an increase of heat than of light.

contact. But, without the assistance of heat, water, and many other fluids, may be made to impinge on a spirit-flame, so as to cause the extrication of yellow light. For this purpose, it is only necessary to impel the fluid in such a way, that, in escaping from the vessel in which it is contained, it shall produce a whizzing noise, similar to that caused by the escape of soda water and carbonic acid gas, through the pores of a cork; or to that produced when a hot body is dropt into water. On such occasions particles are expelled of such a size as renders their explosion inevitable on coming into contact with the flame; the larger particles passing through without suffering more than a slight diminution of their bulk. Thus, let a small quantity of water be introduced into the hollow bulb of a glass blowpipe, and on bringing the water to a level with the distant part of the tube, let air be forced through the instrument, so as to expel water from its point, with a whizzing noise. Thus expelled, particles of water, alcohol, sulphuric acid, and many other fluids, cause a blue flame to give out yellow light. A similar discharge of fluids may be produced in various other ways, and always with the same effect; such as tallow mixed with water, &c. When muriate of soda is placed in a flame it decrepitates, and the yellow light is brilliant, in proportion to the violence of the decrepitation. The muriate of baryta also decrepitates, though in an inferior degree. When held near the apex of a spirit-flame, it gives out white fumes, and these fumes give a yellow colour to flame. The presence of a liquid, such as water, is necessary to the formation of the fumes, which seem to be simply particles of the salt, in a state of minute division. It would be desirable to ascertain the effect of these salts on the flame of a combustible, into the composition of which hydrogen does not enter, and whose combustion is not supported by oxygen.

When a perfectly clean rod of glass is broken in a spirit-flame, yellow light is given out; and the same effect is produced by grinding together the ends of two rods in the immediate vicinity of the flame. Two pieces of pumice stone, that have been previously brought to a white heat, also cause the extrication of yellow light, when struck or ground close to a spirit-flame. Many other incombustible bodies produce a similar effect; and in such cases the origin of the coloured light is very obvious.

The gaseous oxide of carbon, during its combustion, gives out but a very faint light, which is of a blue colour; but when particles of carbon are presented in such a form that they can become ignited, the colour of the light that is given out during their ignition, seems to depend on the existing temperature and the supply of oxygen; it is red, yellow, or white. At a certain temperature the charcoal that is deposited from a flame seems to unite with oxygen, without the extrication of light. Thus, if the end of a rod of glass, that has been blackened in the flame of a candle, be introduced into the centre of a spirit-flame, the charcoal becomes red, without undergoing any farther change; but, on withdrawing the rod from the flame, the charcoal, after becoming black, is observed to disappear from the surface of the glass, exactly in the same way that condensed aqueous vapour disappears in dry air from a polished surface *. If the rod be made to pass quickly through the air the charcoal becomes ignited; but more of it is not consumed than is observed to disappear when ignition is not thus produced. The yellow light that is extricated, when solid vegetable or animal substances are brought into contact with a blue flame, is doubtless produced by the ignition of minute particles of charcoal. The yellow light given out when alcoholic fluids are burned with a wick, or when minute particles of various fluids are made to impinge on a blue spirit-flame, has, I have reason to believe, a similar origin.—

After the preceding part of this paper was written, a first opportunity was had of perusing the highly interesting papers on Combustion, by Sir H. Davy, published about ten years ago, in the Transactions of the Royal Society of London. In these papers the researches of that celebrated chemist are stated to be unfinished, but whether he has since that period prosecuted the subject, I have not had the means of ascertaining. Perhaps, without being guilty of presumption, it may be asked, Is the evidence hitherto adduced, in support of the following opinions conclusive?

" The flame of combustible bodies, in all cases, must be considered as the combustion of an explosive mixture of inflammable gas, or vapour, and air; for it cannot be regarded as a mere

* If it were merely carried off by the current of heated air, it might be expected to be similarly carried off when in the centre of a spirit flame, for the velocity of the vapour is fully equal to that of the upward current of air caused by heat emanating from the glass rod.

combustion at the surface of contact of the inflammable matter; and the fact is proved, by holding a taper or a piece of burning phosphorus, within a large flame made by the combustion of alcohol; the flame of the candle, or of the phosphorus, will appear in the centre of the flame, proving that there is oxygen even in its interior part.

"The form of the flame is conical, because the greatest heat is in the centre of the explosive mixture.

"The heat diminishes towards the top of the flame, because in this part the quantity of oxygen is least.

"When the wick increases to a considerable size from collecting charcoal, it cools the flame by radiation, and prevents a proper quantity of air from mixing with its central part; in consequence, the charcoal thrown off from the top of the flame is only red hot, and the greater part of it escapes unconsumed."

Hypothesis regarding Magnetism. By Dr Büchner.

THE following hypothesis is proposed in the first volume of Dr Büchner's Elements of Chemistry, at present in the press; it has been inserted by the author in a German Scientific Journal, (Archiv fur die gesammte Naturlehre, 1825, No. 12.) However bold it may be, it appears to us, that, with regard to the subject to which it applies, nothing should be absolutely rejected. The new analogies which it is the object here to explain, open a field entirely free to the imagination of natural philosophers.

"There are still," says Dr Büchner, "so many obscure things in the phenomena of magnetism, that it would be rash to present any explanation of these phenomena, otherwise than as a mere hypothesis. We may admit as demonstrated, that the magnetic influences are as extensive in their operation as light, caloric, and electricity, but that they are in a state of reciprocal neutralization, which prevents their being made sensible. There is but a small number of bodies which have the property of breaking this state of equilibrium, and manifesting north and south polarities. Among these we distinguish the loadstone, iron, steel, nickel, cobalt, &c. To what is this remarkable property owing? Is it to a peculiar crystallisation of these bodies, or rather to some defect of equilibrium in their chemical constitution? Of this we are ignorant. It seems to me, that it may be admitted, that, as light emanates from the sun toward the earth, magnetism in return emanates from the earth toward the sun, in a state of neutralization in the equatorial zone, which receives the greatest quantity of light, and in a state of polarization toward the poles of the globe, which receive the least of it. It cannot be refused to admit, that light, caloric, electricity and magnetism, are in a certain mutual relation of causality: the question is merely, what is this relation? The following hypothesis appears to me the most simple and most natural.

"The planets receive from the sun light and electricity in the neutral state; they decompose these principles, and reproduce, in their turn, caloric, and the two polarised electric principles. But caloric dilates bodies, and breaks in them the equilibrium of their cohesion, and of their chemical constitution. Then caloric itself undergoes a modification, which is still enigmatical to us, in virtue of which it is transformed into magnetism. All ponderable bodies are conductors of magnetism, for which they appear to have little affinity. Organised and living bodies, such as our own, are sensible to light and heat; but we want a sense for the magnetism with which we are constantly surrounded and penetrated: hence the difficulty of understanding this agent aright. If we inhabited the sun, perhaps, in place of a sense for perceiving light, we should possess a sense for perceiving magnetism.

"In the present hypothesis, magnetism would not emanate from the earth only, but also from all bodies in the universe that are illuminated by the sun. We may consider as proofs of these magnetic emanations; 1*st*, The magnetic currents which are established in the conducting wire of an electro-chemical apparatus, or in a thermo-magnetic metal; for the earth itself, considered in this point of view, is nothing else than a great thermo-magnetic apparatus; and, 2*dly*, the circumstance that, in the most elevated regions of the earth's atmosphere which man has hitherto been able to attain, the magnetic needle remains as strongly polarised as at the very surface of the globe.

"Further, if we reason according to the ordinary laws of nature, we cannot regard it as probable that the planets, placed as they are right opposite to the sun, act an entirely passive part.

We see every where in the universe mutual changes taking place; why should the sun, on its part, be always giving, and never receiving any thing in compensation? If it were so, notwithstanding the magnitude of its mass, the productive power of light which it possesses would necessarily diminish, after a lapse of some thousands of years, while the earth and the other planets would be supersaturated with light and heat. Now, this is what we do not see happening. It appears to me much more probable, that there must prevail, with respect to this, in the planetary system, a continued order and a periodical return. The sun might be considered as the heart of this system; a common principle would emanate from this centre under the form of light, and would flow toward the planets, as the arterial blood flows toward the extremities; it would there be successively transformed into caloric, electricity and magnetism. In this latter state, it would flow back toward the sun, as the venous blood flows back toward the heart, to be reconverted into a state of light, by a modification the inverse of the first. Perhaps mathematicians might even seek the cause of the laws which regulate the motions of the celestial bodies, in this alternate transportation of light toward the planets, and of magnetism toward the sun. We see motion result from analogous currents in the rotatory electro-magnetic apparatus."—*Bibl. Universelle.*

On the Construction of Meteorological Instruments, so as to ascertain their indications, during absence, at any given instant, or at successive intervals of time. With a Plate.

EARLY last summer a paper, by Mr H. H. Blackadder, was read before the Royal Society of Edinburgh, in which was described the mode of constructing meteorological instruments so as to determine their indications, during absence, at any given instant, or at successive intervals of time. One instrument, of this construction, was exhibited, which had been in daily use for upwards of a year, and which had been found to give perfect satisfaction. An apparatus, consisting of several thermometers or atmizomic hygrometers, was at the same time exhibited, nearly completed, and by means of which, with three in-

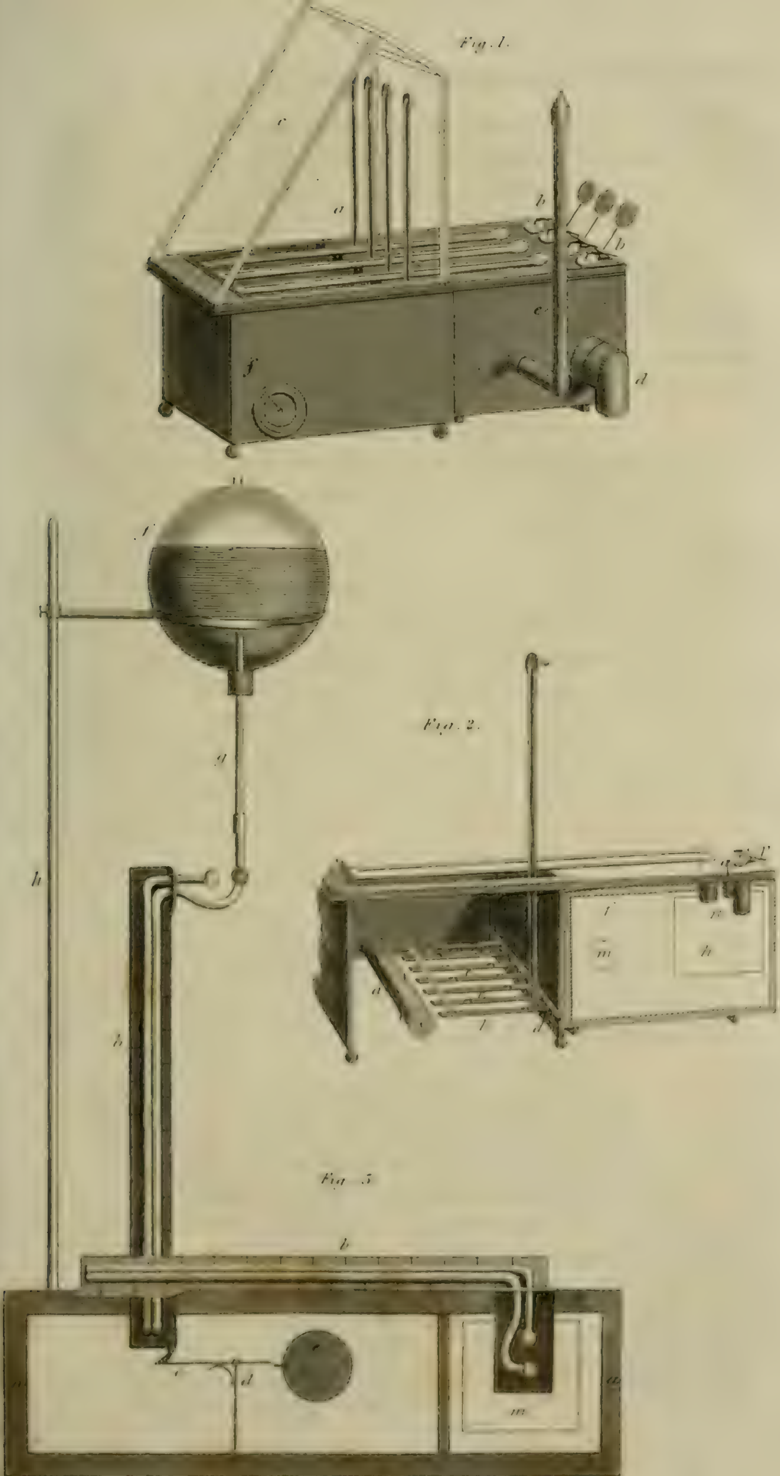

Fig. 1.

Fig. 2.

Fig. 3.

spections in the course of the *day*, the atmospheric temperature, and (on the principle of the late celebrated Dr Hutton) its humidity, for every hour of the day and night, could be readily and exactly determined. For a particular account of this new mode of constructing a meteorological apparatus, the reader is referred to the last volume of the Transactions of the Royal Society. The present notice is chiefly confined to an explanation of the figures, Plate IV., where certain forms of construction are represented, and which will render the practical application of the principle easily apprehended.

The possession of a single thermometer, constructed on this principle, renders the keeping of an accurate thermometrical register a comparatively easy task, as the observer is freed from the irksome necessity of being always at home and disengaged at certain fixed hours. This freedom, be it also observed, is attainable at a very trifling expence; and at a very small additional expence, two thermometers and hygrometers may be thus constructed, and by means of these, an accurate and valuable register may be kept with very little inconvenience. In comparison with the usual method, it would be found an agreeable amusement rather than a labour, tolerable to very few, and easy to none.

Explanation of Plate IV.

Fig. 1. Represents an apparatus applicable to various purposes, and, among others, that of ascertaining the temperature, or the temperature and humidity, of the atmosphere every successive hour of the day and night. For this purpose, only three inspections in the course of the day are requisite; for example, at 7 A. M., 4 P. M. and 11 P. M.

a, Seven thermometers suspended on rollers or hinges; four are in one row in front, and are represented in their vertical position; the other three are suspended about an inch and a-half behind these, and are seen in their horizontal position.

These thermometers are, on the present occasion, supposed to be made with old, colourless, and carefully filtrated spirit, that has been deprived of air. The index may be very minute, and, consequently, the bulb small, which last is an important consideration. The tube should admit of the spirit rising to about 140° Fahrenheit, though it may be unnecessary to divide the scale much above 100°.

b, b, Seven valves, four of which are shut, and three open. They exclude rain, snow, &c. and confine the heat in seven short tubes, which receive the bulbs of the instruments, when these are in their horizontal position.

c, A glass frame or screen for protecting the bulbs of the instruments when in the vertical position. The wooden frame of the apparatus is varnished, so as to be completely water-proof.

d, A lamp giving out no smoke or soot.

e, A chimney.

The temperature of the instruments, when they have received their horizontal position, may be kept above that of the atmosphere in various ways; as by causing water, or ardent spirits and sulphuric acid, to distil slowly from separate reservoirs, and through capillary tubes, on the bulbs of the instruments. An index may even be fixed to its place at any given instant by means of a magnet, and an artificial supply of heat be thus dispensed with; but, in general, a lamp will be found most convenient. On many occasions, however, even a lamp is unnecessary, provided the air of a moderately warm room has free access into the vapour chamber, *h*, fig. 2.; particularly if the communication be such as to favour a constant circulation of air.

f, An index for marking the hour or time at which the registering commences after each inspection. The outer circle is divided into seven equal parts, and is fixed to the wooden frame. The inner circle slides on the outer, and is divided into twenty-four parts, corresponding with the twelve hours of the day and night. If, for example, it is wished, at 9 A. M., to ascertain the temperature each hour, for seven hours in succession, the index is made to point to 7 on the outer circle, and 10 A. M. on the inner circle is brought opposite to 1 on the outer circle.

The axis of the index projects so as to admit of its being connected with a small time-piece or table-clock, by means of a small rod which may be removed at pleasure. When the apparatus is fixed on the outside of a window, the small rod passes through a perforation in the frame of the window, the time-piece being placed on a table within the room, and the two may be thus adjusted in less than half a minute.

Fig. 2. represents the interior mechanism of the apparatus.

a, A cylinder, around which, at equal distances, and in two spiral lines, are seven projecting pins. The index *f,* fig. 1. is fixed on the axle of this cylinder.

b, Seven levers moving on a common wire at *c*, each supported by a small spring *d*.

e, e, Small catches for retaining the instruments in an upright or inclined position.

f, A wire, represented by a dotted line to *g*, which keeps the valve *b*, fig. 1., shut when the instrument is vertical, and allows it to open when the instrument is moving to a horizontal position. There is one such wire for each instrument.

h, The vapour chamber, which is an oblong tin-box, connected in front with the lamp *d*, fig. 1., and at the other extremity with a narrow bent tube *m*, which terminates in the chimney *c*, fig. 1. The vapour chamber is at some distance from the wooden frame, and the space between them is filled with cotton or powdered charcoal.

n, n, Are thin metallic tubes which project into the vapour chamber, and are shut at their under extremities.

p, p, p, Are small bent levers, which, by means of short springs, elevate the valves *b, b*, when these are freed by the wires *ff*.

Fig. 3. Represents a section of a small apparatus which may be carried in the pocket.

a, The frame or case.

b, Two slips of metal bearing each a thermometer and atmizomic-hygrometer, with a separate scale for each.

c, A lever kept in its place by the spring *d*, and retaining *b* in a vertical position by means of a catch.

e, A revolving cylinder, with two projecting pins for depressing the levers. When the apparatus is used, the cylinder is put in motion by means of a pocket time-piece.

f, The vapour chamber.

g, A glass-vessel containing rain or distilled water, and which may be raised or lowered on the upright stem *h*.

i, A small glass-tube, having attached to its under extremity a soft hair pencil, through which the water, in the glass-vessel, slowly distils, so as to keep the bulbs of the atmizomic hygrometers constantly moist. There may be a separate tube for each instrument, or one tube may terminate in two or more branches, each mounted with its brush. The tube slides up or down through a cork in the glass-vessel, so as to regulate or stop the flow of water.

When a thermometer is converted into an atmizomic hygrometer, it has been the practice to cover the bulb of the instrument with soft cambric or silk, for the purpose of extending the moisture over its surface. But though this contrivance certainly answers the purpose, it is attended with considerable inconvenience; for if rain or distilled water is not used, the cloth soon becomes loaded with calcareous and other earthy matter deposited from the water *; and even when the purest water is used, the instrument soon becomes loaded with all kinds of dust, lime, soot, &c. When the bulb has become thus incrusted, it is desirable, if not requisite, to renew the bibulous covering; a troublesome operation, which cannot be effected without considerable risk of breaking the instrument; and which is particularly objectionable in the case of slender, and extremely fragile air thermometers.

This bibulous covering may be got rid of, by having the bulb of the instrument made rough by means of fine emery, with or without the aid of fluoric acid; and by keeping up a constant supply of alkalized water, by means of a capillary glass tube, fitted with a soft hair pencil, and connected with a suitable reservoir.

It would seem, however, that an imperfection attaches to the differential hygrometer, which does not appear to have been particularly adverted to by writers on meteorology. It has been admitted, that moisture is deposited from the atmosphere on glass at a time when the former is not saturated with aqueous vapour. Hence when a differential thermometer is used as a hygrometer, and when, as has hitherto been the case, the naked bulb of the instrument is left freely exposed to the air, it cannot be ascertained, in the evening for example, whether the air is or is not saturated, for moisture will be deposited (as it appears) on the naked bulb before the air is saturated; and when the naked bulb has moisture condensed on its surface, the instrument no longer acts as a hygrometer. Perhaps this imperfection might be remedied by keeping the surface of the naked bulb coated with a thin layer of a fixed oil that freezes at a low temperature; but this would render it a very complicated instrument.

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* The deposition, from the water in this city, seems to be much more copious now than it was some years ago.

Some mechanical Inquiries regarding the Formation of the Tails of Comets. By Dr LEHMANN of Berlin *.

NUMEROUS attempts have been made to explain the formation of the tails of comets. The extraordinary aspect of those bodies, by exciting the imagination of natural philosophers, has often drawn them into hypotheses which have run wide of all the known laws of nature. I propose to inquire here, if the form of the tails of comets, and their changes, may not be explained by means of known powers and mechanical laws only, in the same manner as the flux and reflux of the sea are explained by means of gravitation alone.

Comets do not differ essentially from planets, with respect to their motions, but the eccentricity of the orbit which they describe is much more considerable than that of the orbit of the planets, so that their course is accomplished in a curve, which differs little from a parabola or a hyperbola. The planets on which we can observe spots, turn at the same time upon their axis as the earth does. The satellites in their motion always present, like the moon, one and the same side to the planet round which they move, the time of their rotation being the same as that of their circulation round the planet. That this agreement is not an effect of chance, but must have resulted, in the case of our moon, from the circumstance that its mass is larger toward the hemisphere which it presents to us †, is what has been plainly demonstrated by the celebrated La Place, in his Mecanique Celeste (L. V. Pl 2.)‡.

If we return to the comets, we shall see that two cases may present themselves, with respect to their revolution round an axis. This revolution is performed, either like that of the planets, in such a manner as that they present all the parts of their surface in succession to the sun, or, like that of the satellites, in such a manner as that they always turn the same hemisphere toward that star. It is demonstrated upon mechanical princi-

* Astronom. Jahrbuch, Berlin, 1826; and Biblioth Universelle, Mars 1826.

† In consequence of the earth's attraction, and of the circumstance that the mass of the moon must have been originally fluid.

‡ It being understood that, at the commencement, the times of these two motions did not differ in any considerable quantity. This explanation is originally due to La Grange.

ples, that no third case can exist. Now, it is easy to see, that a comet which should turn round its axis, in the first of these ways, could not have a tail; for, if we suppose that some parts of the atmosphere of the comet were upon the point of extending, over a larger space of the side opposite the sun, than of any other side, they would be immediately displaced by the rotatory motion, since they must possess this motion in common with the nucleus. It may therefore be admitted, that, before a comet can have a tail, it must necessarily always present the same side to the sun. Knowing that some comets shew no trace of a tail, while others acquire one near their perihelion, we may consider it as established, that the former turn in the manner of planets, and the others in the manner of satellites. But if a comet always present the same side to the sun, it can only be, because it has a greater mass on the side which it thus presents, than on the opposite side, as La Place has demonstrated with respect to the moon. Its centre of gravity will therefore be found between the centre of figure of the nucleus and the sun, and nothing prevents us from supposing this centre of gravity near the surface of the nucleus.

The accelerating forces, to which each particle of the atmosphere of a comet will be subjected, are the following, 1*st*, The power of expansion; 2*dly*, The gravitation toward the sun; 3*dly*, The gravitation toward the nucleus; 4*thly*, The attraction of all the other particles of the atmosphere.

The fourth of these powers is so feeble, that, in our inquiry, it may be considered as an infinitely small quantity, on account of the extreme rarity of such an atmosphere. The same might almost be said of the gravitation toward the nucleus; for this nucleus has so little density, that even when it is in proximity to a planet, it exercises no appreciable attraction upon it. This is a circumstance which may be verified by the comet of 1770, which approached the earth to a distance only seven times greater than that of the moon, without producing any sensible action upon it. However, the parts of a cometary atmosphere, which are near the nucleus, are so situated, that we cannot neglect the attraction which this nucleus exercises upon them. There remain, therefore, three powers acting upon this atmosphere; the power of expansion, the gravitation toward the sun, and the gravitation toward the nucleus. Let us decompose each of these forces into two others, and of which one is parallel to the radius vector; there are, then, six forces, of which we have only to consider the three that act in the direction of the radius vector. We shall consider the nucleus as a solid body, such as the atmosphere which surrounds it cannot penetrate, and that the densest part of this atmosphere rests upon its surface.

If we consider the parts of the atmosphere situated on the side opposite the sun, it is plain, that being somewhat more distant from the sun than the nucleus, they will be attracted by the sun with less power than the nucleus itself. The component of the attraction exercised by the nucleus upon the atmosphere will therefore be diminished by the attraction of the mass of the sun. While this diminution will remain insensible, on account of the too great distance of the comet from the sun, the gravitation of the particles of the atmosphere toward the nucleus will be in equilibrium with the power of expansion; in the same manner as the expansive power of the earth's atmosphere remains in equilibrium with its weight, so long as the air is tranquil. But, in proportion as the comet approaches the sun, this diminution will become more and more sensible; the component of the power of expansion, directed according to the radius vector, will gain more and more upon the component of the gravitation toward the nucleus, in the same direction; it will therefore remove from the nucleus the parts of the atmosphere, situated on the side opposite the direction, and will form a tail.

The tail which will be formed in this manner, will always elongate more, and will always increase with more rapidity, because several causes acting in the same direction unite to accelerate this increase. In the first place, every motion once impressed, will continue of itself in one direction, and with a continued celerity. Secondly, if the comet approach the sun, the diminution of intensity of the gravitation toward the nucleus becomes on this very account always more sensible. In the third place, when even a particle of the atmosphere is in motion, for the purpose of removing from the nucleus, the difference which there is between the distances of the sun from the nucleus and the particle, goes on continually increasing, and consequently it is the same with the difference between the gravitation of the nucleus and the particle towards the sun. Thus, in all cases, the particle will remove from the nucleus with an increasing rapidity on the side opposite the sun. In conformity with this, we often see the tail attaining an astonishing length in a short time, while at first sight it might seem that the difference which originally exists between the distance of the nucleus and that of the particle from the sun, compared with this very distance, is too small a quantity for the diminution that must result from it in the gravitation ever having an appreciable influence, or being capable of determining the formation of a tail. But this formation depends essentially upon the circumstance that, according to my supposition, the comet always presents the same side of the sun. Its extension to a length of several millions of miles will then be possible, because all the causes which tend to augment this length, act without interruption in the same direction. If, on the contrary, the comet should turn on its axis like the planets, the enormous increase of its tail from the causes which I have just exposed, could not take place.

How does it now happen that the tail decreases after the passage to the perihelion? It is not difficult to reply to this question, by means of the principles already laid down. When the comet approaches the sun, two causes concur to retard the growth of its tail. The first resides in the law of aërostatics, which determines that the power of expansion diminishes with the density. The tail will not therefore increase so quickly as it would have done, had the power of expansion remained the same. The other cause is connected with the circumstance that we cannot see objects which transmit too little light to our eyes. There results from this, that we can no longer distinguish the extreme parts of the tail, when it is much extended and consequently highly rarified, because a diminution of lustre is necessarily connected with this rarefaction of an atmosphere luminous in itself. For these two reasons, the tail will seem to us to be shorter, and to increase more slowly. It is very difficult to distinguish the limits of the atmosphere of a comet, or its last layers: They escape our view, on account of their extreme rarity, the passage to vacuity being effected in a manner entirely imperceptible. There follows from this that the tail of a comet may appear so much the shorter that we employ a greater magnifying power for observing it, because this magnifier deminishes the intensity of the light.

So long as the comet approaches the sun, and also when it begins to retire from it, the causes which contribute to elongate the tail will gain much upon those which tend to shorten it; and the greatest length will take place immediately after the perihelion. But when, after the perihelion, the comet begins to retire from the sun a sufficient space, the latter causes will begin in their turn to gain upon the first. The gravitation towards the nucleus will always be less surpassed by the power of expansion, which will itself have become smaller and smaller, from the rarefaction of the atmosphere. There will thus be a period at which these two powers will be mutually balanced, and at which, in consequence, the power will vanish, in virtue of which the particles of the atmosphere were propelled from the nucleus on the side opposite the sun. After this there will immediately rise a contrary power, which will draw them towards the nucleus. However, in virtue of the law of inertia, the tail will still grow, but with a slower progress; after a certain time it will be stationary, and at length it will rapidly diminish, so as to form a new and condensed atmosphere. As this atmosphere cannot entirely disappear, the growth of the tail will diminish more and more, till the period when the comet will be sufficiently removed from the sun for its atmosphere to return to the same state of condensation which it possessed at the commencement of the phases which we have described.

Hitherto we have only considered the parts of the atmosphere of a comet which are situated on the side farthest from the sun. We might, by a perfectly similar mode of reasoning, conclude with respect to those which are on the side next the sun, that they ought to retire from the nucleus and stretch toward the sun, as the others extended in the contrary direction. There is no essential difference between the two regions of the comet: It must form as long a tail on the one side as on the other. Why, then, do we only see one on the hemisphere farthest from the sun? Because the centre of gravity of the nucleus does not coincide with its centre of form, but is situated much nearer the surface of the hemisphere turned toward the sun.

It is demonstrated by calculation, that the centre of gravity being so placed, the diminution of gravitation is much smaller in the parts of the atmosphere turned toward the sun, than in those which are on the opposite side; the tail must, therefore, be much shorter in this region than in the other. And as the centre of gravity may be supposed extremely near the surface of the nucleus, as has been said above, it may be conceived that here the dilatation of the atmosphere no longer forms a tail, but only a nebulosity.

Lastly, the tail is ordinarily inflected, so as to turn its concavity toward the side from whence the comet comes, and to have the plane of its curvature coinciding with that of the orbit of the star. The reason is this,—the particles of the tail cannot follow the circulating motion round the sun, with the same rapidity as the nucleus, because to the same linear velocity correspond angular velocities, so much the smaller in proportion to the greatness of the distance from the sun. The radius will be tangent to the curve of the tail in the vicinity of the nucleus, because there the angular velocity of the particles of which it is composed does not differ from that of the nucleus. It is easy also to comprehend, that the tail will appear so much the more strongly inflected, the larger it is; a result of our hypothesis that agrees with observation.

According to what has been said above, the formation and change of the tails of comets may be considered as a sort of flux and reflux of the atmosphere of their bodies, perfectly similar to the tides which are caused by the moon in our ocean, and perhaps even in our atmosphere.

On the Snakes of Southern Africa. By ANDREW SMITH, M. D. M. W. S. Assistant-Surgeon 98th Regiment, and Superintendent of the South African Museum *. Communicated by the Author.

IN no branch of natural history is the want of accurate and perspicuous description more felt than in Ophiology. Such imperfections have unquestionably tended to retard the advancement of the science, to create diffidence and doubt in the mind of the inquirer, and to keep back communications on the sub-

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* Read before the Wernerian Society, 22d April 1826.

ject, from a fear of unnecessary repetition or a chance of plagiarism.

As authors have hitherto, in general, been satisfied with having dead, distorted, and variously altered specimens for the description of species, in that way the confusion complained of most probably arose; and if so, the only method calculated to remove it, would be a series of accurate observations made upon living snakes. As considerable difficulties must necessarily be overcome before that can be generally effected, and as but few individuals, comparatively speaking, can enjoy the means of carrying on such inquiries, it therefore becomes the duty of all interested in the subject, to lose no opportunity of forwarding such a desirable object; and, under this impression, I have taken minute descriptions, from living examples, of the species actually contained in the South African Museum, of which the annexed are abridgments.

Such of them as have been ascertained, beyond doubt, to be already known, are designated by the established names; but where no descriptions have been found in Shaw or Lacepede (the only authors I have on the subject), answering exactly to the appearances which have been observed, I have given them names myself; and, in one of those instances, have selected, as a specific distinction, the name of the noble individual who procured it, and to whom natural history is indebted for the institution of the South African Museum, where the specimen is now deposited, viz. Lord Charles Somerset, governor of the Cape of Good Hope.

The descriptions, though concise, and by no means complete, have been proved to be sufficiently explicit to enable individuals to distinguish, with certainty and facility, the different species, which is all I aim at on the present occasion; reserving the more ample details, as well as the accurate representations which I actually possess, for a work expressly on the subject. With regard to number 5, I have considered it as a species of the genus Naia, more, however, from its manners than from its natural appearances. In relation to the former, they are exactly like those of number 4, or the Naia capensis, and so completely different from those of the vipers, that I have placed it, though devoid of the loose skin on the neck, with the former, at least till such time as an opportunity occurs of ascertaining, by anatomical examination, its proper genus. If examples of all sorts of snakes could be procured alive, and kept so for some considerable time, many excellent specific characters, as well as valuable generic distinctions, would doubtless be obtained, and classifications, which have hitherto been formed upon insufficient data, might certainly be fixed upon clear and lasting principles. Indeed so convinced am I of that being practicable, that I have, for some time past, been forming a collection of live snakes; and, from experience, I find that the more their natural dispositions and appearances are remarked, the more perceptible is the insufficiency of our present divisions, and the want of reform.

To attempt the latter, however, with any prospect of success, would require, previously, great observation and extensive experience, both of which must be the work of time; and therefore, by waiting for them, other persons might notice what we ought to do at least in relation to our own colonies. Therefore, to prevent that happening to the Cape of Good Hope, I propose, in successive papers, to give short sketches of the different species of the serpent tribe which are actually contained in our infant museum, dividing them, for the time being, according to the most popular classification at present in use.

VIPERA.

a. With orbiculo-cordate Head, and Fangs.

1. VIPERA *inflata.* Burchell.

Puff-Adder of the Inhabitants.

Ground colour above, varying from brown to brownish-yellow or dirty yellow, and variegated throughout by transverse curved or zig-zag bands of black, and bright yellow or cream-colour. The bright yellow or cream-colour, which ever of them it happens to be, is generally found immediately behind the black ones, and the same colour is invariably observed marking more or less of other scales in various situations. The lateral portions of the black bands are mostly somewhat semicircular with their curvatures backwards; the central parts again acutely angular or arrow-shaped, with their points nearly in the middle of the back, and directed towards the tail. The bands on the anterior and middle parts of the body are for the most part continuous, though marked by such a serpentine course, but near the tail they become much less distinct, and are often either completely interrupted or lost. Towards the middle as well as more forwards, they have three distinct curvatures or angles, one on each side, being generally semicircular, and the third on the middle of the back mostly acute and angular. Besides those three portions, some of the bands have at their extremities also a black blotch on each side, which in some instances are connected to them, but in the majority are separate. The ground colour of the tail is generally darker than that of the body, and more distinctly intersected by several narrow regular and continuous yellow bands, which extend round the greater part of its circumference. Colour below, as well as on the inferior parts of the sides, bright yellow, some of the scuta and squamæ, however, variously marked towards their extremities by black spots. Head much depressed and mottled above by black, yellow, and brown. Generally posterior to each eye, just over the place where the jaws dilate behind, there is a large blackish blotch, with a yellow centre, and also before and between the eyes is usually observed a transverse black band, dotted more or less with yellow. The eyes are situated well forward and high up on the head, the nostrils are large, and placed close to the edges of the upper lip. The scales with which the head is covered, as well as those on the body, are ovate, imbricate and carinated: The nose and lateral parts before the eyes are covered with irregular flattened, granular-like bodies. Body diminishes suddenly and considerably in size at the commencement of the tail, which is slender for the size of the snake, and measures about ⅛th of the whole length, which is usually from three feet to three and a half. The neck is considerably narrower than either the body or the head. Its motion is moderately quick, its disposition fiery, and its bite frequently, though not invariably, fatal. Scuta somewhere about 139, squamæ generally about 22.

The colouring of this snake is very peculiar, and Burchell's * remark, that it is not easy to convey an idea of it by mere description, is very just.

2. VIPERA *armata*.

Horned Snake of the Inhabitants.

Ground colour above, ash-grey, bluish-grey, or greyish-green, with irregular rows of irregular brown spots, that have their edges considerably darker in general than their centres. In most specimens, two distinct rows are observed along the middle of the back, but in some there is only one, and then the spots are considerably larger, and extend right across the imaginary dorsal line. Along each side again, is another row of spots, but of a much smaller size than those just described, and between them and the scuta is a slight mottling of blackish-blue dots, zig-zag streaks, or waving lines. Colour below a shining pearly white, with in many instances a slight tinge of red. Head depressed, and like the body covered with carinated scales. Eyes prominent, placed well forward; and each guarded above by three or more short, erect and prickly pointed bodies, which have obtained for it the name it bears amongst the colonists. Neck considerably smaller than the head or body, and the latter diminishes much in thickness at the vent. The tail is slender, pointed, and about ⅛th of the length, which is seldom more than fourteen or fifteen inches. Greatest thickness rarely more than that of a man's thumb, unless when enraged, at which time, it can, in common with most vipers, increase its dimensions very considerably. Scuta generally about 120, and squamæ about 26.

The motion of this snake is but slow, its disposition is fierce, and its bite I have found invariably occasion death, when inflicted on young animals, though not always when practised on old ones of the same species.

* Travels in Southern Africa, vol. i.

b. With ovato-cordate Head and Fangs.

Vipera *montana.*

Berg-Adder of the Inhabitants.

Ground colour, a dirty brownish black, the intensity of which varies in different specimens. Along the back there are two rows of large, black semilunar spots, having their convexities directed towards each other, and their margins surrounded by a narrow edging of dirty white. Below those, on each side, is another row of similarly shaped and coloured spots, but of a smaller size, and having their convexities pointing downwards. These are separated from the centre rows by two white longitudinal lines, which are, for the most part, continuous, though here and there occasionally interrupted. The two lateral rows are not well seen on the sides of the neck, but the two central ones extend distinctly forwards, along the upper surface of the head, as far as the eyes; though, in the latter situation, the spots are of an oblong, instead of a semilunar shape. Between the side rows and the abdomen the colour is variegated, black, and dirty white; the scuta themselves are of the latter hue, and mottled with black or blackish blue; indeed, in many examples, the latter is the prevailing colour. Head somewhat quadrangular, with its posterior extremity a good deal broader than the neck, and, like the body, covered above by ovate and carinated scales. Eyes moderately large, and placed well forward. Nostrils close to the tip of the nose. Thickness, as in the two preceding species, diminishes rapidly about the anus. Tail slender, pointed, and about $\frac{1}{12}$th of the whole length of the snake, which is generally between sixteen and twenty inches. Greatest circumference seldom more than that of a man's thumb. Scuta generally about 132. Squamæ about 20. Motion rather slow; disposition ferocious, and bite poisonous; though not invariably fatal.

The above approaches so close in its characters to the Coluber Atropos of Shaw *, L'Atropos of Lacepede †, that I feel disposed to view it as the same snake.

It is commonly found amongst short grass, in dry mountainous situations, all over Southern Africa.

Variety.

Ground-colour cinereous, with four rows of spots, similarly arranged and shaped as in the sort just described, but their colour, instead of being black, is reddish-brown, with lighter centres.

NAIA.

a. With loose Skin on the sides of the Neck, and Fangs.

Naia *capensis.*

Ringhals Slang of the Inhabitants.

Above, black and dirty white, the colours disposed in alternate waving transverse bands. The black is the prevailing or sole colour towards the head,

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* General Zoology, vol. iii. part 2. p. 404.

† Histoire Naturelle des Serpens, tom. ii. fol. 134. 4to. Paris, 1789.

and it is not till nearly two inches from that part that the white is distinctly seen. Towards the tail, as well as on it, the regular disposition of the two colours is most clearly marked, and the bands are most directly transverse. Below, the general colour is black, with the scuta, that are more than a few inches behind the chin, white at their extremities. Between those that are thus marked and the head, the space is a deep shining jet black, except at two points, where some plates throughout are nearly white, and thereby give rise to two broad transverse light-coloured bands. Tail slender, tapering, terminated by a shining horny point, and not quite $\frac{1}{7}$th of the whole length of the reptile, which is generally from two feet six to three feet. Head depressed, narrow before, a little dilated behind, and somewhat broader than the neck; covered above by plates, of which the nasal or most anterior one is triangular, its apex extending upwards and backwards, whilst its base is directed downwards, to form the anterior portion of the upper lip. Eyes prominent, nostrils large, and opening backwards. Body broad and flattish, with a loose fold of skin on each side of the neck, which it can extend at pleasure, and form into small wing-like or thin membranous processes, like what is done by the Coluber Naia of Linnæus. Scales carinated, with those of the two lowermost rows larger than any of the others. Greatest circumference about the middle of the body, and that is seldom more than three or three inches and a-half. Scuta usually about 130. Squamæ about 43.

The motion of this snake is very rapid, its disposition is very fierce, often almost apparently courting opposition, and its bite, in all the instances in which I have tried it, has soon occasioned death.

It delights in warm sandy situations, and is found pretty generally diffused over the whole of Southern Africa.

b. Without any loose Skin on the Neck, but with Fangs.

5. NAIA *Somersetta.*

Nacht Slang or *Night Snake* of the Inhabitants.

Ground colour above, a brick red or orange colour, and intersected by twenty-four or twenty-five black rings, which are generally of greatest breadth about the centre of the back, or under the belly. The one next to the head is by much the largest, and above has a pointed extension in front, which runs a short way along the crown of the head. At some distance before this ring, on the hinder part of the head, an irregular black spot is observed on each side; and from the upper lip of one side, to the same place on the opposite, directly cutting the eyes, extends a narrow transverse black band. Many of the black rings on the body have above an interrupted edging of yellowish white. Colour below a dirty reddish-white, more or less deeply tinged here and there with yellow. Head depressed, inclined to ovate, and its sides slightly dilated behind, thereby giving to it a little superiority in point of breadth over the neck. Above it is covered by large plates, the foremost of which, or the nasal one, is considerably elevated above the others, and triangular, with its apex extending upwards and backwards, whilst its base, which is slightly arched, is downwards, and forms the anterior part of the upper lip. The thickness of the body is pretty nearly the same throughout, and does not exceed that of a man's thumb. It increases but little behind the neck, yet it diminishes considerably and rather abruptly about the vent. Tail thickish along its whole length, terminated by a horny point, and measuring about $\frac{1}{13}$ of the whole length of the snake, which is usually about two feet two or three inches. Scales smooth and slightly imbricate, towards neck and tail inclined to ovate, but, about the middle of the body, a little disposed to an orbicular shape. Scuta about 159, squamæ 20. Motion rather quick; disposition extremely fierce; and bite often mortal.

This sort of snake is but rarely met with here; indeed the present is the first I have seen, though for the last four years I have been endeavouring to procure one. The inhabitants assert that it only moves about during the night, and thereby account for its being so seldom found.

ELAPS.

a. With Fangs.

6. Elaps *punctatus.*

Kousseband or *Garter-Snake* of the Inhabitants.

Ground colour, a deep jet-black, variously marked by minute white dots and blotches. Along the centre of the back the spots are largest, and of irregular forms, some being roundish, and others triangular, oblong or waved. On each side of this central row is a zig-zag line of white dots, which forms more or less frequent connections with the spots of the central row just mentioned. Immediately under this second row, is a third also of white dots, nearly straight, and extending distinctly from the head to the tail. Colour below black and white, disposed in alternate transverse narrow lines, which, under the tail, appear in a double series. Head small, somewhat ovate, roundish in front, and covered above by plates, the colour of which are black, with an interrupted whitish line running along the middle of the crown, and the sides slightly spotted with yellowish-white. Mouth small. Neck not less than the head; nor is any part of the body larger than the neck; so that the whole is therefore nearly of the same thickness, except the tail, which tapers gently to a fine slender point, and measures about one-eighth of the length of the whole, which, in the specimen described (the only one I have seen), was about nine inches, and nowhere thicker than a common quill. Scales smooth, slightly ovate, and scarcely, if at all, imbricate. Scuta 183, squamæ 38.

This is a rare species of snake at the Cape; its motion is quick; its appearance beautiful; and its bite highly venomous; having in several instances occasioned death while it continued alive in my possession. Other snakes besides this, which are either remarkable for their beauty, or the variety of their colours, when of a small size, are generally considered by the inhabitants as a Kousseband.

(To be continued.)

Picture of Vegetation on the Surface of the Globe.—Continued from page 124.

AFTER having viewed with M. de Humboldt, the rich vegetation of the most beautiful countries of America, if we now transport ourselves to the wild and desert shores of New Holland, with Billardiere, Brown and Peron, we shall find, in the little that is known of this vast continent, vegetables entirely different, although in the same degree of latitude. Those which have been collected, approach more to the plants of the Old Continent; those destined for the nourishment of man are here as rare as they are common in America. These countries are scarcely inhabited, and the men who live in them have but barely entered upon the confines of civilization, so powerful is the influence of useful vegetables over the multiplication and development of the human race. In calling the attention of the reader to the works published upon the plants of New Holland, by Messrs de la Billardiere and Brown, I shall here confine myself to the more interesting parts of M. Peron's description of the vegetation of Van Dieman's Land.

"It is a very singular spectacle," says this naturalist, "which those profound forests present, the ancient offspring of nature and time, where the stroke of the axe is never heard to resound, where vegetation, becoming every day richer in its proper productions, can exercise itself without restraint, and every where extend its developments without obstruction; and when, at the extremity of the globe, such forests exclusively present themselves formed of trees unknown to Europe, of vegetables singular in their organization, and in their varied products, the interest becomes more lively and interesting. Here, there continually reign a mysterious shade, a great coolness, a penetrating humidity; here crumble with age those powerful trees from which have sprung forth so many vigorous shoots; their old trunks now decomposed by the united action of time and moisture, are covered over with parasitic mosses and lichens. Their interior swarms with cold reptiles, with numerous legions of insects; they obstruct all the avenues of the forests; they cross each other in a thousand different directions; every where they form an obstacle to progression, and multiply difficulties and dangers around the traveller; sometimes they form by their heaps natural dikes of twenty-five or thirty feet in height; in other cases they have fallen across the beds of torrents, or the depths of valleys, forming in this manner so many natural bridges which cannot be made use of but with fear.

To this picture of disorder and ruin, to these scenes of death and destruction, nature, so to speak, opposes with benevolence all that her creative power can present of the beautiful and imposing. On all hands we see pressed to the surface of the soil those lovely *mimosæ*, those superb *metrosideroses*, those *correæ*, but of late unknown in Europe, and which already gladden our groves. From the shores of the ocean to the summits of the loftiest mountains of the interior, are to be seen the mighty *eucalyptuses*, those gigantic monarchs of the southern forests, many of which are not less than from a hundred and sixty to a hundred and eighty feet in height, and from twenty-five to thirty or thiry-six feet in circumference. The Banksiæ of different species, the *proteæ*, the *embothria*, the *leptospermata*, are developed as a charming border around the edge of the woods. Elsewhere the *casuarinæ* are seen, so remarkable for their beauty, so valuable for their solidity, distinguished by the rich colouring of their berries. The elegant *exocarpus* projects in a hundred different places its luxuriant branches, sprouting forth in neglected beauty like those of the cypress. Farther on appear the *xanthorreæ*, whose solitary stem rises to a height of twelve or fifteen, above a scaly and stunted stock, from which an odorous resin oozes abundantly. In some places are to be seen the *cycases*, whose nuts, enveloped in a scarlet epidermis, are so perfidiously poisonous; every where are produced charming tufts of *melaleuca*, *thesium*, *conchium*, and *erodia*, all equally interesting from the gracefulness of their port, or the beautiful verdure of their foliage, or the singularity of their corolla and fruit. In the midst of so many unknown objects, the mind is astonished, and cannot but admire that inconceivable fecundity of nature, which furnishes to so many different climates productions so peculiar, and always so rich and so beautiful."

The happy climate of India is, perhaps, of all others, that on which nature has bestowed, with the greatest profusion, all the luxury of vegetation. Inhabited by people who have long attained a high degree of civilization, its vegetable productions seem to have equally emerged from their original wildness. All present the most elegant forms, and appear to reflect, by the vivacity of their colours, those floods of light which the star of day continually pours upon their corollas. Those beautiful countries are perfumed by the most precious spices, embellished by the superb family of the liliaceae; scarcely is there one of the plants observed in Europe to be seen. There grow those vegetables which furnish commerce with those gums and odorous resins which are imported by us at so high a price; those medicinal plants, which, for so long a time, have only been known by their productions, and by unmeaning denominations. It is here that we learn to what shrubs, and to what plants, are to be referred the campeachy-wood, the snake-wood, the nux vomica, the cassias, the myrobolans, the tamarind, the curcuma, galamba, ginger, cardamom, zedoary, dragon's-blood, &c. In the fields and in the plains, there vegetate an immense quantity of beautiful plants, some of which constitute the riches of our gardens; the *clerodendra*, *justiciæ*, *achyranthi*, *cerberi*, *pontederiæ*, *eranthema*, *gloriosæ*, *crotones*, *acalyphæ*, &c.

In this general picture of vegetation, we would not forget another corner of the world, where nature seems to delight to shew her munificence, in the infinite number of species belonging to the same genera,—to genera, whose types, for the most part, already exist in Europe; to mingle them with other genera peculiar to the climate, and of which some have been remarked among the plants of America. Such does the Cape of Good Hope present itself to the eye of the naturalist, who visits it for the first time; he is struck with astonishment at the sight of those mountainous rocks, covered with succulent plants, aloës, *mesembryanthema*, *stapeliæ*, *crassulæ*, *tetragoniæ*, &c. If he penetrate into the forests, they are no longer those of Europe or of America; he sees them all shining with that golden and silvery lustre, diffused over the leaves of the numerous *proteæ*. Let him traverse vast plains, he can scarcely count the numberless species of heaths, *borboniæ*, *blæriæ*, *penæa*, &c. The thickets and woods are composed of a multitude of shrubs little known, of beautiful *phylicæ*, *passerinæ*, *myrsinites*, *tarconanthi*, *anthosperma*, *roy-enæ*, *halleriæ*, &c. While in the fields grow in rivalry, the numerous *gerania*, *ixiæ*, *gladioli*, *lobeliæ*, *hæmanthi*, *selagines*, *ste-*

vias, everlasting-flowers, &c.; several of which now shine in our parterres, or form the ornaments of our hot-houses. The species alone which we possess are so numerous, that we can scarcely believe them to be the productions of a single locality. We count several hundreds of heaths, gerania, &c.

To form a comprehension of the work of nature, we must observe it in those countries where the ground, abandoned to its natural productions, has not yet been turned up by the hand of man. Wherever this has established its power, it has subjected to his empire all that might contribute to his well-being, or embellish his abode; the animals have become slaves; rich harvests and vast meadows have replaced the wildnesses of nature; ancient forests have fallen under the axe, and the ground, despoiled of its original productions, no longer presents to the eye of the observer, but a vast garden created by human industry. The tree of the mountains has descended into the plains, and the exotic plant, more useful or more agreeable, has chased from its native soil the plant which is noxious, or of no utility to man. It is therefore only at a distance from great societies in foreign countries, in lands untouched by man, that vegetation can be studied in its natural state, understood in its modifications, development, and progress.

There still, however, exist countries in Europe which the power of man has not entirely subjected; but it is only among the proud rocks, and upon the summits of the Alps, that they are to be looked for. There mountains piled upon mountains, rising above the clouds, form so many gardens, each furnished with a vegetation of its own, the character of which changes at each degree of elevation. There, in proportion as we rise, we find succeeding each other the temperatures of various climates, from that of the tropics to that of the poles, as well as several of the vegetables peculiar to each of these climates.

At the foot of these mountains, and in the lower valleys, vegetate the plants of the plains, and a part of those of the southern countries of Europe. Forests of oaks occupy the first platform; they rise, but not without losing a proportional degree of their strength and beauty, to a height of about eight hundred toises, the extreme limit of their habitation. The beech shews itself equally, but the oak has ceased to grow more than a hundred fathoms beneath the highest limit of this plant. In the zone which succeeds these trees, more exposed to the impetuosity of the winds, would present too much scope for their action, in the large cyme and broad leaves which they possess. The pine, the yew, the fir, furnished with a finely divided foliage, raise securely toward the regions of perpetual snow their robust and branchless trunks. The action of the winds no longer meeting the same resistance, is divided and loses its force among their short and slender leaves. These trees, however, do not attain a greater elevation than a thousand toises; above this, woods of *cratægus*, and birch, and tufts of hazel and willow, among which the rhododendrons flourish, brave the cold and the tempests, to the height of twelve hundred toises. Beyond this, appear, but with a much lower stature, a multitude of beautiful and elegant shrubs, *daphnes*, *passerinæ*, *globulariæ*, creeping willows, and some ligneous cistuses.

Further on, to the region of snow, scarcely any more woody vegetables are found, if we except some dwarf birches, some stunted willows, scarcely a few inches long. A short beautiful and tufted sward springs every summer from beneath the snowy mountains, and is covered with a multitude of pretty little flowers with rosaceous petals, naked peduncles, and vivacious roots: this is the peculiar place of the numerous saxifrages, elegant primulæ, gentians, *ranunculi*, and a profusion of other diminutive plants. The frightful nakedness of the poles reigns upon the summits of these mountains loaded with perpetual ice; if there still remain some traces of vegetation, they only exist in a few lichens, which here, as elsewhere, endeavour, but in vain, to lay the foundations of vegetation.

Thus the traveller, having arrived on these mountains, at the region of ice, has experienced, in the course of a few hours, the different degrees of temperature which reign in each climate from the tropics to the poles; he may have observed a portion of the plants which grow from about the 45th degree of latitude to the 70th, that is to say along a meridian of about eight hundred leagues, a phenomenon which exists in all high mountains, of both the Old and the New Continent, with some modifications peculiar to the localities.

The observations made by M. Humboldt, in the equinoctial regions, and upon the highest mountains of our globe, furnish us with a proof of this. The same order occurs there in the gradation of species, but only above the height of five hundred toises. The species, to be sure, are not the same as in Europe, but they have the same character of aspect, size, and consistence. The burning zone which occupies the lower space from the level of the sea to this height, enjoying a temperature unknown to Europe, is inhabited by vegetables peculiar to this climate; this, as we have seen above, is the country of palms, bananas, amomums, tree ferns, &c. It is only, therefore, at the height of five hundred toises, that, upon the mountains of the torrid zone, the climate commences which corresponds to the base of the Alps, proceeding from the level of the sea, and it can only be here that the zone of plants corresponding to those of Europe can commence.

Such is the spectacle of vegetation, always varied, and incessantly renewed, that presents itself to the view of man; a spectacle rich in its composition, admirable in its contrasts, sublime in its harmony, and which, to produce it, has only required of nature to submit the forms to the influence of different temperatures, of temperatures I repeat, and not of climates. It is a very essential effect to remark, that the production of vegetable species is much more dependent upon the action of heat or cold, of dryness or humidity, than upon the difference of climates; we may meet, and in fact do pretty frequently meet, the same species in very different latitudes, in which, however, from local circumstances, the same degree of temperature prevails. It is thus that we find upon the high mountains of the South of Europe, plants of Sweden, Norway, and even those of Lapland and Spitzbergen. Tournefort made the same observation in Asia minor, upon Mount Ararat. At the foot of the mountain are found the plants of Armenia; in proportion as we rise, those of Italy and the south of France, then those of Sweden, and toward the summit the plants of Lapland. It is by means equally simple, that nature has removed from the surface of the globe that monotonous uniformity which the plants would produce, were they every where the same; but, subjected to the influence of the atmosphere, what varied forms do they present to our admiration!

A temperature constantly humid and warm, such as that of the equinoctial countries, maintained by the rays of a burning sun, and the emanations of a soil watered by the vicinity of large rivers and lakes, gives to vegetation that vigour which astonishes in those magnificent vegetables peculiar to those climates. Another form of plants is seen in those countries which are exposed to the alternations of cold and warm seasons; it is more equal upon the sea-coasts, where the temperature is less variable; but the plants assume another aspect upon the high mountains, where dry and cold winds frequently blow; they vary little in the fresh-waters, or in those of the sea; being there placed in a medium less subject to the inclemencies of the atmosphere. The intensity and duration of the light, the long and humid nights, occasion as many different modifications in the vegetable forms. Nature has also so fixed the station of plants, that the dwarf and creeping willows never descend from the summit of their mountains to associate with the osier willows, upon the banks of our brooks; and the primulæ, which decorate the green swards of the Alps, cannot mingle with those of our meadows.

From these considerations has arisen the idea of a botanical geography, in which the plants are distributed by groups, which have each their determinate height, their climate, and their limits. Several naturalists have directed their attention to this sort of observations, but no one has carried them so far as M. de Humboldt, who has published memoirs of great interest upon this subject. From the observations of this learned traveller, and those partly made before him, we see the cruciform plants and the umbelliferæ disappear, almost entirely, in the plains of the torrid zone; while this zone is the abode of palms, tree-ferns, gigantic gramineæ, and parasitic orchideæ. In the temperate zones grow abundantly the malvaceæ, the labiatæ, the compositæ and caryophylleæ, which are very rare under the equator. The coniferæ, and a great number of amentaceous trees, belong to the boreal regions. There are other families which recur, in almost all the countries of the globe, such as the gramineæ and the cyperaceæ, but under different forms, according to the temperatures. Some of them nearly rival the palms in size, such as the bamboos, &c.; others form but a short and tufted sward. My limits not permitting me to enter farther into detail on this interesting subject, I refer the reader to the learned dissertations of Linnæus, the Stationes et Coloniæ Plantarum, to the Tentamen Historiæ Geographicæ Vegetabilium of Professor Strohmeyer, and particularly to the Memoirs of Messieurs de Humboldt and Ramond *.

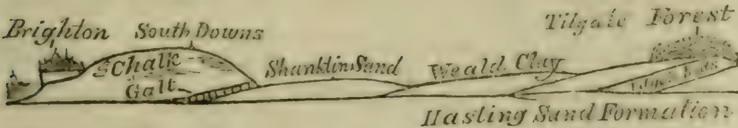
Remarks on the Geological Position of the Strata of Tilgate Forest in Sussex. By GIDEON MANTELL, Esq. F. R. S., &c. In a Letter to Professor JAMESON.

THERE appeared in the Edinburgh Philosophical Journal for April, "Observations on the Position of the Fossil Megalosaurus, and Didelphis or Opossum at Stonesfield," in which the writer alludes to the strata of Tilgate Forest; and remarking on the extraordinary nature of their organic remains, very summarily concludes, that doubts may be raised regarding the geological position, both of the limestone schist of Stonesfield, and the sandstone of Tilgate Forest. I shall leave to the abler pen of Dr Buckland, the defence of the assumed situation of the Stonesfield slate, and confine my observations to the consideration of the writer's conjecture, that the Tilgate strata should be ranked as tertiary, and not as secondary, deposits;—a conjecture no one could, for a moment, entertain, who had examined the strata of the south-eastern part of England with any degree of attention.

The only argument brought forward in support of an opinion so entirely opposed to that held by persons who have devoted considerable time and labour to the subject, is, that "the strata which contains the organic bodies do not appear *clearly covered* by those of the formations which are said to be more recent." If such an argument be considered valid, the progress of geology must be slow indeed. In other branches of natural history induction and analogy are frequently admitted to supply the place of actual observation; and I cannot understand why the same privilege should not be extended to geology. In the present instance, however, it is unnecessary; and I am willing the question shall be decided by demonstration only. That the strata of Tilgate Forest are not *actually* covered by the newer

* Poiret's Leçons De Flore, Paris 1825.

deposits *in those localities that are most accessible* to the geologist, is certain; but their emergence from beneath the weald clay, the superincumbent formation, is so obvious, as to leave not the shadow of a doubt that they were originally entirely covered by the clay, and that their present approach to the surface is owing to the operation of that uplifting power, whose effects are strikingly manifest throughout the whole of the south-eastern part of England. The annexed section of the strata from Brighton (on the coast of Sussex) to Tilgate Forest, is made, not from theory, but from actual observation, and will, I trust, satisfy the writer of the "Observations," of the correctness of my remarks.



If the section were continued on to London, the several formations would re-appear, but in an ascending series (vide Phillips and Conybeare's sections). The attention of geologists was first directed to the remarkable nature of the fossils of the strata of Tilgate Forest, by my work on the Geology of Sussex, in 1822; and although, at that period, the geological position of those deposits was not determined, yet I had not the slightest doubt that they were situated beneath the weald clay. The only question was, whether they should be ranked with the purbeck, or the iron sand; their emergence from beneath the more recent formations was too manifest to be questioned (vide Illustrations of the Geology of Sussex, p. 57). Subsequent observations convinced me, that the strata of Tilgate Forest, instead of being limited, as I had at first supposed, to a small district, were co-extensive with the iron-sand, and might be traced through Sussex to the coast at Hastings; and a paper, describing the result of my researches, was read before the Geological Society of London, in the same year (1822).

The writer of the observations states, "that there are *numerous considerations* that might lead us to consider the two deposits (viz. the Stonesfield slate and Tilgate limestone) as having been formed at a period which would be much newer than that of the oolitic formations; in short, that they are tertiary, and not secondary deposits." What the considerations may be that can lead to such a conclusion I cannot possibly conceive, and shall not therefore occupy the valuable pages of this Journal with useless conjectures; but as my sole object, in these remarks, is the establishment of what I conceive to be the truth, I shall feel obliged, if the writer still entertains a doubt on the subject, by the statement of his objections to what I have advanced.

In the present infancy of geology, if a person discover, in certain formations, remains of animals and vegetables, of classes or orders, which, according to received theories, we might not expect could be found in such deposits, we ought not, on that account only, to doubt the accuracy of his investigations, or the truth of his assertions.

In the comparative list of the organic remains of Stonesfield and Tilgate, inserted in the Memoir on the Megalosaurus, it was the object of Dr Buckland to mark their general resemblance only. It may not, therefore, be uninteresting to give a more extended catalogue, since the difference, as well as resemblance of the fossils of the two deposits, will thus be placed in a more striking point of view.

Organic Remains of

The Limestone Schist of Stonesfield	and *The Sandstone of Tilgate Forest.*
Megalosaurus, teeth, vertebræ, and other bones.	Megalosaurus—teeth, vertebræ, and other bones.
Crocodile.	Crocodile—teeth, vertebræ, &c. teeth more obtuse and large than those of Stonesfield.
Plesiosaurus.	Plesiosaurus—teeth and vertebræ; species unknown.
Didelphis.	Iquanodon — teeth, vertebræ, and
Elytra of insects.	other bones; hitherto not found elsewhere.
Birds—tibiæ, and other bones.	Birds—tibiæ somewhat resembling those of Stonesfield.
Whale ? ?	Whale ? ? the supposed humeri are probably of Plesiosauri.
Balista—species of.	Balistæ—spines of.
Turtles—scales and bones; species uncertain.	Turtles—3 genera; a fresh-water, marine, and terrestrial?

Teeth of Squali or Sharks.	Tricuspid teeth, longitudinally striated; differ entirely from those of the chalk, and from those of the recent species I have examined.
Teeth of Spari and Anarhicas lupus?	Teeth of Spari and Anarhicas lupus? small rounded teeth, very numerous. Bony palates—unknown.
	Bones of unknown animals.
Shells—*Trigoniæ*, *Belemnitæ*, *Ostreæ*, *Pectenitæ*, *Patellæ*, *(marine)*.	Shells of the genera Unio, Mactra, Paludina, Cyrena, *(fresh-water)*.
Ferns and reeds—not of the same species as those of Tilgate.	Ferns—4 species; reeds.
Wood? lignite, charcoal.	Wood? lignite, charcoal.
Fuci, algæ.	Gigantic plants of the Palm tribe; (Endogenites erosa).
	Arborescent ferns—(Blathraria Lyellii).
Carpolithi.	Carpolithi—not the same as Stonesfield.
Quartz-pebbles.	Quartz-pebbles and boulders.

A glance at the above lists will shew, that, although the general resemblance of the organic contents of the two deposits is striking, yet they actually agree but in few particulars. The Stonesfield beds partake more of the character of a marine, and those of Tilgate of a fresh-water formation. The prevalence in the latter, of large terrestrial vegetables, of which the genera, at all analogous *(Cycas*, *Dicksonia*, &c.), now exist in tropical regions only; and the absence of marine shells, particularly of *Belemnites* and *ammonites*, and also of *zoophytes*, seem to prove, that the Hastings Sands (the name now given to the series of sands and clays between the purbeck and the weald clay, and of which the Tilgate strata form a part) have been deposited under circumstances materially different from those which operated in the formation of the Stonesfield slate. But, as a work on the Fossils of Tilgate Forest will shortly appear, it is unnecessary to extend these remarks; and I will only add, that, should the writer of the "Observations," or any one interested in the subject, visit this part of England, he shall have free access to my cabinet; and it will give me pleasure to afford him every facility for an actual examination of the strata of Tilgate Forest.

Castle Place, Lewes, Sussex,
August 2. 1826.

Description of a Design for a Rotatory Steam-Engine. By Mr James White. With a Plate. Communicated by the Author.

After completing my design, I feel a degree of diffidence in submitting it to public notice. Nearly two hundred years have past away since the first attempt to produce a rotatory motion in the first instance by steam, such a period of time having involved itself betwixt the original and the present; and the men of genius, both in our own country and abroad, that have laboured to effect this object, and the universal failure of all their designs, when compared with the present perfect state of the Reciprocating Engine, has absolutely marked the name of Rotatory in Steam-engines as something like a wild scheme, and left us but little hope that we shall ever be able to wipe that stain away.

Those who are well acquainted with the principles of steam, and the different schemes that have been devised for a rotatory steam-engine, are aware, that the friction occasioned from an unequal pressure of steam on the revolving cylinder, has been the great obstacle which stood in the way of success. That such difficulties no longer exist, can be plainly shown in my design. First, let it be understood that the engine consists of one large outside cylinder, divided by plates into three divisions; the mid division being in length equal to the other two. In each of these divisions, smaller cylinders are concentrically placed, called the revolving cylinders; the difference betwixt the inside diameter of the outer cylinder, and the outside diameters of the inner ones, forms the steam-passage. Let A, Plate V. Fig. 1. represent one of the revolving cylinders; then B, B, will be the steam-passage: if the steam from the boiler enter by the steam-pipe *s*, and pass downwards, it will get into the steam-passage B, B, through the valve *f*, act on the piston-plate P, which is fast to the revolving cylinder, and force it round; when it has nearly made a revolution, the quadrants on the piston-plate will come in contact with the valve, but not before the piston-plate has passed the passage C, leading to the condenser; consequently the pressure is removed

Fig. 2.

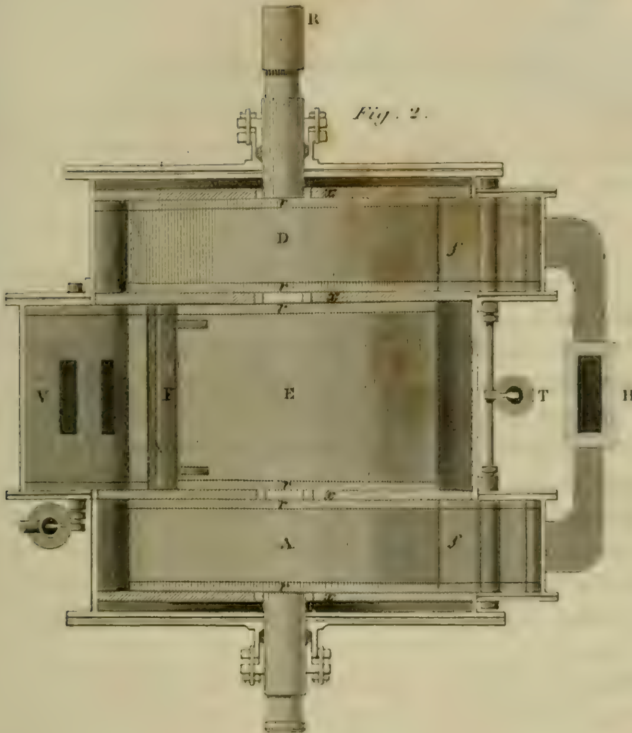
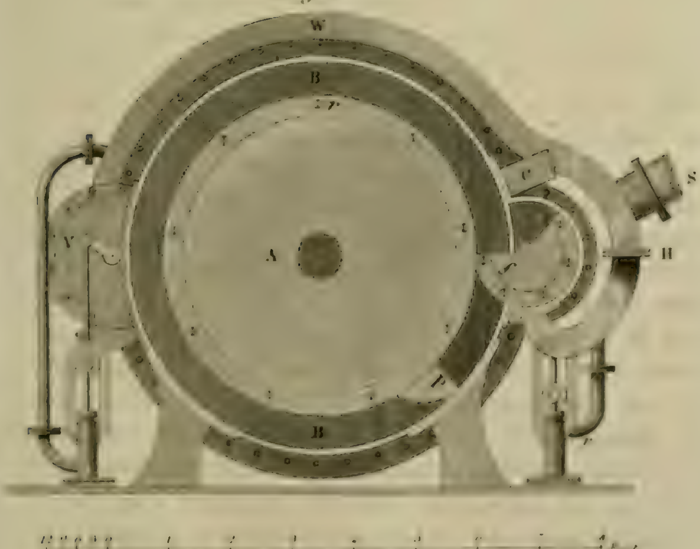


Fig. 1.



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from the valve. A fly-wheel being supposed to be attached to the engine, will continue the motion, cause the quadrants on the piston-plate to open the valve, and allow the piston-plate to pass. It has now made a complete revolution. When the valve *f* begins to open, it shuts the steam off, consequently there is no expence of steam when the power has to be performed by the fly-wheel. The re-shutting of the valve is also performed by steam, from the small lever on the spindle of the valve connected with the piston, working in the small steam cylinder T: when the valve begins to open, it will raise the piston in the cylinder T; but as soon as the piston-plate P has passed the valve, the steam acting on the piston of the small cylinder T, will force it down again, and shut the valve. Thus may we consider it ready for a second revolution. Before explaining further, let us suppose that the engine only consisted of one steam-passage, in place of three, and let it be that which I have already described: when the piston-plate P has only made a half revolution, it is evident that the steam would then be entirely on the under-side of the revolving cylinder A, and force it up against that side where there is no steam, and cause such a degree of friction on its bearings, that the force on the piston-plate would be little more than sufficient to turn the revolving cylinder round. To overcome this great obstacle, I have divided the outer cylinder into three divisions, shown in Plate V. Fig. 2. by the division plates marked *x*, *x*, &c. These plates do not revolve. The first division contains the cylinder A, being that which I have already described as having made a revolution; the mid division, the cylinder E, and the third division the cylinder D. The two end divisions containing the cylinders A and D, are in every respect similar to one another, and the valves *f*, *f*, are on the same spindle. The mid division containing the cylinder E is in principle exactly similar to the other two, and only has this difference, that it is equal in length to both.

Fig. 1. Let the steam be admitted by the steam-pipe *s*, and pass downwards through the two end valves *f*, *f*; at the same time it will pass upwards, through the pipe W, over the outer cylinder, and through the mid valve V, act upon the piston-plate F of the mid division, shewn in Fig. 2. and equalize the

pressure from the under-side. The revolving cylinder will thus be forced round by an equal pressure of steam on all sides, to effect $\frac{9}{10}$ths of a revolution; leaving about $\frac{1}{10}$th to the accelerated force of the fly-wheel, at which period no steam is expended.

Fig. 2. H, shews the flange to connect the steam-pipe W leading to the mid division; *r*, *r*, &c. brass rings fitted on the ends of the cylinders, in such a manner as to make them steam-tight against the division-plates *x*, *x*, &c.; and R the shaft of the revolving cylinders.

In cases where a fly-wheel must be dispensed with, the piston-plates can be so placed on the revolving cylinders as the mid one would be in action, when the end ones pass the valves, and the end ones in action when the mid one passes; but in this case the pressure on the revolving cylinders would not be exactly fair.

London,
7. Pratt Street, Lambeth,
27th July 1826.

Tour to the South of France and the Pyrenees, in 1825. By G. A. Walker Arnott, Esq. A.M. F.L.S. & R.S.E. &c. In a Letter to Professor Jameson. (Continued from p. 78.)

On the 1st of April Mr Bentham and I left Avignon behind us at 4 A. M. We arrived at Lafoux at half-past 7. This is a small village on the other side of the river Gard, from and opposite to the town of Remoulins. It is the La Fourche of Sir James Smith; and I had been much prejudiced against this place by some remarks I remembered to have been made by that author in his Tour on the Continent. I was, however, agreeably disappointed. Instead of a dirty and comfortless inn, we found one remarkable for its neatness and cleanness. Many changes and many improvements have, however, every where taken place during the last forty years. Towards 9, we sallied forth to see the famous Pont de Gard, which is about two miles higher up the river. This remarkable bridge, or rather aqueduct, consisting of three series of arches, one above the other, is thrown over a very deep valley, and served in ancient times to convey water from a hill in the neighbourhood to the town of Nismes. But this astonishing piece of Roman architecture has been so often and so well described, that it were folly in me to say a word more on the subject, than that at present it is so very entire that we walked from the one end to the other, within the aqueduct itself. The covering in some places is broken; but we found little difficulty in returning on the top. On the centre roof-stone was a long Latin inscription; but we had neither time nor patience to attempt to decypher it.

Within the aqueduct, and on the roof, we observed many curious little plants. Indeed, it, like the steps of St Peter's at Rome, may well be said to produce a Flora sufficient to gratify one who had come from a northern climate. Amongst others were *Hutchinsia petræa*, *Linaria rubifolia*, *Helianthemum racemosum β*, Duval, *Valantia muralis*, *Ceterach officinale*, *Polycnemum arvense*, *Tortula chloronotos*, Brid. *Grimmia africana*, &c.

We botanized in the neighbourhood, where we met with several of what botanists call good plants. *Iris pumila*, both the yellow and blue varieties, *Ophrys aranifera*, *Valeriana tuberosa*, *Tulipa clusiana* (I doubt much that this should rank as a species), *Orchis robertiana* (of which only one plant was found by us), *Globularia alyssum* and *Thapsia villosa* (but not in flower), were all here. The *Grimmia africana* covered the rocks, while *Tortula gracilis* was abundant. We had been informed that a peculiar species of *Cyclamen* grew here, as well as at Capouladon, in the neighbourhood of Montpellier, and we sought for it long, but without success. Of the *Iris pumila*, some make two species, I think erroneously, although it is probable that, as garden varieties, they may keep tolerably constant. On the rocks opposite to Lafoux is *Targionia hypophylla*, and behind the inn was a field covered with *Holostea umbellata*, a plant nearly as scarce in the south of France as in Scotland.

Having done ample justice to a dinner that we had ordered to be ready by our return, we left Lafoux at 6, and got to Nismes at 9 o'clock. The amphitheatre and maison carrée, both splendid remains of Roman magnificence, are sure to give high pleasure to all who see them.

The materials for building both these at Nismes, and the Pont de Gard, must have been brought from a considerable distance (probably to the south), at least no stones can possibly be procured at this day any where in the neighbourhood, of so durable a nature.

Leaving Nismes at 11 P. M. we arrived at Montpellier at half-past 6 the next morning, and in a few hours set off for the Chateau de Restinclières, the seat of Sir S. Bentham.

When I left Paris, it was my intention to remain only a fortnight at Montpellier, and then to proceed to Switzerland. But I was induced to alter my plans, and to go to the Pyrenees in the summer, by the persuasions of my friend Mr Bentham, and of two other gentlemen MM. Regnier and Audibert, who were to accompany us for six weeks.

A northern botanist had no leisure to feel ennui in the south of France, such is the variety of almost new objects that meets his eye. A few hours were devoted before breakfast to the gathering of specimens, which, in the heat of the day, we laid out to be pressed and dried, or changed the paper of such as were in progress. By this I was enabled to collect, not only for myself, but for such British and foreign botanists as might desire the productions of Montpellier, without going to look for them. But we were not contented with what we found on Sir S. Bentham's property, one of the richest in wild plants in the neighbourhood of Montpellier. We sometimes, with M. Delile, Professor of Botany, and M. Duval, the author of the monographs on the Annonaceæ and the genus Solanum, made more distant excursions. One of these took place a few days after my arrival.

" *7th April.*—We set off on Tuesday (the 5th) at 5 in the morning for the Pic St Loup, an arid rocky hill of considerable elevation, about sixteen or twenty miles north of Montpellier. There is an old chateau on the right, to which we directed our steps, for the purpose of procuring there the *Arabis verna.* It was not in flower, but we found a few of *Orobanche epithymum* (*O. rubra*, Sm.); and on the other side of the hill we met with *Draba muralis*, and several other interesting plants. We now skirted along the north side of the hill towards the west, until we arrived at a wood, in which we expected to procure the *Pæonia peregrina.* A fortnight ago it had been in bud; but in bud it still was, and we were consequently disappointed. We had, however, another object more worthy of search; and we now began to make inquiries after a place called La Roque, or Roquette. No one of the few we encountered could, however, give us that information. At last we met one who told us that there was a village called La Roque some leagues to the north: of that we were aware, but it could not be our La Roque. The plant we sought for was the *Brassica humilis*, a plant closely allied to *B. repanda*, the *Sisymbrium monense* of Villars, and resembling somewhat our own *Brassica monensis*, but much smaller, growing at a distance from the sea, and in a hot climate. It had been discovered by De Candolle, when Professor at Montpellier, and has hitherto been found no where else. Indeed, it is doubtful if the station be known to any one but De Candolle. He thus indicates the locality: "Planities argillosa pone montem Lupi, in pagos Londres et La Roque." Londres was soon found; but as for La Roque, alas! We searched diligently over several plains all the way to Londres, but without success, and then giving up the pursuit, we returned to St Martin by some meadows. No sooner did we arrive at this village, where we were to pass the night, than we discovered that we had been wandering nearly all the afternoon in part of the individual "planities argillosa" we were in quest of. La Roquette (not La Roque), we found to be an old castle, and a very conspicuous one, too, with a few farm-houses about it, and this the peasants we had met with were in the habit of calling merely the *Castello*, and did not know that it possessed the denomination of *di Roquetta.* Had we known, we might have examined the plain with more attention, but, on account of its great extent, it is not likely we should have been successful. I had, however, no reason to be dissatisfied: much that I saw was new to me, at least in the wild state. MM. Delile and Duval met us in the evening. St Martin is a dirty village; and as for the *auberge*, it certainly had not cleanliness to recommend it.

"Yesterday morning we started at 5 o'clock for the Capouladon. Here grows the same species of *Cyclamen* that we had endeavoured to fall in with at the Pont de Gard. Bentham and Delile had seen it in bud about a fortnight ago, and we hoped to get it in full flower. After a fatiguing walk up hill and down hill for three hours and a half, in which time the sun had broke forth with all his power, we came to the Capouladon. I deserved some recompence, for never did I suffer so by the heat. We proceeded at the rate of full four miles an hour; but this gave no more inconvenience to my companions, than it would to me in a Highland glen with my gun in my hand in the month of August. We arrived at the Capouladon, and found the *Cyclamen* still *en bouton*, apparently not more advanced than it was a fortnight ago.

" From the Capouladon, we descended by a romantic ravine (I say *romantic*, but there was no stream, no not even a drop of water to moisten the parched valley), for a mile or two, until we arrived on the banks of the Herault. On the banks of this river we met with *Lycopodium denticulatum* (a species perhaps too much allied to *L. helveticum*), and *Hepatica triloba*: on some rocks *Globularia alyssum* and *Coronilla glauca*. We returned to St Martin in the evening by a small hill called Agasse. This is the *patois* name for the *Acer Monspeliensis*, which is very abundant on this hill. Owing to the elevation of most of the ground we had passed, the vegetation was not so much advanced as at Montpellier.

" To-day Delile and Duval set off for Montpellier, and we for Restenclières. We botanized by the way, and got some good plants. *Leucodon sciuroides* and *Pterogonium Smithii* were in a fine state of fructification. In one valley, *Erica arborea*, with its handsome white blossoms, and which deserves as good a place in our gardens as the Cape heaths, was abundant, as well as the *Erica scoparia*. *Lavandula stœchas*, scarcely yet in flower, covered the side of a hill. On the rocks here was also *Lichen mamillaris* of Gouan, a species which can be only confounded with *Lecidea candida*. It does not appear to have be taken up by Acharius or any other lichenologist, nor is it noticed in Steudel's Nomenclator Botanicus *.

* I have since ascertained it to be *L. tumidulus*, Smith, Linn. Trans.; but Sir James himself has since united it in English Botany, t. 1138. to *Lichen* (Lecidea) *candidus*. I almost think there are good marks of distinction.

"Through all the districts I have passed during these three days, I observed that the prevailing large plants on the waste lands are *Genista scorpius*, *Cistus monspeliensis*, and *Lavandula spica*, interspersed with *Quercus ilex* and *coccifera*, *Rosmarinus officinalis* (the Rosemary), *Buxus sempervirens* (the Box-tree), &c. Of these, the *Genista scorpius* holds the place of the *Ulex Europæus* or Furze in Scotland: the *Lavandula spica** they have in place of our *Calluna erica*, or heather; and as for the *Quercus ilex* and *coccifera*, they would, if not cropped by the sheep, cover the grounds like the *Quercus sessiliflorus* in the Highlands of Scotland. Upon the whole, the country here is far from beautiful: the whole, with the exception of a few scattered valleys, consisting of waste lands or *Garriques*. These wastes consist of little but small sharp-cornered hard stones, of a grey colour, which in some places ages scarcely moulder down: the consequence is, that there is but little soil, and that little is immediately seized upon by the wild plants. Nor is it possible to cultivate these garriques; remove the surface stones, and you only find more; besides, the heavy October rains wash down the finest mould into the valleys, leaving the hilly parts absolutely destitute of covering. Caledonia's hills are celebrated for being bare and barren; but they must give up the point when Languedoc contests it. On ac-

* The plant found at Montpellier, and throughout Provence, is the true *L. spica*; that usually cultivated in our gardens is a more mountainous species, being the *L. vera* of De Candolle. Between these two and the *L. pyrenaica* there exists great confusion among authors. The chief character pointed out by De Candolle is the shape of the bracteæ being linear in *L. spica*, and broadly cordato-acuminate in the other two; and even in these, the shape is not precisely the same, though not so strikingly different as to afford a good specific character. De Candolle, however, founds upon it. One of the nerves of the calyx in all the species expands at the apex into a small foliaceous appendage, which closes the orifice of the calyx before the appearance of the corolla. The shape of that part, although the character be extremely minute, affords, as my friend the Baron Gingins de Lassarey at Berne has clearly shewn me, the best specific difference. Baron Gingins, the celebrated author of the article *Violarieæ* in De Candolle's Prodromus, is about to publish a monograph on the *Lavandulæ*. Among other remarkable discoveries, he has found that the simple and pinnated leaved species present two very different structures in the embryo of the seed, which promises fair not only to separate the latter generically from the former, but, should a natural classification of the *Labiatæ* demand it, to remove them to a different part of the order.

count of the paucity of soil, it will readily be supposed that there is no pasture for the larger cattle: indeed, there is scarcely a dozen cows in the country. Sheep-milk is chiefly in use, but that cannot always be had, as in summer even the sheep must be sent some days' journey to the north, to the mountains of the Cevennes. How different is even poor Scotland, where every hill has a valley watered by a rivulet. Here there are no such things as springs; no such things as streamlets: we find either extreme aridity or a large river. The Lez (a river which flows past Montpellier) commences close to Sir S. Bentham's house. Where it issues from the rock, it is as large as a good-sized mill-dam; and indeed, before it is allowed to narrow into a river, it is obliged to act on a mill. It resembles Vaucluse, but seems much larger, although the surrounding rocks being by no means so elevated, or on so grand a scale as the other, prevents its being considered so romantic. Though scarcely known, except to the natives of the country, I consider it one of the most remarkable objects I have observed about Montpellier. It deserves well a passing traveller's attention. The rivers here generally decrease in volume as they flow outwards, thus reversing the laws followed by nature in more northern climates. There seem three principal causes: the quantity taken off for irrigation; the want of after supply, on account of the absence of springs or feeding streamlets; and the great evaporation to which the river is subject. Hence, however improbable, there is no impossibility in the circumstance of the African Niger spreading out into a large surface, and being then evaporated.

" Besides the Castello di Roquetta, we saw a considerable number of other forts on the north side of the Pic de Loup. Every small hill was provided with one; but they are all now in a state of ruin. These served as strongholds to the different families during the Languedoc wars. But now that all danger is past, that private feuds have ceased, and that these *castellos* have gone to decay, it is astonishing to see the same desire still prevail here of building even their farm-houses on as elevated a situation as they can choose. What are their motives for so doing it is difficult to conceive. They are farther from water, and more exposed to the sun; for the all-destroying Revolution cleared this country of every tree. Is it to enjoy a view of the Mediterranean? or, as one of my friends jocularly said, Are they afraid of an inundation?"

(To be continued.)

On the Changes which the Laws of Mortality have undergone in Europe within the last Half Century, or from 1775 *to* 1825. By M. BENOISTON DE CHATEAUNEUF.*

1. THE physical circumstances amid which man is placed, the passions which animate him, and the political revolutions by which he is agitated, influence his organization, alter and modify it. The inhabitant of the north, free and happy, is not born, does not propagate, and dies not, like the suffering, unhappy, and enslaved inhabitant of the south; and the calculations, whose object is to determine the chances of his life, no longer afford the same results, when it is spent in affluence and independence, as they do when it is passed in poverty and servitude.

2. These numerical results, therefore, whenever they can be obtained, become the truest expression of the degree of well-being, which he owes to his institutions. They furnish, says a celebrated English writer, Mr Malthus, more instruction regarding the internal economy of a people, than the most accurate observations of the traveller.

3. In the last century, several philosophers occupied themselves in investigating the laws of mortality, and the probabilities of the duration of life, at all the periods by which its course is divided. According to their calculations, the following facts have been considered as sufficiently established:

4. In a growing generation, the half died in the first ten years of existence, and even sooner.

5. Three-fourths had perished before fifty years, and four-fifths at sixty; or, in other words, of a hundred individuals, fifteen only arrived at this age.

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* Read to the Royal Academy of Science on the 30th January 1826.

6. From eighty to a hundred years, none remained: a whole generation had run its course.

7. The general proportion of deaths was determined to be as one to thirty-two*, and that of births as one to twenty-eight.

8. It was reckoned that there was one marriage in a hundred and ten, or a hundred and fifteen individuals, and that the degree of fecundity was pretty accurately represented by four children for each couple, although, at the same time, this, as well as all the other relations, was liable to vary according to the places. In Spain and Italy, there were only two children from each marriage; in France and Russia four; from six to eight in Germany, and from eight to eleven in Sweden.

9. All these facts were deduced from the calculations of Necker, Moheau, and the Pommelles, in France; those of Short and Price, in England; of Sussmilch in Germany, and of Fargentin in Sweden.

10. Such then, about the year 1780, were the principal laws to which a more or less perfect state of society, a more or less active industry, and more or less limited means of existence, subjected the course of human life in Europe.

11. Since then facts have increased, and at the same time have become more accurate; great political changes have taken place; civilization and the arts of industry have advanced with rapidity; and science demands that we examine what may have been their influence upon human life.

12. We have seen what were its laws half a century ago: with the old state let us compare the present.

We have already said that the inquiries into this subject were now facilitated by the possession of more numerous and more extensive documents. Of these documents we shall take the official accounts inserted in the different periodical collections, which have continued to publish them with care for several years. We shall cite especially of these collections, the Bul-

* M. Crome divides the nations, with reference to this circumstance, into three classes. The mortality is 1 in 30 in the rich and populous nations; 1 in 32 in those which are less so; and, lastly, 1 in 36 in poor nations, where the population languishes or decreases. The number 32 is precisely the exact mean of these three proportions; its extreme terms are 22 in Holland, and 58 in Russia.

letin Universel des Sciences, by Baron Ferussac, and the Annales des Voyages et de la Geographie, by Messrs Eyriès and Malte-Brun, &c.

13. At the period in which we write, 1825, of a certain number of children born in Europe, there dies, in the first ten years, a little more than a third (38.3 in 100), in place of the half (49.9) which formerly died.

14. From birth to fifty years, three-fourths of a generation (74.2) were found to be extinct. At present, the proportion of dead to living, in the same period of time, is not more than three-twentieths, or sixty-six.

15. Lastly, twenty-three persons in a hundred now arrive at sixty, in place of eighteen who attained that age half a century ago.

16. These proportions are mean terms; taken separately they become still more favourable. Thus in France, the proportion of those who survive at sixty years is 24.3 in the hundred, while formerly it did not exceed fifteen (14.7).

These results, sufficiently remarkable of themselves, give rise to others which are not less so.

17. From the 40th degree of latitude to the 65th, that is to say, upon a line which extends from Lisbon to Stockholm, embracing an extent of about a thousand leagues, and in a population of sixty-five millions of individuals, which is comprehended by Portugal, the kingdom of Naples, France, England, Prussia, Denmark, and Sweden, the proportion of deaths is 1 in 40.3; that of births 1 in 30.1; that of marriages 1 in 123.3; and the fecundity, four children by each marriage.

18. On comparing these relations with those of the last century, we are struck with the difference which exists in the actual mortality of early life at these two periods, a difference which is not less than that between 38 and 150.

19. This difference would itself suffice to attest the happy effects of vaccination, to which they are partly owing; but it also proves a great amelioration with respect to the cares bestowed on childhood; and those cares themselves indicate a greater prosperity and an improved condition in families. If we now reflect that it was especially in the lower classes that the mortality of children was enormous, we may conclude, that if

these classes lose fewer at the present day, it is because they are in a better state for taking care of them, and bringing them up.*

20. Nor is it less evident also, that if these same causes, as well as some others, had not extended their influence beyond the years of childhood, they would only have had the melancholy advantage of delivering over to death a greater number of victims in the stages which follow. The contrary, however, takes place, and at the present day more individuals attain the fiftieth and sixtieth year than formerly. The action of these preserving causes of childhood must therefore continue to operate upon the grown up person during the remaining part of his career; and these preserving causes are in our eyes, to sum them up into one which contains them all, an improved state of society, a more diffused civilization, from whence results a more happy and easy existence.

21. Along with the fact of the diminution of the number of deaths, we have to place a second, which equally results from the comparison of the true epochs, namely that of the diminution of marriages. They were formerly in the proportion of one in a hundred and ten individuals; they are now in that of one to a hundred and twenty-three. This, which is a mean term, is even too high for some countries. In France, where, according to the calculations of Necker, there was one marriage in a hundred and eleven individuals, there is only reckoned one in a hundred and thirty-five.

22. The natural consequence of the diminution of marriages is that of births. This diminution is always proportional to the increase of the population; for while the proportion of marriages to it has fallen from a hundred and ten to a hundred and twenty-three, and that of births from twenty-eight to thirty, it is yet remarked that the one and the other are augmented in a certain degree.

* Mr Glenny, who has been much occupied in England with statistics, considered with relation to insurance societies, thinks, that since the time of Dr Price, the public health is improved in children, and very little in grown up persons. He estimates, that in the course of the last twenty-five years, the mean term of the duration of the life of children has been increased a fiftieth part.—*British Review*, *Number for November* 1825, p. 168.

23. The fecundity would appear to have remained the same. In the present century, as in the last, the numerical expression which represents it is always four children for each marriage. But this proportion is undoubtedly not the true one, since we are obliged to include among the births that of the illegitimate children, from the defect of proper distinctions in the accounts of births, especially in foreign countries. In France, the exact proportion of births to marriages is 3.9.

24. The marriages, as well as births, have diminished in Europe within these fifty years, and yet the population is seen to increase. This apparent contradiction is explained by another fact, the very great diminution of the proportion of deaths. There was formerly one death in thirty-two individuals: there is at present one in 40.3. This diminution of the mortality bears chiefly upon the earlier stages of life. There are, on the one hand, more newly-born individuals that survive, and on the other more adults that grow old.

25. The necessary result of this latter state of things, is the prolongation of the middle period of life, which appears in fact to extend beyond the limits within which it was formerly confined.

26. The simultaneous diminution of the marriages and deaths in Europe at the present day, confirms Mr Malthus' observation, that whenever the deaths are numerous, the marriages are so also; for then the vacuities must be filled up, and there is room for every body; and that, on the contrary, whenever there are few deaths, there are also few marriages. The reason of this in fact, is, that from the moment when the augmentation of individuals begins to fill all the paths of life, and to obstruct all its courses, the means of existence become more and more scarce and uncertain. People must then be much restrained from gratifying the desire of marrying, and having a family, by the difficulty which is foreseen of providing for them. Thus, although it may appear paradoxical, it is not the less true, that there comes a period when population forms an obstacle to population, and industry arrests industry.

27. From all that has been stated, it would appear that the following conclusions may be drawn:

28. The laws of mortality, such as they were established fifty years ago by the philosophers who were then engaged in their investigation, appear since that period to have undergone the following modifications:

Mortality of the Different Ages.

	Old State.		New State.	
From birth to the age of 10,	50	in 100	38.3	in 100
. . . . 50,	74.4	....	66.0	....
. . . . 60,	82.0	....	77.0	....
Proportion of deaths, -	1 : 32.2		1 : 40.3	
. . . . . births, -	1 : 27.7		1 : 30.1	
. . . . . marriages,	1 : 110.4		1 : 123.3	
Fecundity, - - -	4.0		4.0	

29. This table, without doubt, contains errors, owing to the incorrectness of several of the accounts given. There is a means, however, of remedying this defect, which would be, that in each country where the laws of its population, and the numbers which express them, are well known, while they are only known through the medium of printing, which too often alters them, some person accustomed to calculations of this description, or even learned societies, would publish accounts similar to those which we have given. From these various elements, a general and accurate mean might then be obtained.

It is with this view that we have published the present note, and that we join to it the state of the population of France in particular, such as it was at the time of Necker in 1780, and such as it is at the present day in 1825, according to the Annuaire du Bureau des Longitudes for the year 1826.

	Old State in 10 years.	New State in 7 years.
	Population.	Population.
	24,800,000 inhabitants.	30,400,000 inhabitants.
Deaths, - -	818.490	261.230
Births, - -	963.200	957.970
Marriages, - -	213.770	224.570
Natural Children,	20.480 ($\frac{1}{47}$)	65.760 ($\frac{1}{14}$).

Mortality at Different Ages.

	Old State in 10 years.	New State in 7 years.
From birth to the age of 10,	50.9 in 100	43.8 in 100
. . . . 50,	74.4	67.5 ....
. . . . 60,	81.0	75.6 ....
Proportion of deaths,	1 : 30.2	1 : 39.9
. . . . . births,	1 : 25.7	1 : 31.7
. . . . . marriages,	1 : 111.3	1 : 135.3
Fecundity, - -	4.4	3.9

Now, if we bring in connexion with these new laws of mortality, the political changes which have taken place in Europe within these forty years, and especially in France, we shall perhaps be correct, while at the same time it will afford us pleasure, in thinking that good institutions and well regulated governments alone have this happy privilege, that, under their paternal influence, human life is preserved and prolonged, while it is consumed, and is quickly extinguished, by injustice and oppression.

We had concluded this note, when M. Dureau de la Malle, who is at this moment employed in very extensive researches regarding the ancient population of Italy, communicated to us the following result :

His numerous readings have satisfied him, that the senate first, and afterwards the Roman emperors, did not neglect in their administration, any of the statistical accounts which several modern states collect at the present day, with so much pains and accuracy. He has even been enabled, by means of the various documents furnished by the *digeste* and the Roman laws, to reproduce the complete tables of the requisitions which the censors addressed to the citizens, and it is found that they entered into details in this respect, much more extended than ours, regarding the sexes, ages, professions, the different kinds of cultivation, the number of slaves, &c.

But what is more interesting still, M. Dureau has discovered in the Pandects the calculations of the probability of life for all ages, and he has thus obtained proof that the mean duration of life in Italy was thirty years in the reign of Alexander Severus, toward the end of the third century ; and it is known that this was also nearly its duration fifty years ago (twenty-eight years.)

We leave to M. Dureau himself the task of presenting this fact in his work, surrounded by all the considerations which attach to it, and which will reduce it to the place which it ought to occupy in science. But the fact itself, which at once connects what is with what has been, by making to disappear an interval of two thousand years, and which refers to so early a period the first recognitions of the laws of human life, appeared to us so curious and so interesting, that we gladly availed ourselves of M. Dureau's permission to attach it to our note, and publish it.

Observations on some Fossil Vegetables of the Coal Formation, and on their relations to living Vegetables. By M. Ad. Brongniart.

THE study of fossil organic bodies is so much the more difficult, in proportion to the obscurity in which the structure of the living beings which they resemble is still involved. Numerous collections of comparative anatomy have become necessary for the determination of the isolated bones that are found buried in the strata of the globe. Without such collections, it would have been impossible to fix the families to which those animals of former times are to be referred, to determine their genera, and to limit their species, with accuracy. With reference to fossil botany, we are still entirely deficient in collections of this description. A few specimens brought home by travellers, often without the precise species being satisfactorily determined, are scarcely sufficient to afford an idea of the parts of vegetables which cannot be preserved in herbaria. The deficiency of objects of comparison is so much the more detrimental to the progress of this part of natural history, that, as the fossil vegetables of the old formations appear to be almost all referrible to the great arborescent monocotyledonous vegetables, at present confined to the warmest parts of the globe, the examination of the plants which grow in our own country can throw but little light upon the structure of the trees which composed those ancient forests. If there be added to this the changes which compression, and the other phenomena which have accompanied the destruction of these vegetables, have produced upon them, an idea will be obtained of the difficulties to be experienced in the attempt to determine detached portions of plants so modified. All these circumstances will serve as so many excuses for errors, and numerous observations become necessary for rectifying them.

It is thus, that, from errors too gross to be mentioned, all those large trees which accompany the coal strata, have in a general view been considered as stems of palms. Perhaps even, under this name, it has only been intended to indicate their place among the Monocotyledones, a class in which the arborescent vegetables are rare, and belonging almost exclusively to this family of palms. A closer examination has shewn, that these large vegetables of the coal formation possess characters which announce very different structures, and which have given rise to their being divided into several genera; such are the stems to which have been applied the names of Calamites, Sigillariæ, Clathrariæ, Syringodendra, Stigmariæ, Sagenariæ or Lepidodendra. On comparing them with the different vegetables at present existing, it has been found that none of them could be referred to the family of palms, or to the arborescent vegetables of the neighbouring families, such as the Asparageæ, Pandanaceæ, Liliaceæ, &c. Numerous and important characters, on the contrary, have appeared to me to bring the Calamites in relation with the Equiseta; to associate the Sigillariæ and Clathrariæ, which perhaps should only form two sections of the same genus of ferns; to refer the Sagenariæ or Lepidodendra of Sternberg to the Lycopodiaceæ; and, lastly, to indicate in the Stigmariæ a considerable affinity to the stems of some Aroideæ. With regard to the Syringodendra, their position in the vegetable kingdom has been hitherto the subject of conjectures supported by proofs more or less probable, but always refuted. They have thus been successively transported from the family of Palms to that of Cactaceæ, from the latter to that of Euphorbiaceæ, &c., without its appearing possible to admit any of these affinities. Not finding any thing, therefore, among the vegetables which exist at the present day to which they presented any affinity, I had considered them as remains of a genus entirely different from all those with which we are acquainted. New observations, however, made in the very places which contain these vegetable remains, allow me now to do away with this error, and will shew how much one is exposed, in this sort of study, to the danger of subdividing unnecessarily, by considering as distinct species the different portions of the same plant.

The genus of fossil plants to which Count Sternberg has given the name of Syringodendron, contains stems, the surface of which is covered with numerous parallel, and very regular, convex ribs. On the middle of the ribs are placed in quincunx order, simple or double lines, or rounded impressions, which are always, however, very small, and never have the form of a disk or shield, as in the genus Sigillaria. This character alone would distinguish these two genera, but it would further appear of great importance, inasmuch as it announces a great difference in the form of the organs, whose insertion is indicated by these impressions. In the Sigillariæ, the disks have been regarded, with reason, as the marks left upon the bark by the base of their petioles, after the fall of the leaves. The form of the base of these petioles, and the disposition of the vessels which have traversed it, render it almost certain that these plants have belonged to the family of ferns. The form of the impressions of the Syringodendra, indicates, on the contrary, small organs, often in pairs, in which the traces of spines, like those of the cactuses, fleshy Euphorbiæ, &c. have been supposed to be recognised. This character has been deemed sufficient by several naturalists to induce them to admit the analogy. A perfect similarity of form in the Syringodendra and Sigillariæ, and their existence in the same strata of the globe, might have impressed an idea, if not of their identity, at least of their mutual resemblance; yet these two genera have been admitted as distinct by all modern authors. Direct observation, however, comes to prove, that they are only two parts of one and the same plant; that the genus Syringodendron must be erased from the list of plants; and, in a word, that the alleged species of this genus are nothing else than Sigillariæ deprived of their outer bark. Several specimens collected in the mines of Valenciennes, Mons, and Charleroi, evidently prove this identity; they are either Sigillariæ or Syringodendra, according as the carbonized bark which envelopes the stony nucleus of which these stems is almost entirely composed, is still preserved, or has fallen off. It is in fact a character peculiar to the fossil stems of the coal deposits, to be transformed or rather entirely replaced, by an inorganic substance, deposited in the way of sediment, often very coarse, and retaining no traces of the internal organisation of the stem; while around this nucleus there occurs a layer, more or less thick, of very friable lamellar charcoal, which has exactly preserved the form of the surface of the vegetable. According as this cortical layer has a thickness more or less great, and more or less equal, the central nucleus, when it is deprived of it, preserves more or less accurately the form of the external surface of the vegetable. In the Stigmariæ, the Sagenariæ, the Calamites, and some Sigillariæ, this bark forms an extremely thin layer, a sort of epidermis, which leaves to the stony nucleus the same form which the surface of the vegetable itself presented. In the greater number of the Sigillariæ, on the contrary, this bark, which has a thickness of from one to two lines, does not preserve internally the form which it had on the outside; the disk produced by the entire base of the petiole no longer exists. The vessels alone which traversed it still leave a mark internally, and produce those narrow, and often punctiform, impressions which were observed on the Syringodendra. This character still furnishes an additional reason for considering their genus as allied to the tree ferns. In the small number of stems of these plants which we have had an opportunity of observing, and particularly in those of the old continent, there is observed a perfectly distinct bark, or rather external layer, of an organisation very different from the bark of dicotyledonous vegetables. This bark appears to detach itself from the substance which occupies the centre of the stem, and then forms a sort of hollow cylinder, of a very dense substance, the external surface of which presents, with much accuracy, the form of the bases of the petioles, while the inner surface presents only the passage of the vessels. Let us suppose this woody cylinder to be filled up with an earthy substance, and the bark afterwards converted into charcoal, stems will be obtained, having a nearly perfect resemblance to the Sigillariæ; if, again, the carbonaceous bark be removed, the earthy nucleus will represent, with but slight differences, the Syringodendra.

If all the proofs which we have adduced establish almost with certainty the resemblance of these immense stems to the stems of the arborescent ferns, a very remarkable character distinguishes, if not all the Sigillariæ, at least some of them, from our presently existing arborescent ferns. All the tree ferns known present a perfectly simple stem, similar in its general form to that of the palms, cycases, &c., but commonly broader toward the base: a character which is not observed in the stems of the greater number of arborescent monocotyledones, and which is equally observed in the fossils of the genus Sigillaria. All the specimens of these fossils which I had hitherto observed in collections were perfectly simple, and this character appeared to be common to all the species of the genus. In conjunction with several others it had served to distinguish this genus from the Sagenariæ, the stem of which is commonly dichotomous. This difference would tend to confirm the analogy of the former of these genera with the ferns, and of the latter with the Lycopodia. I was therefore very much astonished on seeing, in the collection of M. de Derschau, engineer of mines of the Grand Duchy of the Lower Rhine, a stem which was indicated by all these characters to belong to the Sigillariæ, and which was yet twice divided into two. Three specimens of the same species presented this character more or less completely. Having myself descended into one of the coal mines of the neighbourhood of Essen (the mine of Kunzwerk), I was enabled to satisfy myself on the spot regarding this remarkable organization. The almost vertical roof of one of the beds of coal, in which the gallery had been wrought, presented an immense quantity of impressions of vegetables of different species. After having seen with astonishment, among the remains of this ancient forest, stems of Sagenariæ of nearly two feet diameter rising perpendicularly from the bottom of the gallery, dividing once or twice, and presently losing themselves in the rocks which covered this gallery, without its being possible to judge whether their length was proportional to their diameter; after having endeavoured in vain to trace several of these stems, which were interwoven in all directions, I at length came upon a stem of Sigillaria, the position of which enabled me to trace it in almost its whole extent. This stem lay parallel to the bottom of the gallery, almost at the height of the observer's eye; towards its base, it was about a foot in diameter, and appeared broken and not naturally terminated; it was, like all the stems deposited in the direction of the strata, compressed to such a degree as to be entirely flat. On following this stem in the gallery, I was astonished to see that it attained, without interruption, a length of more than forty feet; its diameter diminished insensibly, so that it was not more than six inches at its upper extremity; but this extremity, instead of terminating suddenly, was divided into two branches, each of about four inches diameter, which separated from each other, and were prolonged a few inches, when they were interrupted by a fracture in the rock. I was not able to trace beyond this point with certainty; but it is nevertheless well proved that these stems, after attaining a great height, finish, if not always, at least in some cases, with becoming furcated, and probably dividing several times by dichotomy. It is to this latter division of the stem that we must attribute the rare occurrence of specimens presenting examples of it. On the contrary, the great extent of the simple part of the stem of these vegetables, must render the specimens of these portions of stems very common in the rubbish extracted from mines. In the Sagenariæ, on the contrary, where the stem appears to divide at a small distance from the base, and to ramify a great number of times, examples of these dichotomous divisions are of more frequent occurrence.

After having properly established the mode of division of the stems which compose the genus Sigillaria, there remains for us to determine, if, notwithstanding this dichotomous form, they ought still to rank among the ferns, or if this character be sufficient to separate them from these plants, among which no example of the kind of structure in question is now observable.

The mode of division of the stem does not appear to me to form a character of sufficient importance to induce a separation of vegetables which have so many other characters common. We see these two modes of structure united in the most natural families of monocotyledonous plants; and there is nothing in the organization of the tree-ferns that appears to militate against the possibility of their having united, like these families, plants with simple stems, and others with branched ones. Supposing that, among the palms, the doum, a palm with dichotomous stem, so common in Egypt, had been destroyed by some revolution of the globe, all the botanists would consider a simple stem as a general character of the plants of this family, and perhaps would hesitate to assign a place in this group to a plant, the organization of which would appear to separate it from all the other species known. We are not acquainted with any circumstance that would induce us to believe that the family of ferns, the arborescent species of which are still so imperfectly known, does not contain plants with stems thus divided. The characters deduced from the form and disposition of the bases of the petioles, and from the disposition of the vessels in these petioles, characters which are only observed among the ferns, appear to us of much greater importance, and decide in our opinion the place which these vegetables ought to occupy.

All the families of phanerogamous monocotyledonous plants which contain arborescent species, present these two forms of stem. It is therefore probable, that when the equinoctial zone shall be better known to us, cycases, zamiæ and ferns with dichotomous stems, will be discovered, as we already know draconæ, yuccæ, and palms, which present this organization. Perhaps, also, these vegetables, so remarkable for their form, their magnitude, and we may even say their elegance, have ceased to exist at the surface of the earth, and their remains will serve to perfect our ideas regarding several families of plants, of which the present vegetation of our globe no longer presents but imperfect fragments, in the same manner as the ancient world has already served to fill up several voids of the animal kingdom.

Explanation of Plate VI.

Fig. 1. *Sigillaria Hippocrepis.* Ad. B.

Sigillaria with flattened ribs, eight lines broad; bark smooth externally, striated internally; cicatrices semi-elliptical, truncated beneath, or in the form of a horse's shoe, marked with three vascular fasciculi above; internal cicatrices simple, oval.

Found in the coal mine of Mons.

Fig. 1.

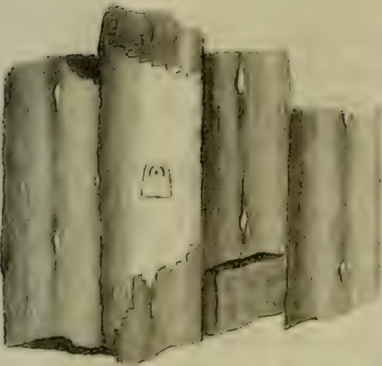

Fig. 2.

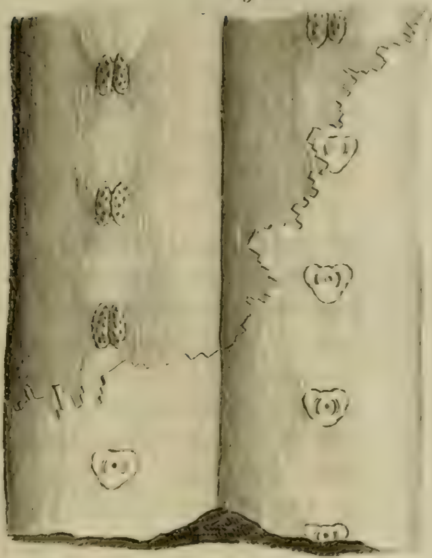

Fig. 5.

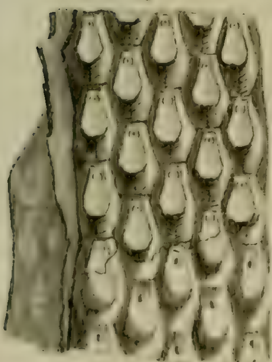

Fig. 2.

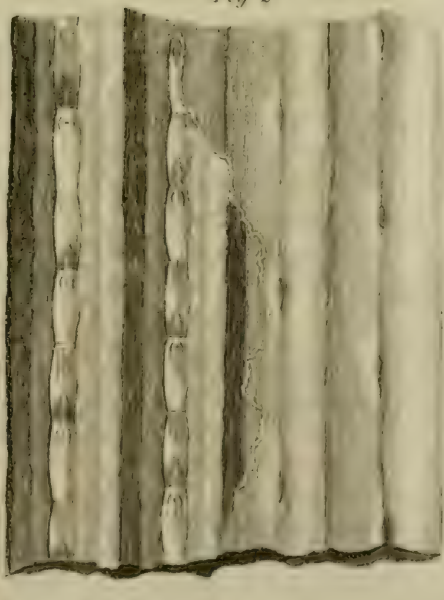

Fig. 3.

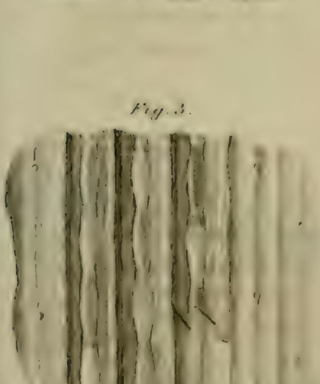

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Fig. 2. *Sigillaria reniformis.* Ad. B.

Sigillaria with flattened ribs, about 15 lines broad; bark thick, smooth externally, striated internally, cicatrices small, from three to four lines broad, reniform, notched above and marked with three vascular fasciculi; internal cicatrices oval, large, double.

Gathered in the coal-mines of Mons.

Fig. 3, 4. *Sigillaria elongata.* Ad. B.

Sigillaria with convex angular ribs; bark pretty thick, smooth externally, striated internally; cicatrices oblong, truncated at the two extremities, marked with three vascular fasciculi above, the cicatrices are close together, and the interval between them is rugose and transversely striated.

Var. α. *minor.* Ribs from five to six lines broad; inner cicatrices rounded. (fig. 3).

Var. β. *major.* Ribs from eight to ten lines broad; inner cicatrices elongated, linear. (fig. 4).

Occurs in the coal-mines of Charleroi.

Fig. 5. *Sigillaria mamillaris.* Ad. B.

Sigillaria with ribs alternately narrowed, from four to five lines broad, forming lamellæ which support narrow cicatrices, truncated above, widened and rounded beneath, marked toward their upper edge with three vascular fasciculi. Bark very thin, striated transversely beneath the cicatrices, smooth internally; internal cicatrix rounded.

Occurs in the coal-mines of Charleroi.

Obs. The three first species differ essentially from all those figured by M. Sternberg, Schlotheim, Rhode, &c.; the last species pretty much resembles Sternberg's *Lepidodendron alveolare*; but it is distinguished from it by its cicatrices being wider set, and its bark striated in the interval of the cicatrices.—*Annales des Sciences Naturelles, Jan.* 1825, p. 23.

Professor P. Prevost, *upon the Magnetical Influence of the Sun.*

Numerous observations made at different periods, appear to attest that the southern hemisphere is colder than the northern. This fact is explained by the theory of radiating caloric, and is not capable of being accounted for by any other. The following is a brief account of the state in which the discussion on this subject stands at present.

The southern winter is longer than the northern, and the summer proportionally shorter. But this circumstance introduces no difference in the quantities of solar irradiation, which either hemisphere experiences in the course of a season of the same name. It is demonstrated that, in the elliptical orbit, the difference of the distance from the sun exactly compensates the effect of the duration of the corresponding seasons of the two hemispheres; the quantity of rays received by the earth is constantly the same for the same number of degrees traversed upon the ecliptic; in other terms, the quantity of heat which the earth receives from the sun is proportional to the true anomaly. From one equinox to the other, the earth therefore receives the same quantity of solar rays. Thus, for a season of the same name, summer for example, each of the two hemispheres similarly situated with relation to the sun, receives precisely the same semestral light, measured by 180° of the ecliptic. If, therefore, one of the two hemispheres is more heated by solar irradiation than the other, this cannot depend upon the quantity of rays which it receives. It only remains to be seen whether it might not depend upon the different manner in which the distribution of this same quantity is operated. But if all this quantity be considered as fixed, and in some measure stored up in the bosom of the earth, it is of no consequence although there should be some inequality in the form of its distribution. It may therefore be said in general, that the unequal temperature of the two hemispheres does not depend immediately upon the heat which they receive from the sun.

But it is known that all the rays received in this way do not remain imprisoned in the terrestrial globe. A part of them emanates by means of radiation, and loses itself in space. If, according to the general theory of radiation, regard be had to the different distribution of solar heat in the two hemispheres of the earth, if, for example, confining ourselves to the summer (the influence of which is entirely predominant), we consider the effect which the length of the northern summer has upon the radiation, we find that the southern hemisphere is more cooled, and that there remains to the northern (deduction made of the radiation) a superiority of heat. This is the result of a train of reasoning which will be found in the treatise on radiating caloric, sect. 285, to which I can only refer here.

These truths which I have laboured to establish, in two essays published in 1792 and 1809, would have been sufficiently confirmed by the experiments of M. de la Roche, and by those of MM. Dulong and Petit, could it be admitted that what takes place in very high temperatures is applicable to lower degrees. But I cannot at present attend to this remark, nor to several others which refer to heat, having another object in view.

What has been demonstrated of the heat which has emanated from the sun, easily applies to every other emanation from that body. Accordingly, in 1792, I made application of it to a fluid which I was disposed to refer to this origin. Proceeding on the supposition, now very generally received, of two magnetic fluids, I thought that the magnetism of the terrestrial globe might come from the abundance in excess of one of them upon one of our hemispheres. Then, viewing it as probable that such a fluid emanates from the sun, or that in some manner or other the solar emanation affects the magnetism, I proposed to examine if the abundance in excess of this fluid upon our hemisphere might not be attributed to the same cause which produces an excess of heat in it. I remarked, lastly, that, if these suppositions were verified, we might hope to detect, between the magnetic variations and the known motions of the earth's exis, relations that it would be useful to observe.

These reflections have been suggested to me by experiments which seem to indicate the emission of one of the magnetic elements by the sun, namely, those upon the influence of the violet ray first made by Mr Morechini, and afterwards repeated and varied by Mrs Somerville.—*Bibliotheque Universelle*, *May* 1826.

On the Reaction of Sulphate of Magnesia and Bicarbonate of Soda. By M. Planche.

It is known that the bicarbonate of soda and the sulphate of magnesia, in a state of aqueous solution, exercise no reciprocal action in the cold, and that it is only when a certain quantity of carbonic acid has been disengaged by heat, or, in other words, when the alkaline bicarbonate has passed into the state of subcarbonate, that the sulphuric acid prevails over the soda, and leaves the magnesia to the carbonic acid. But I have nowhere seen it mentioned that the two salts mixed together, in a dry state, and in the form of powder, react upon each other. This must at least be the case with regard to their immediate and instantaneous mixture, since in this state they dissolve in water without affecting its transparency, and consequently without any decomposition taking place, or at least any apparent decomposition. Presuming upon this property of the two salts, a physician prescribed several years ago to M. de Sommariva, a mixture of powdered sulphate of magnesia, and saturated carbonate of soda. He gave alternately either this mixture alone, or bicarbonate of soda. Being charged with the preparation of both these medicines, for a journey of three months, which M. de Sommariva made annually to Italy, I always had the precaution of placing the mixture, in a very dry state, and divided into parcels in tin canisters, to preserve it from humidity. I used the same precaution with regard to the carbonate of soda. I observed that the sulphate of magnesia was free of hydrochlorate.

During three years M. de S., a man very careful of his health, and besides a good observer, never perceived that cold water became turbid when he dissolved the two salts together in it; but in 1822, having been obliged to prolong his journey beyond the usual time, he laid up a store for a year. Toward the end of the fifth month, M. de S. remarked that the same water which he ordinarily used became slightly milky, and that the change, which he rightly attributed, though without being able to explain the cause, to the alteration of the powder, went on increasing as the time advanced. At length, by the seventh month, the precipitate which formed in the water became so considerable, that M. de S. deemed it proper to intermit the use of the powder, and sent for some more, promising to inform me on his return from Italy, of what, according to his expression, had happened. M. de S. returned at the end of six months, and sent me back the powder in question, which I submitted to the following experiments.

1*st*, This powder put into a quantity of cold water, double that which is necessary for dissolving the two salts, rendered it milky.

2. Dissolved in a large quantity of water, it deposited a white powder, which, on being washed several times and dried, was found to be subcarbonate of magnesia.

The liquor in which this deposit was formed was limpid after being filtered, and was not rendered turbid, either cold or hot, by the soluble alkaline subcarbonates. All the acids stronger than the carbonic disengaged this latter from it. Lastly, when suitably evaporated, sulphate and carbonate of soda were obtained, part of the latter of which was in the form of subcarbonate. To explain here the presence of the carbonate of soda, it requires to be known that the quantity of bicarbonate mixed with the sulphate of magnesia, was more than sufficient to decompose this latter salt.

There results from this observation, that the sufficiently prolonged contact of sulphate of magnesia and bicarbonate of soda in a dry state, determines a chemical action similar to that which the concurrence of water and heat would produce, affording a new example of the inaccuracy of the old chemical axiom : Corpora non agunt nisi soluta.—*Journal de Pharmacie, March* 1826.

Observations on the Nature and Importance of Geology.

A CELEBRATED school of philosophy among the ancients, maintained that there was only one virtue. With as much, nay even more, propriety, it might be maintained, that there is only one science, at least one physical science. The various departments of this science are so framed, as, in some measure, to accommodate the incommensurability of nature to our capacity; and by connecting things that are homogeneous, they enable us to take a survey of natural phenomena; but, while we are occupied with a single department, we become sensible of its dependence on others, and are frequently at a loss to assign to each its peculiar province.

Of all the departments of physical science, geology is the most intimately connected with other branches, and stands in need of their assistance, or assists them more frequently than any other. This mutual relation, which contributes, in no small degree, to bestow a peculiar charm on geology, has, at the same time, a tendency to render it a difficult study.

When speaking of Geology, it must be understood to comprehend Oryctognosy as its foundation; the latter gives us a knowledge of the characters, the former of their combination. Whoever is in danger of mistaking one character for another, will never learn to read accurately; and he who continually devotes his attention to nothing but the characters, may, indeed, owing to the difficulty of recognising them, be very profitably engaged, but he will be frustrated as to the ultimate and most essential object of their study.

The terrestrial globe, whose structure, so far as it is exposed to our view, is the proper object of geognostic investigation, is the extensive workshop wherein the powers of nature, with which natural philosophy and chemistry are engaged, have operated, and are still operating. It is not therefore matter of surprise, though these two sciences have both a kindred affinity for geology, to which the latter is indeed so closely related, that geology may be considered as practical chemistry. In addition to this, geology has, with other departments of science, many points of contact, from which it may be allowable to select a single example.

Geometry, guided by simple principles, formed regular bodies from limited plane surfaces, and determined their peculiar properties, without foreseeing that models of them would be found in nature herself; but since observation has brought us acquainted with the regular figures of mineral bodies, they exhibit in relation to this science one of the most important applications, as well as one of the most unerring standards, by which they are distinguished.

When the geometer, by his measurements, proves that the figure of our earth may, like that of other planets, be determined by its revolutions, and hence draws conclusions regarding its original state of fluidity, we find, that the phenomena of geology lead to the same result. When he weighs its mass in a balance, whose arm is the semidiameter of the sun's orbit, we are unable to confirm his statement by immediate observation; but we obtain, in this way, a basis on which we can, in some measure, rest our conclusions regarding the internal structure of the earth.

If we contemplate its surface, with all its inequalities, it is geology alone that can give us a distinct representation of them. All local descriptions, not springing from this source, either leave behind them indistinct and erroneous conceptions, or are entirely fanciful. This surface being the habitation of our species, its figure and its changes must, therefore, be closely connected with the history of the human race; and though the most important of those changes may be far anterior to their origin, and to the period of history, we may yet, in more than one geognostic fact, find suggestions and disclosures, which cannot be unacceptable to the historical investigator. These facts concur with historical testimony, in representing the elevated platforms of Asia as the cradle of the human race, and in explaining their diffusion from that centre; and the traditions of deluges, found among all the nations of antiquity, are corroborated by the still existing traces of those violent events.

The monuments concealed in the bosom of the earth, and extending to the whole organic creation, are still more instructive. Between the dead and the living there yawns a chasm, indeed, which we can never overleap; but if any thing can lift the veil that hangs over the origin and progress of the organic world, it must be those remains of it, for the knowledge of which we are indebted to geology. So far as we have examined the crust of the earth, we have discovered in its structure and materials no transition from simple to compound. The order of time has established no relation, according to which the strata of simple rocks of the earliest formations are the simplest, while the newer are more and more compound; on the contrary, the oldest appear to be the most compound. In complete opposition to this, the organic world, in each of its two principal divisions, exhibits a series of formations from simple to compound; the simplest being the oldest. Thus we observe animal life commencing in infusory animals, without any discernible organs. Simple digestive organs are first visible in the polypi; in the echinodermata the organ of respiration first appears; in insects a system of nerves and muscles; in crustaceous animals circulation; and in the last two, simple organs of sense make their appearance. At the same time, generation preserves the peculiar character of organic beings; and after having accomplished its purpose, by mere division and dissolution, the particular generative organs develop themselves in distinct sexes. With the avertebral animals are conjoined the series of the vertebral, in which every system appears more perfect, and more closely connected. New organs of sense are unfolded, and the brain becomes the centre of feeling, perception and life, till in man it attains the highest state of perfection, and endows him with consciousness and rationality. Long ago, celebrated naturalists, relying upon these observations, attempted, with more or less success, to arrange the species of animals, sometimes according to a scale of gradation, and sometimes according to a reticulated form, without giving any distinct account of the meaning of such an arrangement. Should it, like the piling up of a collection of books, merely serve for a more convenient survey of innumerable creatures, without any reference to their origin? Or, do they intend, by means of such an arrangement, to express the design that hovered in the mind of Omnipotence, before he called these creatures into being? Or, have they originated in the way in which they appear in the scale of gradation, as if the hand of the Creator, like that of a human artist, perhaps, must first be exercised on simple formations, before it was capable of producing such as were compound?

Upon these questions, whose answer might contain no less than a key to the profoundest secrets of nature, Mr Lamarck, one of the most sagacious naturalists of our day, has expressed himself in the most unambiguous manner. He admits, on the one hand, the existence of the simplest infusory animals; on the other, the existence of the simplest worms, by means of spontaneous generation, that is, by an aggregation process of animal elements; and maintains, that all other animals, by the operation of external circumstances, are evolved from these in a double series, and in a gradual manner. On that account, the scale of gradation, according to which he arranges the animal kingdom, is, at the same time, the history of their origin; and the discovery of this truly natural method, the most important problem of the natural philosopher. Although it should not be forgotten, that this meritorious philosopher, more in conformity with his own hypothesis than is permitted in the province of physical science, has resigned himself to the influence of imagination, and attempted explanations, which, from the present state of our knowledge, we are incapable of giving, we nevertheless feel ourselves drawn towards it, and these notions of the progressive formation of the organic world, must be found more worthy of its first Great Author than the limited conceptions that we commonly entertain.

Geology can alone inform us, how far this successive course of development may have been followed by nature. When all the races of animals, whose remains are contained in the crust of the earth, have been better ascertained than at present, and their situations better known, when we have discovered at what period of the earth's formation any species of animals makes its appearance for the first time, we shall then be able to draw conclusions, more or less accurate, concerning the order of succession. The doctrine of petrifactions, even in its present imperfect condition, furnishes us with accounts that seem in favour of Mr Lamarck's hypothesis. We, in fact, meet with the more perfect classes of animals, only in the more recent beds of rocks, and the most perfect, those closely allied to our own species, only in the most recent; beneath them occur granivorous, before carnivorous, animals; and human remains, are found only in alluvial soil, in calcareous tuff, and in limestone conglomerates.

Geology does not inform us merely of the origin of animal species, but also of their destruction. Out of the vast number of animal remains, but few belong to species now living, and these only, in the most recent rock-formations ; by far the greater number of their primitive structures are lost, and the older the beds of rock in which they make their appearance, so much the more do they deviate in their formation from the species now in existence. May this destruction, as is commonly received, have been the result of violent accidents, and destructive revolutions of the earth ; or does it not rather indicate a great law of nature, which cannot be discovered by reason of its remote antiquity ? Within the narrow circle of vision in which the organic world manifests itself to our observation, we observe individuals only going to destruction, and in opposition to that, great preparations making for the preservation of the species. But if all living perish, may no point of duration have been fixed for the species ; or do we not rather, in these signs of a former world, discover a proof, that, from a change in the media in which organic creatures lived, and from powerful causes operating upon them, their power of propagation may be weakened, and at length become perfectly extinct ? Is the continual decrease, then, which we observe among some species, a consequence of the various modes of destruction they experience from the hand of man, or may it not rather be produced by natural circumstances, and be a sign of the approaching old age of the species ?

The distinction of species is undoubtedly one of the foundations of natural history, and her character is the propagation of similar forms. But are these forms as immutable as some distinguished naturalists maintain ; or do not our domestic animals and our cultivated or artificial plants prove the contrary ? If these, by change of situation, of climate, of nourishment, and by every other circumstance that operates upon them, can change their relations, it is probable that many fossil species to which no originals can be found, may not be extinct, but have gradually passed into others. As there are periodical movements of the heavenly bodies, that is, movements that are visible only after hundreds of years, so these are undoubtedly periodical changes in the organic world. If these have required intervals of time that are antecedent to all historical traditions, and to the duration even of the human race, the monuments concealed in the bosom of the earth can alone reveal them. We indeed observe that the Ibis, which was worshipped in ancient Egypt, and preserved as a mummy, is still the same in modern Egypt; but what are the few thousand years to which the mummy refers, in comparison with the age of the world, as its history is related by geology.

Geology likewise supplies us with instructive disclosures regarding the distribution of organic beings. If we, in all the regions and climates of the world, meet with a striking uniformity in the structure of the earth, we also, on the contrary, observe plants and animals of a most varied character scattered over its surface. As there are among the dicotyledons, that is, among the more perfect plants, no species, which are at the same time indigenous to the hot climates of the old and new world, so both halves of the globe in the same zone possess mammiferous animals, birds, reptiles, and insects peculiar to each. Species common to both are found only among the inferior gradations of organization, and species of a higher order are found only in those high northern latitudes, where the continents were undoubtedly at one time conjoined. From the combined results of organic geography, and the doctrine of petrifactions, it will at once follow, whether the ancient population of the terrestrial globe was distributed according to the same laws as at present. Even now, many of the petrifactions of cold climates, whose species and families are produced only in hot countries, indicate a great change in the temperature of their former situations, and phenomena, like that of the rhinoceros found on the shore of the Wilhui, and of the mammoth at the mouth of the Lena, are likewise indications of sudden changes in those places. Along with the distribution of species, we also acquire a knowledge of the distribution of individuals, and of their modes of life, from their fossil remains, because these remains, like living creatures, appear to us sometimes single, and dispersed at other times in numerous bodies, and closely crowded together.

The doctrine of petrifactions contains also the history of the organic world, as natural history contains its description. Like the coins, inscriptions, and works of art, which make us acquainted with the varied destiny of our own species, these monuments have been buried in the earth, and, by that means, have been secured against destruction. The Siberian and Chinese popular traditions of the mammoth living in the interior of the earth, are at least figuratively correct; and, in conjunction with the remains of a former world, bear evidence of an earlier state of things. The remains of all plants and classes of animals, whose structure permitted it, have been preserved in great abundance; and, although the distinction of species not unfrequently confronts us with unsurmountable obstacles, a knowledge of them must lead to important results; at least, if we admit that the various forms have been evolved from a primitive model, and that the species have arisen from an original generic form. But to perform what may be expected from it, the doctrine of petrifactions should keep pace with the improvement of botanical and zoological methods, and renounce names and distinctions which have no longer any meaning.

Independent also of this connection between the inorganic and the organic world, between geology, botany, and zoology, it is surely no unprofitable occupation for a rational being, to inquire what this earth upon which we live consists of, how it is constructed, what changes it may have suffered, and what it may still be destined to undergo. Whoever is still unsatisfied, whoever estimates the value of science, not by intellectual desires but by practical advantage, ought to recollect that there are few of the arts of life to which geology is not more or less applicable. It is one of the foundations of agriculture, which cannot flourish without a knowledge of the soil: it instructs us in the course and operation of water, whether we wish to prevent it from doing injury, or to turn it to advantage; it enables us to search out materials for our habitations and furniture, and the art of working mines, with which geology originated, and which in return yields its most valuable productions. We hence conceive that the study of geology brings us in continual contact with the most exalted scenes of nature, with all that can captivate our imagination, and fill our souls with vast conceptions, and thus explains the interest that is daily more and more excited by it, and which warrants the most sanguine expectations of its future progress.

Geology has shared the fate of all experimental sciences. Its first steps, for the most part directed by necessity, consisted of loose and superficial observations on those phenomena more immediately presented to our attention. But, as it is a peculiar prerogative of our nature to entertain a desire of tracing back causes, and explaining operations, theories of the earth were early indulged in; and these, although often absurd, were not without their use. Afterwards it was considered presumptuous, from those fragments of the earth's crust which we had looked upon rather than examined, to draw conclusions as to the formation of the earth, and to relate its history, as if we had been coeval with the events; and that true geology must be a collection, arrangement, and comparison of facts, and its theories only general observations. This view being generally admitted, geology may be said to have passed from the condition of childhood, and assumed its station among the sciences.

These theories are essentially different from those of other branches of physical science. When the natural philosopher makes mention of two electric fluids, or of a luminous matter, he is perfectly well aware that the causes of electrical or luminous phenomena might be different from what he imagines; yet these modes of expression are most convenient for producing unity and connection among the facts that have come under his observation. Geological theories are, on the contrary, of a purely historical character. Whether granite be a production of fire or water, is a matter of indifference in the explanation of its origin, if we are incapable of producing it either in the one way or the other; but whoever tells us that the present crust of the earth was once in a state of fusion, and that, upon cooling, it became a solid mass, exhibits an event which, like the heroic exploit of a Curtius or a Clœlia, should be received only upon the most indisputable testimony. Geological theories are, therefore, more exclusive than physical; hence a reason why geologists have always been more at variance than natural philosophers.

It is therefore the duty of the geologist to proceed cautiously with his conclusions. In return for that he is sufficiently indemnified by the nature of his study, which bears in the most distinguished manner the peculiar character of all physical science.

Geology obtains its materials from mineralogical geography, whose general results it selects and combines, in the same manner as state policy does with the results of civil geography. The advancement of the one, therefore, depends on the progress of the other; and although it may be advantageous to science, from time to time, to exhibit a correct view of its progressive advancement, as it is profitable for the traveller to stop sometimes and take a retrospective view of the country he has passed, geology has nevertheless to expect improvement principally from a patient and laborious investigation of single districts. There are but few who, by a glance, can determine general relations and throw light upon science, as there are but few travellers who are qualified to give any instructive information concerning the social condition of a country: On the contrary, any one provided with the necessary knowledge, may, by an accurate and detailed examination of a district, contribute, if not general views, facts that serve as a foundation for the great geological edifice. And, any one who reflects how much time and perseverance are necessary for examining the geognostic character of even a limited district, especially if its interior is not laid open by mines and natural sections, will agree with us, that this investigation, like that of the character and customs of a people, must chiefly be the work of an inhabitant.

On Female Pheasants assuming the Male Plumage. By M. ISIDORE GEOFFROY ST HILAIRE.

PHEASANTS sometimes occur in the woods, as well as in a state of domestication, which, from the dulness of their colours, while at the same time they possess the male plumage, were long considered as males in a diseased state, or with their feathers soiled and tarnished; but it has been ascertained that they are hen birds with the plumage of males; and, in fact, Vicq d'Azyr and Mauduit, from the inspection of the sexual organs in such birds, have placed this curious fact beyond the reach of doubt. Mauduit, in his account of it, in the Encylopedie Methodique, has confined himself to the change of plumage solely, adding only the fact that the ovarium was extremely small in all such birds as had been dissected by himself or Vicq d'Azyr; and since his time no person has paid attention to the interesting physiological phenomenon in question, which has only been barely mentioned in a very few works on ornithology. Having lately had an opportunity of observing the change of plumage in female pheasants to a greater extent than has hitherto been done, I consider my observations not without interest, as they will enable me to shew that the transition in question, which Mauduit only saw produced in a partial manner, may be effected in the most complete.

My observations were made upon females of the Silver Pheasant *(Phasianus nycthemerus)*, the Collared Pheasant *(Ph. torquatus)*, and the Common Pheasant *(Ph. colchicus)*.

Change of plumage in the Common Pheasant.—A female pheasant that had been reared in the phaisanderie of the museum, ceased to lay at the age of five years, and the change of plumage began to become apparent about the same period. It manifested itself first upon the belly, which assumed a more yellow tint, and upon the neck, which became brighter in its colours; and soon after the whole body participated in the change. The following year the feathers acquired still more of the lustre and brilliancy of those of the male; and in that state it might with propriety be said, that the bird in question was like a *male with dull and tarnished plumage.* In the third year after the commencement of the change, it became almost impossible to distinguish it from a male, the resemblance was so great, although still not altogether complete.

Such was the state of the plumage of this female at the age of eight years; it ate well, and enjoyed good health, and there was every reason to hope that next season would see it clothed in the perfect plumage of the male, but an unexpected accident deprived it of life.

It had always lived, like the other hen pheasants, with the males, but ever after its plumage began to change, it became an object of indifference to them; it neither sought nor avoided them itself, and thus became like one of themselves both in appearance and manners.

At the time of its death it so resembled a male, that people accustomed to see, and even to take charge of pheasants, were deceived by its colours, and believed it to be a male. Nevertheless the plumage, as has been said, was not complete.

Change of Plumage in the Silver Pheasant.—A female of this species was brought up in company with a male, at the country seat of an old friend of my family, M. Montand, a notary at Paris; but in its old age it was given to the museum. It was eight or ten years old before it began to change its plumage. Another remarkable circumstance is, that it had ceased to lay, three or four years before the change began to become apparent. In the other pheasant, on the contrary, the age was only five years when the change commenced, and it continued to lay up to this period. The transition to the male colours was first announced by the appearance of white feathers among the regular brownish ones. The following year the change was still more decidedly marked; but it was not until the third year that it could truly be said to have taken place. The fourth year the resemblance became complete; the tail and the crest being even elongated as much as they are seen to be in the males, and at the same time appearing with more vivid colours. This is a circumstance that ought to be taken notice of, as we see not only the colour of the feathers changing, but also their natural proportions. The fifth year the resemblance was complete, and the bird represented a male adorned with the most brilliant livery.

The male was still living at the period when the change began to make its appearance, and had not become indifferent to the female, no doubt because she was his only companion; but she, on the contrary, shunned him, appearing sometimes troubled at his presence. However, the male happening to die, she appeared to become dull in her solitariness, for which reason she was immediately given to the Museum, where she was kept for some time. But the infirmities of age announced the approach of death, and from a desire to preserve the plumage in all its beauty, it was determined to kill her, before it should fade. At the time of her death, she was thirteen or fourteen years old, and it was then four years and six months since the change had commenced. The plumage was exactly similar to that of the male bird in its best state, as may still be seen in the specimen, which is deposited in the Museum.

The sexual organs were also preserved : On dissecting them there were found, beside the ovarium, which still remained, two small bodies which appeared to be vestiges of the last eggs that had escaped from the ovarian sac. The aduterum (or horns of the uterus) was very distinct, and of an ovoidal form. The presence of the ovarium is an important fact, from the observations on this subject made by Vicq-d'Azyr and Manduit.

The feathers shed during the years that preceded the last moult, have also been preserved through the care of the first possessors of the bird ; and it is to this circumstance, as well as the accounts with which they have obligingly furnished me, that I owe the knowledge of a great part of the details which I have given.

Change of Plumage in the Collared Pheasant.—The female of the collared pheasant of which we have here to speak, was brought up, like the preceding, near Paris, by a private person, and it was, like it, also given to the museum in its old age. The accounts furnished by the giver make it appear that it had laid several times while in his possession. However, as the change of the plumage was at the time of its delivery much advanced, and as it then presented more of the external appearance of a male than of a female, it was thought expedient, when its death took place some time after, to determine its true sex by the dissection of the genital organs.

The colours were in fact very like those of a male, as may still be seen in the galleries of the Museum, where its spoil is deposited. However, the upper coverts of the tail and wings were red, like the rest of the body, the collar less marked, and the belly much blacker than the male, so that it was still far from having that complete and perfect resemblance of which we gave an example in the silver pheasant. Nor would we have spoken here of this female, which besides we did not see alive, and whose development we cannot therefore follow, had it not presented a great degree of interest under another point of view. The spur, a part peculiar to the male, was present in it, and was even nearly as large as it usually is in ordinary males.

We therefore see that the spur itself is not so much the exclusive property of the males in pheasants, that it may not equally exist in certain females, and thus, a hen-pheasant may not only become invested with the precise plumage of the male, in a certain period of time, but it may even assume all its other external characters, the narrowness of the red membrane surrounding the eye remaining the only indication of its true sex.

General Remarks.—It is not a very uncommon thing to see the spur anomalously developed in females of species, the males of which are furnished with that organ, and particularly in the common domestic fowl; but in this case, besides being commonly of smaller size than in the male, it almost constantly bears the character of an anomalous, and, as it were, diseased organ. Thus, the two spurs in hens are commonly very unequal in size; and it even sometimes happens, that, while one leg has a spur, the other has none. Hence it happens, that the sole inspection of the spur in a female resembling the male in possessing that organ, may of itself lead to a knowledge of its true sex, without having reference to any other character.

The pheasant being reduced to a state of domesticity, like the common fowl, and approaching it closely in its organization, it were easy to foresee that it would turn out the same in this respect; and of the accuracy of this analogical conjecture, we have seen a proof in the collared pheasant. Its spurs differ in form from those of the male; the left is much larger than the other, but it is slender, and, as it were, embossed over its whole surface.

Be this as it may, the possibility of a complete change taking place in the plumage of one species, an important fact not hitherto observed by any ornithologist, being perfectly established, ought we to conclude that it is equally possible in other species, whether of the genus phasianus, or of any other? In my opinion, it would be using a very unnecessary reserve, not to admit this possibility with regard to the species of the same genus, in which the change in question has been seen to be produced entirely, or even only partially, such as the common pheasant, the collared pheasant, and the golden pheasant. Taking analogy for our guide, we might even be tempted to give a much greater degree of generality to these conclusions; and there are in reality several facts that seem to favour such an opinion. Thus, several travellers have made recitals which can only be properly explained, upon the supposition that they have spoken of females with male plumage. M. Dufresne, who has charge of the zoological laboratory of the museum, assures me, that the females of the cotinga become similar to their males as they grow old. M. Florent Prevost has seen the change of plumage begin in several female chaffinches; and the same observation has also been made with regard to the female of the rouge-queue, and of that of our starling. *Lastly*, I might remark, that similar facts are observed even in animals of very different organization, and in the human species itself. Thus, in many women, after the cessation of the menses, the chin and upper lips become furnished with a true beard, a phenomenon, the relation of which, with the development of the plumage of our hen pheasant, cannot be denied.

It would, however, be wrong, notwithstanding these remarkable analogies, to make a general fact of this phenomenon; for there are species of birds in which it would appear never to be observed. Thus, although a great number of peacocks are kept in the menagerie of the museum, where they are always allowed to die a natural death, and where many females must consequently have died of old age, no such change has ever been observed, as that which I have related to have taken place, more or less, completely in three individuals of different species of pheasant, and which has been also seen in many others. It is to be observed that the peacock, although thus differing from the pheasant in this respect, is not only of the same order with it, but also of a genus very closely allied, which renders the case more striking.

We remark further, that the young male pheasant, and the female pheasant, when she begins to grow old, are both in a similar condition with respect to the point in question. Both have the same plumage; both will at length complete the change; and it were natural to think that it will be brought about in the same manner, with the sole difference of a greater celerity in the one case than in the other, so that the young male will make the same progress in a certain number of months, that the female requires a certain number of years to accomplish. This, however, is not the case; and it will be sufficient to compare the descriptions of young males given by ornithologists, with the details which I have presented with regard to old females, to perceive that in either case the change is brought about in a different manner; and, in fact, it can never be said of an old female pheasant in which the change has commenced, that it has the plumage of a young male pheasant of any particular age. Be this as it may, the observations of Mandius has already demonstrated, that female pheasants, when they grow old, resemble males,—that the change of the plumage is produced in a gradual manner, advancing more and more as the animal grows older,—and that the ovary diminishes in size, and even disappears, in several of these females with male plumage. It might be presumed, that those in which the ovary had disappeared, were those in which the change is most complete; but this is not the case, since that organ is not found in females which resembled males but incompletely, while I found it existing in one in which the resemblance was perfect.

To these results, the observations which I have related, add the following facts: that the change of plumage commences much sooner in some females than in others; that it may only shew itself several years after the bird has ceased to lay, although it must depend, more or less directly, upon this phenomenon, with which it may also coincide as to time; that it is commonly in the fourth year that the change is complete; that then the female has not only the colours, but also the brilliancy, of the male, which it resembles even in the ornamental appendages of its plumage; that it may even acquire spurs like the male; that the transition from the dull colours to the glowing tints of the adult male, is effected in a very different manner in the young male, and in the adult female, although ultimately the result is the same; *lastly*, that the change of plumage of old females is not absolutely a general fact, and that it is not even certain, because it has been observed in one genus of a family; that it occurs in the other genera of the same family, although, on the other hand, several groups separated, at great distances from each other, appear to present examples of this remarkable phenomenon.

Note by the Editor.

THE interesting fact of female birds assuming the plumage of the male, was, in modern times, first attended to by the celebrated J. Hunter, who, in a memoir on this subject in the Philosophical Transactions of London, describes a hen pheasant and pea-hen which had in old age assumed the male plumage. Mr G. St Hilaire in the preceding memoir says, that of the many pea-hens in the menagerie in Paris, no instance occurred of the pea-hen assuming the male plumage,—a fact which shews such a change is rarely met with in the peacock. In the Museum of this University there is a fine specimen of the *pea-hen* with the male plumage; presented to the Museum by the Duchess of Buccleuch. In the note accompanying the gift it is said the change was effected during the course of a few years. The following description will convey an idea of the degree of change experienced in this individual:—The head and neck have assumed the same green and blue tints which characterise the male, the breast and belly also have the same deep colour. As in the male, the primaries are pale brown, and a patch upon the wing bright green. The dorsal feathers, however, are still more or less mottled with grey; and the green which they have partially assumed is lighter than in the male, and not blended with the coppery hue which in his plumage extends from the middle of the back to the rump. The rump feathers are elongated, some of them the length of 18 inches, but the train formed by them is scanty, and the ocellar spots are neither so large nor so varied as in the male. The ordinary tubercles on the tarsi of the female have been developed into thick regular conical spurs, about half the length of those of the male. In short, the change is so much advanced, that after another moult it would probably have been complete.

In the Museum of the University there is a specimen of the female *pheasant* with the male plumage, presented some years ago by Dr Hope. The only differences which the plumage of this individual exhibits, when contrasted with the male bird, are the following: 1*st*, The tail feathers are shorter than those of an adult male, although considerably longer than those of an ordinary female; 2*d*, The lustre of the colours in general is not quite so vivid as in the male, especially on the back of the wings. There is no appearance of spurs.

Sometimes the same sort of apparent change of sex is observed among *domestic poultry*. Mr Neill at Canonmills had a black hen, of what is called the French breed, which, in her twelfth year, ceased to lay eggs, and gradually assumed somewhat the appearance, and to a considerable degree the manners, of the cock. The principal change of plumage consisted in the tuft on the head becoming thinner, and shewing some upright stray feathers, and in a single elongated feather projecting from the tail. The spurs were larger than usual in hens, but these had probably been increasing for some years. The change of manner of the bird was quite remarkable: she strutted about in an overbearing way, with a firm pace, and raised tail. She formed a party among the fowls, which she led separate from the cock; and she roosted apart from him. She became very voracious; and when food was set down, (losing all resemblance, in this instance, to the generous male), she beat off the other hens: when, in these cases, she came in contact with the cock, she stared at him, but without making any attack. She soon became very fat, and died within a few months, seemingly of over fatness. Her cry was altered, but had little resemblance to the crowing of the cock; less, indeed, than is sometimes noticed in young hens.

In a valuable paper, by Dr Butter of Plymouth, in the third volume of the Memoirs of the Wernerian Society, there are many interesting facts on this subject, and from which we extract the following table:

Table of such birds as have, in advanced life, assumed the plumage of the male, with the names of those authors who have noticed the fact.

Ord. 4.—Gallinæ.—*Domestic Birds.*

Gen. 1. Pavo, Pea-hen, - - - - - - - -	*Hunter.*
2. Meleagris, Turkey, - - - - - -	*Bechstein.*
3. Phasianus colchicus, Pheasant, common, - - -	*Hunter.*
—— pictus, golden, - -	*Blumenbach.*
—— gallus, Fowl, domestic,	*Aristotle, Tucker, Butter.*
4. Tetrao Perdix, Partridge, - - - - -	*Montagu.*
5. Columba, Pigeon, - - - - - -	*Tiedemann.*

Ord. 5.—Grallæ.—*Waders.*

2d Family, Prepirostres, Gen. 1. Otis, Bustard, - -	*Tiedemann.*
3d —— Cultrirostres, 3d Tribe, Gen. 4. Platalea, Pelican of America, - - - - - - - -	*Catesby.*

Ord. 6.—Palmipeda.—*Web-footed.*

4th Family, Lamellirostres, soft skin on the beak.	
Gen. 1. Anas, Duck, (Common and Wild), - - -	*Tiedemann.*

1. CAVENTOU *on the Chemical Properties of Starch, and the various Amylaceous Substances of Commerce.* 2. ENGELHART *on the Colouring Principle of the Blood.* 3. *On Arsenic, its Oxides, and Sulphurets; by* M. GUIBOURT. 4. *Preparation of Chloride of Lime.* 5. *On the Detection of Arsenic.* 6. *On Cafeine.* 7. *Analysis of the Root of the Bryonia alba.* 8. *General Treussart on the Preparation of Hydraulic Cements.* 9. *On a New Method of Purifying Crystals; by* M. ROBINET. 10. *Repetition of the Comparison of the Rate of the Mercurial and Spirit Thermometer.*

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1. *Caventou on the Chemical Properties of Starch, and the various Amylaceous Substances found in Commerce.*

IN order to determine the relative nature of the different kinds of amylaceous substances, such as Salep, Sago, Tapioca, and Arrow-root, M. Caventou found it necessary to revise the chemical examination of pure fecula or starch; and the result is, that, besides adding some interesting facts on the chemical properties of that principle, he has been able to account satisfactorily for the differences which it exhibits in its various natural states.

Chemists, he says, have too generally considered the action of warm-water on starch as one of simple solution or gelatinization, although they are perfectly aware that its properties are materially changed. In its unmodified state, it is insoluble in cold water; but water at a temperature between 140° and 160° Fahr. converts it into a transparent gelatinous mass, which is commonly regarded as a *hydrate* of fecula. It is essentially different from the true hydrates, however, because its former properties cannot be restored by the abstraction of the water; and in particular, it is rendered more or less soluble in that fluid, and cannot in any way recover its insolubility. This change is the effect of heat; for it may be equally brought about by exposing dry starch to heat; but in that case a higher temperature is required, namely, a little above 212°, or under the point at which decomposition takes place. It then acquires a reddish colour, smells like baked bread, and forms with cold water a paste just like that procured at once in the humid way, by the action of hot water. In paste, therefore, the fecula is not merely hydrated, but is essentially modified. In this state, it still possesses the characteristic and well known property of forming a blue compound with iodine. It seems to be quite the same as the *amidine* of M. de Saussure; who imagined, however, that the principle he procured was the result of putrefaction. It was not, according to Caventou, the result of putrefaction, but was formed in consequence of the action of hot water on the undecomposed part of the fecula.

When amidine is boiled long in water, it loses its property of striking a blue colour with iodine, causes a purple tint instead, and has become much more soluble. The same change of properties may be effected by mere heat, namely by a higher degree of torrefaction than that required to form amidine; or it may likewise be very readily effected by boiling starch in water acidulated with a twelfth part of sulphuric acid. In this state, it has not so great an affinity for iodine, as in the state of amidine; for if a little paste be mixed with the purple compound, the colour becomes immediately blue.

When starch or amidine is boiled still longer, it becomes still more soluble; and iodine does not cause any change of colour on it at all. Most of these facts, particularly the property possessed by heat, of rendering dry fecula soluble, more or less, in cold water, have been familiar to chemists since the researches of Vauquelin and Bouillon-la-Grange; but the merit of taking a connected view of the whole changes induced by heat and water, and of associating those caused by heat alone with those caused by boiling water, seems to belong to Caventou. He might have stated more distinctly, however, than he has done, where our former knowledge ended, and his discoveries begin.

Of the substances in commerce usually considered as amylaceous, *Salep*, according to the analysis of Caventou, ought not to be accounted such. It yields a considerable quantity of matter to cold water; and the properties of this portion, both when dissolved and when dried by evaporation, are almost precisely the same with those of *gum*. The residue, after the action of cold water, is a tremulous, jelly-like mass, which, when treated with boiling water, enlarges in volume, but imparts only a small quantity of matter to the water. This solution is turned blue on the addition of iodine, and in a few hours the ioduret of fecula falls down. Hence, salep contains *fecula*, but only in very minute proportion. The jelly-like mass, remaining after the action of boiling water, is of course insoluble in that fluid under any circumstances; it is very soluble in hydrochloric acid, and yields oxalic acid when treated with nitric acid. It is therefore the principle discovered by Bucholz, and known by the name of *Bassorine*. This analysis shews that salep is not an amylaceous matter, but is closely allied to gum tragacanth, which, according to Bucholz, consists almost entirely of gum and bassorine.

Sago when treated with successive portions of cold water, and then with boiling water, is almost entirely dissolved, and appears therefore to be homogeneous. Cold water takes up a large quantity of it, and forms a transparent mucilaginous fluid, which becomes intensely blue on the addition of iodine. As fecula, in its characteristic state, is insoluble in water, and as no other substance strikes a blue colour with iodine, Caventou infers, that sago is *modified fecula*, the modification consisting in the amylaceous substance, (which, according to the process followed in the West Indies for procuring it, must be insoluble in water, and therefore true fecula), being converted by drying or roasting into *amidine*.

Tapioca when treated with cold water, rapidly yields a portion to it, and, after several successive macerations, it is entirely dissolved, without the aid of heat. All these fluids of maceration strike a strong blue colour with iodine. Tapioca, therefore, is closely allied in nature to sago, and, like it, is fecula modified by roasting, or amidine.

Arrow-root must be dried without heat; for, like the fecula of wheat and the potato, it is insoluble in cold water, with the exception of a mere trace of gummy matter, which it parts with; and it forms a paste when heated in water to near the boiling point.

Several remarks are added to this paper of Caventou, on the opinions of another French experimenter, M. Raspail; who believes he has discovered, by microscopical observations, that the grains of fecula are composed of a membranous cyst filled with gum. Caventou considers this notion to be visionary.—*Annales de Chimie et de Physique, Avril* 1826.

2. *On the colouring principle of the Blood.*

In 1825, the medical faculty of Gottingen decided their prize-question on the Nature of the Colouring Principle of the Blood, in favour of the thesis of Dr Frederick Engelhart. His experiments are very interesting, and establish satisfactorily some disputed points with regard to the composition of the blood; but we cannot go altogether along with him in considering that he has determined the colouring principle to consist of a compound of iron.

Two doctrines prevail at present among chemists and physiologists as to the cause of the colour of the blood. The oldest opinion is that it depends on iron; and this opinion is believed to derive support particularly from the late analytic inquiries of Berzelius, who found a notable quantity of iron in the colouring particles, namely about 0.5 per cent. Others maintain the doctrine first proposed by Dr Wells, that the colour is owing to a peculiar arrangement of the animal principles, independently of the presence of iron; and their opinion receives confirmation from the unsuccessful attempts of Vauquelin and Brande to detect iron in the quantity in which it is represented by Berzelius to exist.

These contradictory statements and ideas being held in view, Dr Engelhart proceeded to ascertain, in the first place, the characters of the pure colouring matter of the blood, and, secondly, the relation which the three great principles of the blood bear to one another, as to the quantity of iron they contain. 1. A preliminary object of investigation under the first head, was to separate the colouring matter in a state of purity. This he succeeded in doing by a new and very simple process; but, although the colouring particles certainly appear to be procured by his method in a state of perfect purity, it is equally certain that this object is not gained without some change being wrought upon their properties. He first separated them by the method of Berzelius, in which state, however, they are still mixed with a little serum. Having found that serum when much diluted is not coagulated by heat, while, as Berzelius formerly showed, the colouring particles are coagulated even in a very diluted solution, he dissolved the impure particles in about fifty parts of water, and then raised the temperature a little above 150° F.

Greyish-brown flocculi were thus separated; and a muddy colourless fluid remained, in which phosphoric acid and corrosive sublimate demonstrated the presence of serum. The precipitate, when collected on a filter and well washed, and half dried, recovers its red colour, particularly when viewed by transmitted light. When entirely dry it appears black, but when a thin slice is held between the eye and the light, the colour is garnet red. In this state it is hard, not easily broken, and has a shining fracture. It consists of the colouring particles in a state of perfect purity, but modified by heat.

In this state, the colouring matter of the blood is insoluble in hot or cold water, or in ether, and yields only a little fatty matter to alcohol. Sulphuric, hydrochloric and phosphatic acids dissolve a part, and form brownish-red solutions; nitric acid also dissolves a part, but the solution is muddy, and the residue is likewise altered in colour; phosphoric acid has no effect any more than on the colouring matter in its ordinary impure unmodified condition; acetic, citric, oxalic, and tartaric acids dissolve a little with the aid of heat. The alkalis, with the aid of gentle heat, dissolve it rapidly and completely, and form deep blood-red solutions, which yield greyish brown flocculi when neutralized; the carbonated alkalies have little effect.

The colouring particles, when not modified by the foregoing process, but simply separated from the serum as much as possible by Berzelius's method, are variously acted on by the gases. Agitation in air makes them scarlet-red; and this change is produced even after arterial blood has become dark by standing in repose, nay, even also after it has begun to decay. In hydrogen, carbonic acid, nitrogen, nitrous oxide, olefiant, or sulphuretted hydrogen gas, the colour, on the contrary, becomes darker, if it is changed at all. A stream of nitric oxide transmitted through a diluted solution in water, makes it brown, and subsequently causes gelatinization. Sulphuretted hydrogen, in the same way, makes it olive-green; sulphurous acid, brown; and chlorine first makes it brown, then dirty green, next grey, and lastly white; and a flocculent colourless precipitate falls down, leaving a colourless fluid.

2. These observations conclude the first part of the inquiry. The next part relates to the presence of iron in the colouring

matter and other principles. If, as Berzelius says, iron exists in the colouring particles in notable quantity, and not any where else, Dr Engelhart conceives the presumption to be, that it is the foundation of the red colour of the blood. If, on the other hand, as Brande and Vauquelin insist, there is much less iron in the colouring particles than Berzelius maintains, *and not more than in the fibrine and serum*, the colour cannot be owing to the presence of that metal.

The pure modified colouring matter, when charred in a crucible, had a metallic lustre, and was attracted by the magnet; and when the charred matter was incinerated, it acquired a yellow colour, was almost entirely soluble in hydrochloric acid, and then exhibited, with the ordinary re-agents, all the characters of the hydrochlorate of iron.

The pure serum and fibrine, when dried and charred, had not a metallic lustre, and were not attracted by the magnet; and, when incinerated, gave a white powder, which, although soluble in hydrochloric acid, evidently did not contain a trace of iron. The only kind of blood which can be used for these experiments is human blood, or that of the horse; the blood of the sow, sheep, ox, or turkey, does not yield a serum free from colouring particles. If care be taken to avoid that fallacy, therefore, it is found that iron exists in the colouring particles only.

Chemists have hitherto succeeded in detecting iron in the blood, only by the process of incineration. But Dr Engelhart has at length discovered a method of separating it in the humid way; and the result of his analysis gives the same proportion as that formerly determined by Berzelius. His method is, by transmitting a stream of chlorine through a solution of the unmodified particles, or through water containing the purer modified colouring matter in suspension. It has been already stated, that, in this way, a white precipitate and colourless fluid are procured. The fluid after being filtered evidently contains iron in the state of a peroxide *. Two methods were employed for discovering its quantity. In one process, he threw

* Care was taken that particles of iron did not pass over with the chlorine,—supposing even that that was possible.

down the oxide with ammonia, redissolved it in hydrochloric acid, and threw it down again with carbonate of soda. In the other process he first threw it down with hydrosulphuret of potass, then dissolved it in nitric acid, and threw it down again with carbonate of soda. The precipitate, when dried, weighed, in one case, $\frac{49}{10000}$, and in the other $\frac{55}{10000}$ of the pure colouring matter employed; a result which accords very nearly with that of Berzelius.

It is unnecessary to mention that serum and fibrine treated in the same way did not yield any iron. But it is an interesting fact, which the author thinks will apply to most of the animal fluids and soft solids, and consequently facilitate their analysis, that chlorine separates all the *fixed principles* from the insoluble animal matter which it throws down; for the precipitate is entirely dissipated by incineration.

The paper concludes with some arguments from his experiments, in support of the opinion, that the colour of the blood is owing to iron. The amount of them is, that iron is an essential part of the colouring particles, while theother principles, the serum and fibrin, which are colourless, but resemble the colouring particles very closely in other respects, contain no iron; and that this metal, in all its known combinations, is coloured when oxidated, has a great tendency to assume tints of red, and in some compounds (such as the sulpho-cyanate, and a variety of silicious ore) has almost exactly the colour of the blood. This exposition may constitute a presumptive argument, but nothing more. For, in the first place, it is not yet proved that the iron in the blood is oxidated, still less that it exists in the form of a peroxide, in which state alone it imparts a red tint to compounds into whose composition it enters; and, secondly, granting that it is peroxidated, there is no analogous fact to authorise the belief, that so minute a proportion as a 200th part of oxide of iron can give to a compound so deep a tint as that possessed by the blood.—*Kastner's Archiv für die gesammte Naturlehre, December* 1825.

3. *On Arsenic, its Oxides, and Sulphurets*, by M. Guibourt.

M. Guibourt of Paris has lately endeavoured to settle some of the disputed points in the physical and chemical history of arsenic and its compounds; and has succeeded in explaining so far some of the anomalies and discrepancies which the investigations of previous experimenters have presented.

According to Bergmann, the specific gravity of metallic arsenic, when melted, is 8.308, but in its native state only 5.763. M. Guibourt found, that small portions of the latter had a specific gravity of 5.789; but larger fragments, in consequence of the interstices between the conglomerated crystals, did not exceed 4.166. He failed in several attempts to fuse it under pressure, and was deterred from repeating them by a formidable explosion. But he found the weight of several fragments, which were agglutinated by heat, to be 5.959.

The *oxide of arsenic*, though it has been examined by many able chemists, still presents some obscurities in regard both to its physical and its chemical properties. Guibourt has found, that the discrepancies among former experimenters may be partly reconciled by a difference in property which exists between the oxide in its transparent, fresh-prepared state, and in that more common opaque form, which it assumes after being long kept. Transparent specimens, he finds, have a specific gravity of 3.7385; the opaque varieties are somewhat lighter, being 3.695. He has never been able to observe any specimen with the high specific gravity of 5.0 assigned by Bergmann. His results agree with those of our countryman Dr Ure, who found the specific gravity to vary from 3.728 to 3.730. Very opposite statements have been made with respect to its solubility. The most accurate, however, have been generally considered to be those of Klaproth; who found that a hundred parts of water dissolve a quarter of a part at a mean temperature, 7.77 parts at the boiling temperature, and retain 3 of these on cooling. Guibourt finds, that the transparent oxide is less soluble than the opaque variety. Of the former 100 parts of temperate water dissolve nearly one part; and 100 parts of boiling water take up 9.68 parts, and retain $1\frac{3}{4}$ on cooling. Of the opaque variety 100 parts of water dissolve $1\frac{1}{4}$ at a mean temperature, 11.47 at the boiling temperature, and retain 2.9 on cooling. Chemists are as little agreed regarding the effects of its solutions on vegetable colour. Guibourt has remarked, that the transparent variety reddens litmus faintly, but that the opaque variety restores its colour to blue, when previously reddened by an acid*. The cause of these differences has not been examined with sufficient care, and Guibourt leaves it unsettled. He says it takes place in consequence of the contact of the air; but the accuracy of this opinion may be questioned. He has remarked, that it is brought about very rapidly by treating the transparent variety with ammonia; but he draws no conclusions from the fact.

As to the compounds of sulphur with arsenic, the latest minute researches, those of Berzelius and of Laugier, seemed to show, that, contrary to the opinion of Proust, the native and artificial sulphurets differ in no essential particular from one another, and that none of them contain oxigen. Whence does it happen, then, says Guibourt, that, according to the observations of Hoffmann, and the late experiments of Renault, the native sulphurets, orpiment and realgar, as well as the sulphuret procured by transmitting sulphuretted hydrogen through a solution of oxide of arsenic, are not poisonous, while the sublimed orpiment, and even the artificial realgar, prepared by melting together metallic arsenic and an excess of sulphur, are exceedingly deleterious? It depends, he says, on the artificial sulphurets always containing some oxide of arsenic intermingled. The artificial realgar contains 1½ per cent.: the artificial orpiment so much as 40 per cent. This last fact we can confirm by our own experience; in fact, we have seen fine tetrahedral pyramids of the oxide on the inside of the cakes sometimes sold in the shops. M. Guibourt is wrong, however, in supposing that the native sulphurets are not poisonous. Renault, it is true, found them to be much inferior to the oxide and other soluble compounds of arsenic, in their effects on the animal system. But instances are to be found in the *Acta Germanica*, of poisoning with realgar, and M. Pelletan informed him, after the composition of his paper, that he had known an instance of poisoning with natural orpiment. In consequence of the opinion expressed by Guibourt, Professor Orfila has related, in an ulterior number of the Journal de Chimie Médicale, some experiments he has made expressly with the native sulphurets, and with that procured by transmitting sulphuretted hydrogen through a solution of the oxide; and it ap-

* Our experience is at variance with that of the author; a solution of the opaque oxide faintly reddens litmus, and restores reddened litmus very imperfectly.

pears, that all of them, when introduced into the stomach, or applied to wounds, in the quantity of forty or sixty grains, kill dogs in two, three, or six days, and cause the same symptoms as the oxide.—*Journal de Chimie Médicale, Fevrier, Mars et Avril* 1826.

4. *Preparation of Chloride of Lime.*

This substance, it is well known, was recommended not long ago by M. Labarraque, a *pharmacien* of Paris, for destroying the odour of putrefying animal and vegetable matters, and the exhalations in apartments crowded with the sick; and it has been found to answer his expectations so completely, that the French Government have given every possible publicity to the process, and have advised its introduction into all hospitals and lazarettos. The mode of preparing it is well enough known to chemists; but as several experimenters have not procured the effects assigned by the discoverer, and by the official persons appointed to inquire into the accuracy of his statements, and as for this and other obvious reasons, it is a preparation liable to considerable variety, M. Labarraque has published the following process for making it of uniform strength and composition. To prepare the dry chloride for store, he recommends that a twentieth part of muriate of soda be mixed with the quicklime, after it is completely slaked, and that the mixture be put into deep earthen pots, and the gas transmitted through it from a retort containing the usual ingredients, in the proportion of 576 parts of muriate of soda, and 448 of oxide of manganese. The quantity of acid required to decompose this quantity is 576 parts, diluted with 448 of water; and the acid is to be introduced into the retort in successive portions, by means of the double bent tube. To prepare the solution, which may be more convenient for hospitals and other places where it is used daily, he recommends a pound and a half of slaked lime to be mixed with forty pounds of water, containing half a pound of muriate of soda in solution. The tube from the retort is to be plunged nearly to the bottom of the vessel which contains the milk of lime; and the mixture is to be stirred with a wooden agitator till it is saturated. In this state it is too strong for use; and may be diluted according to the purpose to which it is to be applied *. In this country

* Journal de Chimie Médicale, Avril 1826.

the trouble of preparation may be saved by those who can procure the chloride of lime, as prepared by our chemical manufacturers, particularly by Mr Tennant of Glasgow, who has succeeded in saturating the lime completely, so as to form a true bi-chloride.

5. *On the Detection of Arsenic.*

In the number of the Edinburgh Philosophical Journal, vol. xi. p. 389, we gave an account of a paper by Dr Christison of this University, showing the insufficiency of the existing processes for detecting small quantities of arsenic in mixed animal and vegetable fluids, and pointing out a new method, by which so small a quantity as a quarter of a grain might be procured in its metallic state from the most complex mixtures. The second volume of the Medico-Chirurgical Transactions of Edinburgh, published a few months ago, contains another paper by the same gentleman on the chemical and symptomatological evidence of poisoning with arsenic; and from this it appears that he has applied the proposed process to two medico-legal cases, one of suicide, the other of murder; that he was successful in both instances; and that the process is one even of much greater delicacy than was alleged in his original paper on the subject. In one case, a portion of the contents of the stomach, in which the first inspectors had failed to detect the poison, was transmitted by order of the authorities from a distant part of the country, and arsenic was discovered to the amount of a *twentieth* part of a grain. In the other case, which Dr Christison himself examined soon after interment, about a *fifteenth* part of a grain was detected in the contents and texture together of the stomach.

For detecting the precise nature of the metallic crust, when its quantity is too minute for its physical characters to be unequivocally ascertained, the author has added a very elegant test, which was suggested to him by Dr Turner, lecturer on chemistry here. It consists in chasing the crust up and down the tube by heat till it is all oxidated; *when it assumes the appearance of sparkling crystals, which may be ascertained, by a microscope of four powers, to be octaëdres.* His process now consists, therefore, in presenting the same portion of the poison successively in the form of sulphuret, metal, and oxide; and he discards the fluid tests for liquid mixtures entirely, except as trial tests. Both he himself and Dr Turner have satisfied themselves, that the physical characters of the metal and oxide, when successively formed in a small tube by reduction and subsequent oxidation, may be determined accurately with a *hundredth* part of a grain. This is a degree of delicacy which, considering that decisive evidence is required, is not equalled even by the liquid tests.

In the Annals of Philosophy for last July, Dr Christison has replied to some comments which Mr Phillips had made not long before on his paper. As Mr Phillips' criticisms referred only to a defence of his process for decolorizing coloured arsenical fluids by animal charcoal, and Dr Christison states, in his reply, that he considers the necessity of that process to be completely superseded by the equal, if not superior delicacy, and universal applicability, of his own, it is unnecessary to say any thing farther of the dispute, than that Mr Phillips' process certainly appears liable to material fallacies, although Dr Christison, from misunderstanding his directions, had somewhat exaggerated one of them.

The *Journal de Pharmacie* for last April likewise contains some comments on Dr Christison's paper by M. Dublanc of Paris. It is evident that the writer has wholly misunderstood the character of the paper he criticises, and is utterly ignorant both of the grounds on which Dr Christison objects to the processes of Rose, Rapp and Orfila, and of the circumstances on which is founded the proof of the delicacy and universal applicability of his own. Nor indeed is this to be wondered at, as M. Dublanc has consulted, not the original paper, but some garbled extract in a German Journal.

6. *On Caféine.*

In 1821, M. Robiquet of Paris published an elaborate analysis of the coffee-bean, in which he announced the existence of a new vegetable principle of a crystalline nature. This principle, which was denominated *Caféine*, has been since examined by M. Pelletier, and M. Garot. Both of these experimenters have confirmed completely the researches of Robiquet, regarding the characters of the principle, and the method of preparing it. M. Garot, however, has recommended a new process for procuring it, which consists in exhausting the unburnt bean, by successive infusions in boiling water; throwing down a quantity of colouring and fatty matter from the filtered infusions, by the acetate of lead; removing the excess of lead by a stream of sulphuretted hydrogen; saturating the free acid with ammonia; and evaporating the remaining liquid with a gentle heat. Long silky crystals are thus procured, which are the cafeïne in a state of impurity, and which may be got quite pure, by a second solution and crystallisation. The researches of Pelletier were directed chiefly to determine whether this principle is of an alkaline nature; because certain circumstances had led him to imagine, that its discoverer was mistaken in denying to it alkaline properties. The result has been, that M. Robiquet's views are substantiated; for cafeïne dissolves in acids without neutralising them, crystallises in a state of purity from the diluted acids, and does not affect the vegetable colours. It must therefore be arranged with the class of principles, of which *narcotine*, one of the principles of opium, is the most remarkable and best known.

The most interesting fact contained in the researches of Pelletier regards the composition of cafeïne. It contains the largest quantity of azote of all the vegetable principles hitherto analysed; and contains more than even any animal principle, urea and uric acid excepted. It is composed of 46.51 carbon, 27.14 oxigen, 4.81 hydrogen, and 21.54 azote. Although so highly azotised, it is, like urea and uric acid, by no means prone to putrefaction,—a fact which accords with a general law pointed out by Robiquet, that azotised principles of the organic kingdoms, although, in general, very liable to decay, are not so, if they are crystallised.—*Journal de Pharmacie, Avril* 1826.

7. *Analysis of the Root of the Bryonia alba.*

The root of the bryony possesses properties in relation to the animal economy, which renders it an object of some interest to the chemist. It is one of the most powerful of the vegetable acrids,—of that order of poisons whose prominent character is the power of producing diffuse inflammation, to whatever tissue they are applied. Accordingly, it has been examined by several chemists, namely, by Vauquelin, Brandes, and Feirnhaber; but the most complete analysis hitherto made, is one by M. Dulong of Astafort, related in the Journal de Pharmacie. He has found it to consist of a large quantity of fecula, a small quantity of fatty matter, resin, and vegetable albumen; some gum, a considerable proportion of submalate of lime, a little carbonate of lime, some other salts in minute quantity, and a bitter matter, possessing peculiar chemical properties, and endowed with all the poisonous qualities of the root.

This bitter principle is contained in the juice, so that the fecula may be separated from it entirely by the usual process. The fecula, when properly washed, possesses all the properties of that procured from the different kinds of grains; and, consequently, as the quantity is large, and the roots are of enormous size, compared to the stem (being often a foot long, and three or four inches in diameter), M. Dulong thinks that the extraction of the fecula may be made a subject of profit, at least in years of scarcity. The bitter principle is solid, soft, and a little viscous, excessively bitter, soluble in water and in alcohol, but quite insoluble in sulphuric ether; and its solutions have no action on the vegetable colours. Its aqueous solution is precipitated by infusion of galls, subacetate of lead, proto-nitrate of mercury, nitrate of silver, and hydrochlorate of gold. Acetate of lead, nitrate of lead, proto-hydrochlorate of tin, and tartar emetic, have no effect on it. The acids dissolve, and alter it, rendering it insoluble in water. The concentrated sulphuric acid forms with it a rich green, nitric acid a golden-yellow, and hydrochloric acid a reddish-brown fluid; and the affusion of water throws down precipitates possessing the colour of each solution. In its general properties M. Dulong considers it as closely allied to the *coloquintine*, a resinoid matter, which is procured from another of the same order of poisons, the colocynth, and which, like the bitter principle of bryony, concentrates in itself the whole qualities of the raw material.—*Journal de Pharmacie, Mars* 1826.

7. *General Treussart on the preparation of Hydraulic Cements.*

General Treussart, referring to some observations published at St Petersburg in 1822 by M. Raucourt, and to some experiments of his own, related in a late number of the *Memorial de l'Officier de Génie*, states, that he has since then established an important fact, which he had previously been led by Raucourt's remarks to anticipate, with regard to the preparation of artificial pozzolan mortar, or hydraulic cement; namely, that the access of air, during the calcination of the argillaceous cement, is of great consequence to the tenacity of the mortar, and the quickness with which it hardens. He first refers to his former experiments (which we have not yet seen) as proving, that, contrary to what is generally supposed, neither the oxide of iron, nor that of manganese, nor magnesia, can communicate to lime the property of hardening under water. He then observes, that, on calcining an argillaceous earth, procured near Frankfort (and consisting of silica and alumina, a 66th part of magnesia, and a trace of iron), and mixing it with half its weight of lime to form a mortar, he found, that, if it had been calcined under free exposure to the air, it hardened under water in two or three days, and at the end of a year required a weight varying from 390 to 530 pounds to break it; while, if the clay had been calcined out of reach of the air, the mortar took thirty days to harden, and broke with a weight of 40 or 50 pounds. Analogous results were obtained with a clay from Holzheim, near Strasburg; and in this instance he also found that it was useful to mix a 50th part of lime with it before calcination. It is not easy to account for these differences; but the General himself is disposed to ascribe them to the absorption of oxigen by the alumina. In proof of this, he mentions, that the same difference is observed, if, instead of impure clay and lime, the purest alumina, and the lime of white marble, be employed. The alumina, when calcined under a current of air, makes a mortar which hardens sooner, and is much stronger than when the calcination is conducted in a close furnace. Another fact in support of his conjecture is, that alumina, when calcined in the air, dissolves more easily in sulphuric acid. The results of his latest investigations are, that the clay to be chosen for the best hydraulic mortars should contain a little lime; that it should be calcined under exposure to a current of air, contrived according to the nature of the furnace; that, after being reduced to a fine powder, it should be mixed with paste of lime in the proportion of one of the atter to two, or two and a-half, of the former;

that the mortar should be kept for ten or twelve hours before it is used, in order to acquire a certain degree of consistence; and that it may be perfectly relied on, if, by a preliminary trial, it is found to harden in three or four days; his experience having invariably shewn that the mortars which harden soonest, are also the most tenacious.—*Annales de Chimié et de Physique, Mars* 1826.

9. *On a New Method of Purifying Crystals;* by M. Robinet.

Every practical chemist knows how difficult it often is, particularly in the analysis of organic substances, to clear away from crystalline products the mother water, and other heterogeneous matters, which collect in their interstices. When the crystals are very fine, and still more when they are soluble in the ordinary menstruums, it is sometimes impossible to clear them, although perfectly pure, by any other method than repeated crystallization and digestion with animal charcoal; both of which processes are troublesome, and occasion considerable loss. M. Robinet has proposed a new and very simple method, which was suggested to him, in consequence of observing that, when a parcel of crystals came into contact with the mouth of the pipette during the act of suction, they were instantly and perfectly cleaned. The process depends on the transmission of a current of air through the crystals. He has suggested various forms of apparatus for the purpose. The simplest consists of a double-mouthed bottle, with a funnel in one mouth, and a bent tube in the other; the lower opening of the funnel being obstructed by a ball of cotton-wool, and the crystals placed above the cotton. On sucking the air through the crystals by a bent tube, they are cleaned in a few seconds; and, if necessary, the operation may be repeated after previously introducing a little water into the funnel. A convenient way of constructing the apparatus so as to work of itself, is to make the second tube reach the bottom of the bottle with one limb, and with the other a vessel of water situated on a lower level. The whole bottle and tube being filled with water, the funnel is to be introduced, and the water then allowed to run off by the syphon. On the large scale a more suitable apparatus will be a tube from a steam-boiler, by which the bottle may be filled with steam from time to time.

The steam communication being shut off, and the steam in the bottle condensed, the stream of air will immediately carry through with it the whole of the mother water from the most silky crystals.—*Journal de Chimie Medicale, Fevrier* 1826.

10. *Repetition of the Comparison of the Rate of the Mercurial and Spirit Thermometer.*

Dr Wildt of Hanover has made a new set of experiments for ascertaining the real indications of the spirit thermometer, chiefly with a view to the employment of that instrument in the Register Thermometer of Rutherford. His results, which are stated below, do not differ materially from those of Deluc. The observations are made at intervals of five degrees of Réaumur's scale.

Mercury.	Spirit.	Mercury.	Spirit.
— 45	— 28.50	20	16.48
40	25.92	25	20.97
35	23.19	30	25.60
30	20.32	35	30.38
25	17.30	40	35.31
20	14.13	45	40.38
15	10.82	50	45.60
10	7.36	55	50.97
5	3.75	60	56.48
0	0.00	65	62.14
+ 5	3.90	70	67.95
10	7.95	75	73.90
15	12.14	80	80.00

(*Kastner's Archiv für die Gesammte Naturlehre, December* 1825.)

Description of the Ciconia Ardgala, or Adjutant Bird. By J. ADAM, M. D *.

AMONG the many extraordinary and striking objects in natural history which present themselves to a stranger on his arrival in Bengal, perhaps none has been more generally remark-

* This interesting memoir, by my former pupil and very intelligent friend Dr Adam, is extracted from the 1st volume of the Transactions of the Medical and Physical Society of Calcutta, which has just reached this country. It is a work highly creditable to the Calcutta Society.

ed upon, and at the same time less studied, than the subject of the following description. We are all familiar with the appearance of the Adjutant bird, and know something of its habits: its astonishing voracity, for instance, is a frequent topic of conversation; and the singular orange-coloured bag depending from the neck, while it gives a peculiarity to its expression that cannot fail to attract attention, has also furnished abundant matter of speculation as to the purposes which it serves in the economy of the animal. Of these, however, we are yet entirely ignorant; nor does it appear that we are much better informed regarding its general internal structure.

Adjutant Bird, Gigantic Stork, Ciconia Argala, Hurgeela.—One of the largest of the storks, whose general character is formed by his great size, enormous bill, bare head and neck, long limbs, and, above all, by a peculiar solemnity in his gait and general demeanour, that renders the appearance of the bird extremely striking and interesting. He measures from the crown of the head to the foot five feet two inches, and his other dimensions are proportionably great: across the body, from the tip of one wing to that of the other, seven feet; length of body, from junction of the neck to the vent, two feet; breadth one; bill in length, sixteen inches; at its broadest part two inches; legs two feet and a half. General colour of plumage, black or slate-blue; a few of the small feathers surrounding the lower part of the neck, white, and those of the belly and the under part of the wings; the larger wing-coverts blackish or bluish grey; all the others slate-blue, as mentioned. Tail short; bill strong, horny, almost bony, sharp at the edges, broad at the base, straight and tapering towards the point; inferior mandible composed of two sides, joined by a membrane not capable of much dilatation; nostrils, a slit at the base of the bill, which is common to both, and passes directly through; head the size of the base of the bill, by which it appears in a great measure to be formed, and the one merely a continuation of the other; head bare (excepting a little soft long hair at the back part), and scurfy; iris white. The bareness of the head, and white iris, combined with the other peculiarities, gives this bird an uncommonly grave aspect; and in his whole expression, but particularly that of the eye, he resembles very much a kindred giant among quadrupeds, the elephant. Legs long and strong; breadth at the largest diameter three inches six tenths. Feet walkers composed of three toes before, and one behind, the outermost having five joints, the second four, the third three, and the posterior two; claws short, strong, blunt; the colour of the neck, and bag depending from it, a bright orange (Dutch orange, *Werner*). The bag, which constitutes one of the principal characters of this bird, is not directly connected with the gullet nor the trachea, but enters by a small aperture into the left side of the pharynx or mouth, and is evidently not intended as a receptacle for food. It is composed of two coats, an inner membranous one, and the outer orange-coloured skin: within this bag nothing is found but air and saliva. The gullet is ample, and folded into many longitudinal plicæ, increasing in number and size as they approach the cardiac orifice. The stomach is very large, compared with the size of the other viscera, and fills up the whole of the abdomen from the ribs to the vent; it is seen immediately on laying open the cavity, in the shape of an urinal, and covered with a fatty membrane. The stomach consists of two parts, which, from their structure, appear to perform separate functions. The upper portion is of a glandular structure; the lower muscular. The former is small, compared with the latter, very narrow, and of an oblong figure. Interiorly it is furnished with a glandular apparatus, similar to what I have observed in some other fowls: a small contraction marks the division between these two, and from this line the structure becomes very different, feeling harder to the finger, and consisting of muscle and tendon of great thickness at some points. The tendon is in the centre of the flattened circle, and the muscle sweeps all round the margin. The stomach in the specimen was distended with earth, hair, and bones. The gut is a narrow tube of considerable length, lying immediately behind the stomach, and occupying but a small part of the general cavity. The liver of a dirty brick colour, palish, and different from those of other fowls which I have hitherto examined; heart of a proportional size, and very firm.

The specimen from which this description was taken, was killed by me on the banks of the Hoogly, and appeared to be a full grown male bird.

Having had greater opportunities of observing the habits of this bird since the foregoing description was drawn up, I shall here add a few remarks, which, it is hoped, may throw light on some of the peculiarities alluded to. In the first place, the orange-coloured bag forming so prominent an appendage of the neck, dissection reveals to us, contains merely air and saliva; and the latter, in all the instances which I have examined, has been so trifling in quantity, that its presence could only be regarded as accidental, having accumulated in all probability in that situation from the mere effect of gravity, after lubricating the pharynx and mouth. Besides, the structure of the bag does not resemble that of a secreting organ. It is also quite evident, from the smallness of the aperture communicating with the mouth, that it cannot serve as a receptacle for food, at least of such massive and solid materials as we know constitute the food of the Adjutant bird. In what, then, it may be asked, consists its use? If it perform any function, I should conceive it to act merely as an air-vessel, to be employed as occasion required, either in sustaining the bird in his elevated aërial flights, or enabling him to be more daring in the water in the search after his prey. At first sight, such an apparatus may appear superfluous; but on an attentive consideration of the subject, we shall be disposed, I think, to regard it in the light rather of a wise provision of nature, adapted to the peculiar circumstances of the bird. In order to explain this, it will be necessary to bear in mind, that the *Hurgcela*, though domesticated in a great measure among ourselves, is originally an inhabitant of the forest and marsh, whither these birds yet resort annually, for the purpose of breeding, and rearing their young. Their periodical disappearance during the hot and dry months, it may be presumed, has this object in view; and there can be little doubt in that season they retire to the depths of the Sundurbunds, where they congregate (*quære* build in trees?) like their congener, the Heron, in more temperate regions. Their natural food in that situation, consisting of reptiles and amphibia of every description, they must be necessitated, in quest of it, to enter the *jeels* (lakes) and marshes, while, from the structure of their limbs, they are not endowed with the capacity of swimming; and their bulky and ponderous beak must operate greatly to their disadvantage as waders, compared with many other individuals of the same tribe. To overcome these difficulties, then, may not the bird have the power of distending the bag with air, so as to counteract the weight of its enormous bill, and thus be enabled to procure food, in situations where it would otherwise be unattainable? In a communication lately received from a friend, this view of the subject appears to be confirmed by what he himself was an eye-witness of. An Adjutant bird was observed seeking its prey in a large piece of water, and wading till it reached to so great a distance from the shore, that it attracted his attention, as he conceived the depth at that spot to exceed the perpendicular dimensions of the limbs and body united. He had the curiosity to inquire into the fact, and ascertained that the bird had actually advanced into the water beyond its depth. The conclusion which he drew from the circumstance was similar to what I have now proposed, namely, that the bag had acted as an air-vessel, and supported the bird where, without such assistance, it must have unavoidably been submerged and perished.

The other idea, that this appendage may perform a similar office in the ethereal element, naturally suggests itself, when we consider the anatomical structure of the parts, and compare it with the extraordinary elevation to which these birds are known to soar, and the great length of time they frequently remain on wing in the higher regions of the atmosphere. When the dense vapours of the rainy months are dispersed, and the sun has again burst forth with undiminished fervor on our Indian plains, then the Adjutant bird is observed to avoid the meridian heat by taking his elevated flight, and rising gradually in the atmosphere, till he appears a mere speck in the distance, or attains a height that conceals him entirely from the view. In the month of October, when not a cloud obscures the vault of the heavens, it is a beautiful spectacle to observe hundreds of these gigantic birds (now diminished to the size of swallows) performing their graceful evolutions, and wheeling majestically at a vast elevation from the earth. The painter, looking at the face of nature, would behold the scene as merely characteristic of a tropical climate; while the philosopher, who views every object with reference to an ultimate purpose, cannot but admire its adaptation to the peculiar economy of the animal, and regard the phenomenon as a concord in the grand harmony of creation. The food of the Adjutant bird being wholly of an animal nature, its digestion and assimilation must obviously augment the internal temperature, and therefore render its frame less capable of enduring heat from without. To obviate the effects arising from this susceptibility, nature, then, has bestowed on him the instinct of ascending to a more rarefied and congenial medium; and that he is enabled to remain there, it would seem not improbable, is chiefly owing to the agency of this organ. Even with the aid of a glass, we cannot perceive whether the bag is distended during the time the bird is soaring in the atmosphere, and so prove the correspondence of the fact with the theory; but as it seems remarkable that so heavy a bird should continue long poised in "mid air" without some provision of the kind, it cannot be deemed unreasonable, I think, if we infer that such may be supplied by the appendage now under consideration.

As to any other peculiarities of structure which may have been noticed in the description, they receive a ready explanation from the well known habits of the bird. The vast capacity of gullet, furnished by the numerous longitudinal plicæ, extending from the pharynx to the cardia, and the enormous size and powers of the stomach, are in perfect unison with his extraordinary voracity. To relate instances of this would be to repeat an often times told tale. In India they are of every day's occurrence, and would scarcely be credited by those who have not had an opportunity of witnessing them. A leg of mutton, or a litter of live kittens swallowed whole, prove equally acceptable to his all-devouring maw; and earth, bones, and hair (as the above dissection shewed), form a mixed mass, from which he appears indiscriminately to draw his subsistence.

On the Theory of the Air-Thermometer. By Mr Henry Meikle. Communicated by the Author.

Various notions have been at different times advanced regarding the rate of expansion in solids and liquids as a measure of temperature; but it has more generally been admitted, particularly of late, that the expansions of gaseous bodies under a constant pressure follow the true law of the influx of heat. In proof of the latter opinion, it has been alleged, that, when a solid is expanded by heat, its cohesion, being greater at lower temperatures, resists the expanding power so much the more; and therefore, in the lower parts of the scale, the increments of volume produced by equal additions of heat are smaller than at higher temperatures; or, in other words, that the expansion of solids proceeds at an accelerated rate, whilst the increase of heat is uniform. Something of the same kind, though in an inferior degree, is said to take place in liquids; but gaseous bodies being supposed to have no cohesion between their particles, are accounted free to obey the true law of temperature.

With this species of argument I am by no means satisfied, because I really cannot pretend to see the force or meaning of it; nor do I think we are likely soon to arrive at any certain conclusion, by reasoning on principles which are less known perhaps than the thing to be proved. Does analogy not rather render it probable, that the particles of gases attract each other with forces varying inversely as the squares of their distances? Many other objections, and reasonable ones, too, might be proposed, to which no solid answer can be given. Such, however, serve to shew on what a slippery foundation a very general opinion may sometimes rest,—an opinion, in the present instance, with which many speculations must either stand or fall. Indeed, if authorities are allowed to have any weight in settling a disputed point, then I believe by far the greater number of the more enlightened are not only favourable to the common theory of the air-thermometer, but scarcely entertain a doubt on the subject.

It must, however, be admitted, that conjectures or opinions, though supported by numerous and respectable authorities, are not to be compared with experimental evidence, or with conclusions deduced from such evidence by sound reasoning. I have, therefore, with the view of approaching a little nearer to certainty in a point which is any thing but settled, been induced to attempt an investigation of the theory of the air-thermometer on its own principles, divested as much as possible of hypothetical assumptions. How far I have succeeded will appear from a careful perusal of what follows.

For this purpose, I shall set out from the same principles as M. Poisson does in his Memoir on the Caloric of Gases and Vapours *; but it is only for a short way that I can go in with the doctrines which that able mathematician endeavours there to establish; because, as will shortly appear, his data soon become both redundant and inconsistent, though not till he has investigated the law which connects the density and pressure with the temperature by the common scale in a mass of air, when its quantity of heat is constant. This law exactly agrees with that which our learned countryman Mr Ivory has obtained by a different process; so that no doubt need remain on this part of the subject, so far as mathematical reasoning is concerned. But it is not necessary that I should be first in possession of this law, to establish the law which connects the variations of volume under a constant pressure, with the variations of heat, though indeed they are so intimately connected, that either of them may be deduced from the other.

The experiments of MM. Gay Lussac and Welter are entitled to a considerable degree of confidence, and from these it appears, that the specific heat of air under a constant volume, is to its specific heat under a constant pressure, in a ratio sensibly constant, viz. that of 1 to 1.375, nearly agreeing with 1.354† deduced from the experiments of MM. Desormes and Clement. Adopting this, no objection can be made to M. Poisson's reasoning till he gets past his equations (5). But immediately thereafter, in attempting to prosecute the subject, and supposing his data exhausted, M. Poisson, after the example of the Marquis Laplace, adopts the well known hypothesis already noticed, that the expansions of air under a constant pressure are proportional to the increments of heat; and it is curious that neither of these distinguished philosophers were aware that this hypothesis was both unnecessary and directly at variance with the above mentioned *constant* ratio of the specific heats. The

* *Annales de Chim. et de Phys.* xxiii. 337.; *Phil. Mag.* lxii. 328.

† *Journal de Physique*, lxxxix. 331. The following investigation, so far as regards the law of temperature, has nothing to do with the value of this ratio.

consequence is, that all the subsequent part of that memoir connected with the hypothesis is erroneous.

Let t be the temperature of a mass of air, ϱ its density, and p the pressure. Then, from known principles,

$$p = b\varrho\,(1 + at)\ ^{*}\ldots\ldots\ldots\ldots\ldots\ldots(\mathrm{A}).$$

a being the expansion for 1°, and b another constant.

When the quantity of heat in a body varies, it is evident that the variations of temperature on the common scale must be, *cæteris paribus*, inversely as the specific heat. From the above equation making p and ϱ respectively to vary with t, whilst the other is constant, we have

$$dt = \frac{1 + at}{a p}.dp, \text{ and } d't = -\frac{1 + at}{a\varrho}.d\varrho.$$

Also when the quantity of heat changes in the mass of air, let this change be denoted by q; then the specific heat will be proportional to $\frac{dq}{dt}$. Hence the specific heat of air under a constant volume will be to that under a constant pressure as

$$\frac{dq}{dp}.p : -\frac{dq}{d\varrho}.\varrho :: 1 : k;$$

whence

$$kp.\frac{dq}{dp} + \varrho.\frac{dq}{d\varrho} = o.$$

Now, supposing k constant, we have by integrating

$$q = \mathrm{B}\left(\frac{1}{k}\log p - \log\varrho\right) + \mathrm{C};$$

and if, whilst $q = o$, we reckon the pressure and density to become each equal unit at the same instant, then $\mathrm{C} = o$; hence

$$q = \mathrm{B}\left(\frac{1}{k}\log p - \log\varrho\right)\ldots\ldots\ldots\ldots\ldots\ldots(\mathrm{B}).$$

To determine the proper form of this integral, M. Poisson deemed it necessary to assume an additional hypothesis; but in that assumption both he and M. Laplace have deceived themselves. The value they give to q is

$$\mathrm{A} + \mathrm{B}\left(\frac{1 + at}{a}\right)p^{\frac{1}{k} - 1} = \mathrm{A} + \frac{\mathrm{B}\,p^{\frac{1}{k}}}{b\,a\,\varrho}$$

* It must be observed, that, though the indications of an air-thermometer be here used, no stress is laid on the *theory* of that instrument.

where A and B are two arbitrary constants. Hence, when $d\varrho = o$, $dq \propto p^{\frac{1}{k}-1}\,dp$; but, by hypothesis, $dq \propto dt \propto dp$, or $p \propto 1$, which is absurd. Indeed as we shall soon see, (B) is the only form, which constructed geometrically, can agree with the forementioned law connecting p, ϱ and t when $q = o$; and which will make the specific heats independent of the actual density or pressure, as their *constant* ratio requires them to be.

When, in equation (B), $\varrho = 1$, q varies as log p, that is, when the heat varies equably, the pressure under a constant volume varies in geometrical progression. If p be constant, the variations of q are as those of $-\log \varrho$, or of $+\log \frac{1}{\varrho}$; that is as the variations in the logarithm of the volume. Hence, when the quantity of heat varies in arithmetical progression, the volume under a constant pressure varies in geometrical progression, or the real temperatures are as the logarithms of those on the common scale of an air-thermometer, reckoning from —448°F. or —266°.7 cent., and placing the new zero at —447° F. or at —265°.7 cent. The absolute zero might thus correspond with the first two of these numbers, or with minus infinity, by the new scale; but this is a point which I do not pretend to decide.

The divisions on the scale ought therefore to form a geometrical progression, increasing with the temperature, instead of being, as at present, equal parts.

When $\qquad q = o,\ p = \varrho^k$ .... (C).

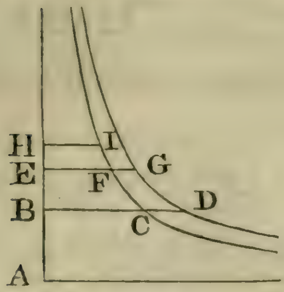
Let τ be the temperature when p and ϱ are each equal unit; then, if these vary while $q = o$, we have from equation (A),

$$\frac{p}{\varrho} = b\,(1 + at) = \frac{1 + a\tau + ai}{1 + a\tau} = \varrho^{k-1} \text{ .... (D).}$$

The change of temperature, by the common scale, produced by the change of density from unit being i.

Equations (C) and (D) are equivalent to M. Poisson's equations (5); or to Mr Ivory's equations (D), *Phil. Mag.* lxvi. 9. They form the law which connects the pressure and density together, or with the temperature on the common scale, when the heat in the air is constant.

But the relations of the different quantities may be more clearly exhibited by means of a geometrical diagram. This will appear whilst I proceed with the construction, illustrating it, at the same time, by a sort of example.



On the common scale of an air-thermometer, let the straight line $AB = \frac{1 + a\tau - ar}{a}$. From B draw BCD at right angles to AB, making BC to BD as the specific heat of air under a constant volume is to its specific heat under a constant pressure, or as 1 to k. Through C and D describe two rectangular hyperbolas having A for their centre, and AB for an asymptote.

Let $\tau - r$, the temperature of a mass of air, be increased r degrees, or from B to E: Then $AE = \frac{1 + a\tau}{a}$. Draw EG parallel to BD, and meeting the curves in F and G; hence EF : EG : : 1 : k, and so of every such parallel. If this increase of temperature take place under a constant volume, the additional heat may be represented by the area BCFE, but if under a constant pressure, by area BDGE. For in the hyperbola, as is well known, the variations of the area are as those of the logarithms of the abscissæ. Suppose the temperature to have increased under a constant pressure, and then let the volume of air be instantly reduced to its former magnitude, the temperature by this operation will be farther augmented i degrees, or from E to H, making area HIFE = CDGF. For the heat at first added now brings the temperature to the same pitch, as if it had been added to the original volume all the while invariable.

By the property of the hyperbola, the area BCFE represents $\log \frac{AE}{AB}$. Hence also area HIFE = CDGF = $(k-1) \log \frac{AE}{AB}$ $= \log \frac{AH}{AE}$, and therefore $\frac{AE^{k-1}}{AB} = \frac{AH}{AE}$.

But $AE = \frac{1 + a\tau}{a}$; $AH = \frac{1 + a\tau + ai}{a}$, and the compression has evidently increased the density in the ratio of unit to $\frac{AE}{AB} = \varrho$. Hence

$$\varrho^{k-1} = \frac{1 + a\tau + ai}{1 + a\tau}, \text{ as in equation (D).}$$

Again, area $BDGE = k \log \frac{AE}{AB}$ = area $BCIH = \log \frac{AH}{AB}$, and the compression has augmented the pressure in the ratio of unit to $\frac{AH}{AB} = p$. Hence

$$p = \varrho^k, \text{ as in equation (C).}$$

In the hyperbola, as already hinted, the areas vary arithmetically, whilst the abscissæ vary geometrically. But the variations of the area represent variations of heat, and the variations of the abscissa represent the corresponding variations of volume under a constant pressure, or of pressure under a constant volume. So that, besides agreeing with the other conclusions, this construction exactly represents the former result, that the real temperatures are as the logarithms of those on the common scale, reckoning from — 448° F., or — 266°.7 cent.; and placing the new zero at — 447° F., or at — 265°.7 cent.

The law of temperature now given, stands on a much surer foundation than any other that has been proposed, and affords ample ground for questioning the present graduation of our thermometers. Were DG a straight line parallel to AB, as the ordinary graduation supposes, then, whatever CI might be, it is evident, that, unless in a few particular cases, very little change of temperature could be produced by a change of density; because there would not then be that inexhaustible source of both heat and cold which experiment proves, and which a line differing much from the hyperbola could not supply. Independently therefore, of more elaborate proof, this consideration alone ought to overturn the common theory. This law also gives some countenance to the notion, that the quantity of heat in bodies is infinite, compared with all the change that we can effect on it. But it ill agrees with the opinion of MM. Dulong and Petit, that the absolute zero on the common scale may be infinitely remote, and yet the quantity of heat finite. Indeed, this opinion is itself a contradiction in terms, with regard to the heat in a thermometer, considered as measuring its own heat.

Mr Dalton supposed that mercury expands as the squares of the true temperatures, reckoned from its freezing point; and that, relatively to the degrees of this scale, taken in arithmetical progression, the expansions of the gases proceed in geometrical progression. But the researches of M. Gay Lussac, Dr Ure, and of MM. Dulong and Petit, have proved fatal to this hypothetical law of temperature, and have shewn, that mercury and the gases observe the same law through a great range, only at length diverging very slowly. So that after Mr Dalton's erroneous progression in the expansion of air relatively to the mercurial thermometer is corrected, the relation between his scale and that expansion is curiously metamorphosed. It is thus evident, that his scale bears a totally different relation to the common mercurial thermometer from that of the law I have investigated: the latter only differing about half the quantity that Mr Dalton's does from the old scale, between the freezing and boiling points of water; especially since Mr Dalton's scale, as actually constructed, differs less from the old one than his theory strictly allows. The more scientific part of chemistry certainly owes much to Mr Dalton; but though his law of temperature had happened to be that of nature, it was still to be considered unknown, and entitled to no confidence, so long as nothing satisfactory was advanced in its behalf.

The specific heat of a given weight of air, is *cæteris paribus* independent of its density or pressure.

For, in the former figure, let the temperature of this air correspond to the point E, and let EF × 1° and EG × 1° be respectively the specific heats under a constant volume and constant pressure; suppose the air now to be condensed till its temperature rise to H; then HI × 1°, which is less than EF × 1°, will be its specific heat under a constant volume relatively to the common scale *; but whilst the temperature sinks to E,

* It is obvious that the specific heat of air, relatively to the true scale, must be independent of the temperature.

still, under the same reduced volume, the specific heat will just regain its former value EF $\times$ 1°; and the same may be proved of EG $\times$ 1°.

What a difference between this simple result and the complex conclusions which a gratuitous hypothesis has enabled the Marquis Laplace to state in his Mécanique Céleste, and M. Poisson to copy from him, as already quoted! And yet, had they used a diagram even with straight lines, as their hypothesis required, they might have obtained precisely the same result as I have got. For inconsistent data sometimes produce a correct result. This, however, only happens when opposite errors destroy each other, or when part of the data is allowed to lie dormant.

The specific heat of steam is very likely independent of its density; and if so, ought it not, under a constant volume, to be equal that of water? And if the specific heats of equal volumes of elastic fluids, as analogy would almost lead us to suppose, be the same under equal pressures and temperatures, the specific heat of air would be ·625 under a constant volume, and ·833 under a constant pressure; about three times the common estimate, which is very uncertain. But this is merely thrown out as a conjecture.

M. Poisson's memoir being nearly related to the foregoing inquiry, I have, for the better pointing out the errors into which that illustrious author has fallen, kept closer to his method than was otherwise necessary. It must now be sufficiently evident, that his hypothesis, so often mentioned, was both superfluous and at variance with his other principles. In the same memoir, M. Poisson acknowledges that his theory of the expansive force of steam is far from accounting for the economy of heat, which experiment indicates in the use of high pressure engines. This furnishes a farther proof in favour of the law we have investigated; for, according to it, when the temperature is elevated, the force even of air having its density constant, increases in an enormously higher ratio than the quantity of heat does, viz. in geometrical progression, whilst the heat increases in arithmetical progression. Thus, calling the heat unit, which doubles the force when the density is constant, we shall have the following two series:

1, 2, 3, 4, 5, 6, &c.
2, 4, 8, 16, 32, 64, &c.

the upper being the additional heat, and the lower the ratio in which the force is augmented. But all this is on the supposition that the density does not increase with the temperature; whereas the density of steam in a state of saturation, augments in a ratio almost as much above the second of these series, as that exceeds the first. Now the temperature of all elastic fluids is increased by condensation; that is, the same weight of steam, at a given temperature, contains less heat as its density is greater. These arguments, I presume, would more than account for the saving of heat which experiment indicates; and, for this reason, they are the more satisfactory, because high pressure engines work under many disadvantages, the greater excess of their temperature above that of the ambient air subjects them the more to its cooling influence.

From what we have seen above, it is extremely probable that the absolute quantity of heat in bodies is very great. This consideration may assist in accounting for the heat which becomes sensible in the case of friction, of chemical combinations, electrical phenomena, combustion, respiration, and in many of the other operations which take place in the economy of nature.

The chief points discussed in this brief essay are highly important in the doctrine of heat; and when once it is known that they admit of such proof, I expect to see them investigated differently, and no doubt with improvements.

Observations on the Structure of some Silicious Sponges. By R. E. Grant, M.D., F.R.S.E., F.L.S., M.W.S., Honorary Member of the Northern Institution, &c. Communicated by the Author.

The existence of *silicious spicula* in sponges, and in other genera of zoophytes, has been long known. Pallas sixty years ago described the *Alcyonium aurantium*, *Alcyonium cotoneum*, and *Alcyonium asbestinum*, as composed of minute asbestine needles, which he compares in hardness to pumice (El. Zooph. p. 344, 357, 360.) Ellis seventy years ago, Gmelin, Lamouroux, have described the hard glassy needles composing the axis of the *Gorgonia briareus*, an animal which possesses remarkably large eight-tentaculated polypi (Sol. & Ell. Cor. p. 93.) Montagu has described these rigid asbestine or pumice-like spicula in three of his species of British Sponges, *Spongia penicillus*, *S. verrucosa*, and *S. pilosa* (Wern. Mem. vol. ii. p. 93. *et seq.*); and the same hard glassy asbestine or silicious needles have since been observed in different species of *Tethya*, *Cydonium*, *Spongilla*, *Cliona*, and in a great variety of marine sponges. The extreme hardness of these spicula, however, is the only character mentioned by preceding authors as indicating *silica* to be their component earth. Not only the hardness of these spicula, and their power of resisting heat, but also their regular forms, their sharp points, and even their mode of arrangement in several sponges, were known to our countryman Ellis, who has described the spicula of the *Spongia tomentosa*, and represented their mode of grouping round the *pores* (Cor. Pl. xvi. fig. D.), and mentions, that when they are burnt and rubbed on the human skin, they pierce it, and excite an itching pain. The regular forms of the spicula of several sponges have been represented in the plates of Ellis, Cordiner, Lamouroux, and they have been noticed by most writers, as Ellis, Gmelin, Montagu, Lamouroux, and Lamarck, in their descriptions of certain species. Donati had shown the example so early as 1750, by describing and representing the forms of the spicula, and their mode of arrangement in other zoophytes (Storia Nat. Mar. dell' Adriat.); the useful example of Donati has been rarely followed, but its advantages in the study of polymorphous zoophytes will probably one day be more highly appreciated from the constancy and preciseness of the character it affords. The sponges in which I have found the spicula to consist of silica, I have termed *silicious* sponges, to mark them as a separate group, distinct from the *horny* and *calcareous* species already described. The spicula of silicious sponges are generally smaller and simpler in their forms than the calcareous. They can be more easily examined as the connecting animal matter enveloping them can be completely removed by the blowpipe, or by concentrated acids, without injuring their symmetrical forms, and they can thus be quickly obtained isolated for microscopical examination, on plates of glass, or between thin scales of mica, where they may be preserved for any period.

The *Spongia papillaris* of Pallas, Gmelin, Montagu, and Lamouroux, which is by far the most abundant species of this animal inhabiting the British shores, affords a good illustration not only of the silicious axis, but of that peculiar simple form of spiculum, which I have considered as the first or most elementary in marine sponges. This species is mentioned by Pallas, as an inhabitant of the coast of America. Montagu found it common on the coast of Devonshire, and I have found it abundant on several parts of the east and west coasts of Scotland, on the north coast of Ireland, and on the shores of Bute, Islay, Iona, Staffa, Skye and Arran; but I have nowhere met with it so large and abundant as on the south side of the Frith of Forth, where it seems to enjoy its natural climate. It is generally seen at low-water mark, spreading on the sides of rocks as a thick soft spongy covering, of a yellow or green colour, with numerous conical tubular papillæ projecting irregularly from its surface; its prominent papillæ are all terminated by wide fecal orifices, with thin translucent margins, sometimes quite circular, and sometimes presenting a very irregular broken outline. It occurs in portions, from half an inch to an inch thick, and from a few inches to more than a foot in breadth; sometimes it appears as a single isolated papilla, growing on the side of a rock, or on the root of a fucus. Its surface is sometimes very smooth, sometimes slightly corrugated and uneven, and is every where covered with very minute regularly formed pores, visible to the naked eye, which give the surface the appearance of the finest gauze. The *papillaris* not only has a great range of colour from bright yellow, through the intermediate shades, to dark sea-green, but it likewise presents the greatest variety of surface of any of the spreading species met with in the Frith of Forth; and, I have no doubt, that some of these varieties of outward form, have been described and represented as distinct species. The papillæ, though generally very irregular in their distribution, not unfrequently unite from their proximity, so as to form elevated ridges; and when these ridges happen to lie in a straight and parallel direction, they give the surface a crested appearance, as represented by Mr Ellis, (Phil. Trans. v. 55. Pl. II. Fig. G.)

At other times, we observe the papillæ so slightly and gradually raised, as to produce only an undulated smooth surface; this is frequently the case where it is much exposed to the direct force of the waves or currents, or where it envelopes the roots and stems of marine plants. It is more probable that these varieties of form depend on situation, or other accidental circumstances, than that they are perpetuated by generation; for we sometimes find these different kinds of surface on the same specimen. Where the papilla has a regular conical form, the margins of its fecal orifice are circular, thin and translucent, but in the ridged portions the fecal orifices are often very wide, with abrupt irregular broken margins; when we look down into one of these wide orifices, we distinctly perceive, on every side, the terminations of the internal canals, which unite and widen as they approach the orifice, and open at such an angle, as to throw their currents nearly in the direction of the main stream. This part of the anatomy is beautifully exhibited, by cutting a living papilla perpendicularly into several sections. The ova, in this species, begin to appear in the deeper parts of its substance between the canals, near the end of February; they are in full maturity in May, and not a trace of them is discernible in its texture at the end of June. The surface of the *papillaris* is often quite green, although its whole texture within is filled with ova of a lively yellow colour; and sometimes we find a specimen, some parts of which are yellow, and others green, although the whole interior is equally filled with ova. In dried specimens of the *papillaris* the internal texture may be rendered as soft as the finest down, and of a pure white colour, by careful and repeated maceration in hot water; in this condition, the part covering the whole outer surface appears like a thin white calcareous crust, lying loosely over the downy texture, and everywhere closely perforated with regular minute angular pores, which are now rendered more distinct, by the removal of their soft parts, and by the contraction of the loose fasciculi which surround them This thin white shining porous covering contains no lime, but appears to have been sometimes taken by authors for a calcareous crust, both in sponges and in other allied genera.

When a very thin portion, cut from the surface of the recent *papillaris*, is viewed on a plate of glass under the microscope, we observe the whole texture to consist of polygonal pores systematically, though somewhat rudely, constructed of loose fasciculi of minute transparent, colourless, pointed, and slightly curved, needles, entirely imbedded in a viscid yellowish translucent matter; and we cannot fail to be convinced, on the slightest inspection, that the form, size, composition, and arrangement of these needles have a perfect relation to the function they fulfil of forming and defending these passages, and that the spicula could not possibly have been pushed into this dense systematic order round the pores, by worms, insects or animalcules piercing and traversing the soft surface, nor have we the least acquaintance with any inhabitant of the ocean, capable of secreting such singular crystalline bodies, and of piling them up into so complicated a fabric for the protection and development of its ova. We shall see further proofs of this in the anatomy of the soft parts of this animal. By allowing a portion of this sponge to remain a few hours in a watch glass with nitric, sulphuric, or muriatic acid, the soft connecting matter dissolves, and the spicula fall separate to the bottom, without having suffered any change in their size, form, or appearance. If we rub these spicula with a wooden or glass rod against the bottom of the watch glass, after pouring off the acid, and washing them with water, we feel distinctly, that they are of a hard quartzy nature, and that they cut the bottom of the glass; with a lens we can perceive the minute streaks they produce, when they are rubbed on the surface of smooth glass. At a red heat the spicula suffer no change, but when they are kept at a white heat for a few minutes by the blowpipe, they become semiopaque and white, and some of them are observed to dilate and burst. When the spicula have been simply dried, we can perceive by the microscope a distinct cavity within them, extending their whole length, and completely shut at both extremities; probably some fluid matter within that cavity prevents it from being so distinctly seen in the recent spicula. To try in a more satisfactory manner the silicious nature of these spicula, I removed the animal matter by means of the blowpipe from a portion of the *papillaris*, and formed the remaining dried axis into a paste, with three or four times its bulk of pure potassa. On exposing this mixture of spicula and potassa, on a tin plate for a minute or two to the flame of a candle, a white brittle dry crust was produced, which was entirely soluble in water; on examining the aqueous solution of this crust, under the microscope, I found that the silicious spicula had been fused by the aid of the alkali, and had entirely disappeared. I have now preserved the spicula of this sponge for more than twenty months immersed in nitric, sulphuric, and muriatic acids, and they have suffered no change in their hardness, size, transparency or symmetry; they still scratch glass, and retain their sharpest points unblunted. From the spicula suffering a diminution of their transparency, by the action of heat, it is probable that they possess some animal matter in their composition, which, however, would be very difficult to demonstrate. Mr Children is said to have detected animal matter in the silicious spicula of some species of Tethya, (An. of Phil., vol. ix. p. 431), but his experiments have not yet been made known. I have not had an opportunity of trying their solubility in fluoric acid, and have relied on the above chemical characters, in examining the silicious spicula of marine sponges. The spicula of the *Spongia papillaris* very much resemble those of the *Spongilla friabilis*; they are slightly curved, thickest in the middle, from which they taper gradually to a sharp point at each end, they are of one form though of very different sizes, their length ranges from the tenth to the fifteenth of a line, and their diameter from the sixth to the tenth of that of a human hair. They have a vitreous lustre, their texture appears quite homogeneous, and their internal cavity occupies scarcely a third of their diameter. They exhibit neither joints, fibres, nor granular bodies in their substance, nor any kind of motion of themselves, or within their cavity, and appear incapable of contributing to produce the currents of this animal, both from their arrangement round the pores and canals, and from their internal cavity being completely shut at both ends. A number of these spicula lying in the same direction, and close to each other, form a fasciculus, the fasciculi which lie parallel to the surface, and form the strong walls of the pores, may be called the *bounding fasciculi* of the pores, to distinguish them from certain others, which project from the margin over the entrances of the pores, and are termed the *defending fasciculi* of the pores. Both bounding and defending fasciculi are seen also in the course of the canals, and the bounding fasciculi near the pores are observed to afford attachment to a very delicate apparatus calculated for the further defence of these passages from foreign bodies, and for assisting in the production of the currents. To avoid erroneous hypotheses in searching into the nature of this perplexing substance, it will be of some advantage to notice every minute piece of structure which may illustrate its mode of existence, explain its functions or help to distinguish the species, and it will be proper here, as in other parts of anatomy, to adopt a technical language for parts that are of constant occurrence, and important in the economy of the animal. Although the spiculum of this sponge agrees with that of the spongilla friabilis in being curved, and pointed at both ends, it differs from the latter in being thickest in the middle, and a little less in size. This double pointed fusiform curved spiculum is met with in several other sponges, and always occurs unaccompanied with any other form but its own modifications, so that it affords a determinate and easy means of subdividing the great tribe of silicious sponges into lesser groups. We observe this first form of spiculum likewise in the *Spongia urens* or *tomentosa*, *cristata*, *coalita*, *oculata*, *prolifera*, *dichotoma*, *palmata*, &c., but in the four last branched species it is very minute and imbedded in a tough ligamentous matter, which, in the dried state, assumes a faint resemblance to the horny tubular fibres of the *S. communis*. It would appear from examination of some tropical species, that the transition from the silicious to the horny axis takes place by the spicula becoming more and more minute, and their enveloping matter more tough and fibrous.

The second remarkable form of silicious spiculum met with in marine sponges, is that which presents only one pointed extremity, while the opposite end is either simply rounded, or is dilated into a distinct spherical head, like that of a common pin. In the species already frequently mentioned in this memoir, under the name of *Spongia panicea*, and which agrees with the characters given of that species by Lamouroux, (*Hist. des Polyp. p.* 29.) in forming irregular spreading masses more than an inch thick, and presenting in the dried state a white cellular texture, like hard bread, with a flat and very porous surface, we have the most familiar and distinct example of the one-pointed spiculum. The spicula of the *panicea* are silicious, straight, thick, short, cylindrical, pointed rather obtusely and suddenly at one extremity, and rounded, but not swelled at the other; they are of various thickness, but of one form and length, they are fused by the aid of potassa, resist heat and acids, scratch glass, &c. In specimens of the *panicea* which I brought this summer from the Island of Staffa, the spicula have the same characters as in those which abound in the Frith of Forth; and the same form of spiculum is met with in the *Spongia parasitica* of Montagu. In the large *Spongia patera* of the Indian seas, many specimens of which have been lately brought to Europe, and six of which are preserved in the Museum of our University, measuring from two to four feet in height, the spicula are silicious, long, thick, cylindrical, slightly curved, pointed at one end, and in place of being simply rounded or truncated at the opposite end, like those of the *panicea*, we observe them all headed like pins with a distinct sphere or round bead on one extremity, which has twice the diameter of the rest of the spiculum. I have elsewhere shown that this one-pointed, curved, headed spiculum, occurs in the *Cliona celata*, a zoophyte possessing polypi and very distinct irritability, (see p. 80), so that it would be highly interesting to examine whether the cup-like sponges, found so abundantly near Sincapore, do not manifest likewise some signs of contractility in the living state.

A third distinct form of spiculum, met with in silicious sponges, is where one of the sharp points is lost, and the whole spiculum appears to be composed of a series of round transparent beads, diminishing in size from one extremity to the other. This remarkable form I have yet observed only in one species, a thick, branched, tubular, yellowish brown, rough, wiry sponge from the Indian seas, from the zoological collection of a zealous young naturalist Mr John Coldstream of Leith. The branches are about $1\frac{1}{2}$ inch in diameter, cylindrical, dichotomous, tubular, of a hard and very tough texture, and marked on the outside with distinct open round pores, which pass directly through the thick parietes, and open into the internal tubular cavity by somewhat larger orifices. These tubular branches are of course open at their free extremities for the exit of the currents; their openings are cylindrical, wide, and with rounded margins. The remarkable notched spicula are seen with the naked eye projecting on every side perpendicularly from the margins to the centre of the pores, in which position they are fixed by a tough and almost horny substance enveloping their bases. Notwithstanding, the regular notched or jointed appearance on the outer surface of these spicula, we perceive with the microscope that they are formed of one piece, and have a distinct continuous cavity within, shut at both ends, like every other cavity observed in marine spicula. They are comparatively strong spicula, from their thickness and shortness, and are acutely pointed at one end. The connecting matter enveloping their thick ends, resolves itself by maceration into bundles of delicate ligamentous threads; but this appearance is never to be trusted in sponges which have once been allowed to dry, as parts then become hard and fibrous, which we observe in the living state to consist of a soft homogeneous pulp. This third form of spiculum is so very distinct from the two preceding, that it is probably not confined to this one species of zoophyte, but may be found, like the other two forms, to belong to an extensive series, yet unknown, however, to naturalists, and concealed like the present species in the depths of the southern hemisphere.

A fourth form of silicious spiculum is seen in the long slender asbestine filaments, composing the axis of the *Spongia ventilabrum*, Linn. When a portion of this fan-shaped sponge of the British, Norwegian and American coasts is kept for some minutes at a white heat by the blowpipe, to remove the animal matter, and is then plunged into strong nitric acid, it becomes easy to reduce it by the pressure of a glass rod, into its component spicula, which we feel by the pressure as well as by their resisting the acid, to be of a silicious nature. They are neither pointed at their extremities nor notched on the surface, but consist of smooth, long, uniformly thick, transparent, waved rods, obtuse at both ends. Those forming the so-named woody veins of this species, lie close and parallel to each other in dense fasciculi, which are disposed in a longitudinal direction from the base to the apex of the sponge. And the spicula which form the loose porous surface, have one end inserted into the dense central fasciculi of the woody veins, while their opposite end projects outwards at right angles to these fasciculi. The waved direction of the remarkably long silicious filaments of this sponge is a necessary result of the kind of basket-work they are employed to construct. The same form of spiculum is met with in the *Spongia hispida* and *S. fruticosa* Mont.; but in the *fruticosa* it is very short.

These general forms of silicious spicula are variously modified in different species of sponge, though they are regular and constant in the same; and there may be many other general forms which have not fallen within my limited observation, or belonging to species yet undiscovered. As the slender vitreous spiculum, acutely acuminated at both ends, is the form met with in the simplest and most irregular of the marine sponges, and also in the fresh-water sponge, a simpler and older zoophyte than any of the marine species (see Ed. Phil. Journ. vol. xiv. p. 283), this spiculum may be considered as the first or simplest in the silicious sponges. It is easy to observe, however, in these sponges, that only one of the acuminated points of the spicula is employed in the defence of the pores and canals, while the other sharp point is fixed and imbedded in the tender substance of the animal, which it is apt to pierce and tear on the slightest motion. The second form of spiculum, therefore, where the unnecessary and probably hurtful imbedded point has been removed, either by being simply struck off, as in the *S. panicea*, or by being still further softened by the addition of an enlarged spherical head, as in the *S. patera*, seems much better adapted for insertion into the soft texture of this animal, or for defending its pores and canals, and probably was of later formation than the preceding form. It is found in some tropical species, and in the Cliona, an animal already possessed of distinct irritability. The numerous inequalities of the waved surface and the round extremity of the third form or jointed spiculum must add to the safety and strength of its attachment to the soft parts; and the shortness and thickness of this spiculum peculiarly fit it for warding off the assaults of extraneous bodies from the pores of this animal, for which office it seems to be allotted in the specimen before me. It may be supposed, that, at the time of its formation, animalcules of a larger magnitude swarmed in the heated ocean; and this stronger mechanical protection of the pores seems to have been the more necessary, as no animals had yet been formed which could contract and shut their superficial pores by a vital effort like the Cliona, Alcyonium, Lobularia, &c. It is interesting to observe, that the earthy matter of the skeleton of these earliest inhabitants of the ocean, is the same with what we know to have paved the bottom of the vast abyss at the remotest periods we can reach of the earth's history, whether we imagine the silica of the primitive rocks formed by the oxidation of the solid surface, or precipitated from the superincumbent fluid. The appearance of many of their crystalline silicious pointed spicula is the same with that of the slender hexaedral acuminated prisms which silica naturally assumes in the crystallized state; and the silicious crystals formed by nature contain cavities and fluids like those formed by organic life. The laws, therefore, which regulate the forms of the simplest silicious spicula composing the skeleton of the marine sponge, do not appear to differ much from those which regulate the forms of brute matter.

Notice of a Voyage of Research. In a Letter from Captain BASIL HALL, R. N., to Professor JAMESON.

IN answer to your questions as to what would be the most useful objects of inquiry, were a voyage undertaken for the express purpose of research, I beg leave to offer you the following remarks,—the result of a good deal of reflection on the subject, and of some personal experience of those points in the investigation most important in practice.

Voyages of discovery, as they were formerly called, seem now at an end; since all, or very nearly all, the navigable parts of the earth have been pretty well explored. Much, however, remains to be done, in order to complete the work commenced by former voyagers, in a manner suitable to the greatly improved means, and the still more enlightened ideas, of the day.

It may assist your apprehension of the subject, to class the different objects of inquiry under distinct heads, that their importance may be examined separately.

First, To make observations having direct and immediate utility in the practice of Navigation, and the advancement of Geographical Science.

Secondly, To institute experiments, and series of observations, calculated to improve the Theory of Navigation, by furnishing mathematicians with data for the correction of Nautical and Astronomical Tables.

Thirdly, To ascertain the resources, Nautical and Commercial, of remote countries.

Fourthly, To make observations of a scientific nature, in places distant from England, and under circumstances of situation and climate which are not to be obtained at home; and which, independently of their own local value, would in many cases enhance the importance and utility of observations already made; while, at the same time, the field of new knowledge would be extended and enclosed, if I may use such an expression, and that of prejudice and error contracted.

Fifthly, To attend to that class of topics called Popular, having less in view any precise object of utility, than the rational amusement and information of persons who have no means of investigating such subjects for themselves.

The desideratum which is unquestionably of most importance in practical navigation, is the exact measurement of the Difference of longitude between place and place, especially between those headlands and harbours generally used as points of departure by ships starting, or which are looked out for as land-marks on their return voyage. It is not necessary this should be done with that rigorous precision used in trigonometrical surveys. The well-being of navigation, however, certainly requires that this element should be determined within much smaller limits than those which at present bound our information. Without such knowledge, indeed, much of the utility of improving nautical instruments and tables is essentially lost. It may assist your imagination to consider, that the evil of loosely settled longitudes, is quite as great in practice, as if the geographical positions of the places on the earth's surface were supposed to be actually shifted about from time to time. No skill, it must be obvious to the least informed person, can obviate the perplexing dilemma into which sailors are thrown by tables of longitude, which vary amongst themselves. All the requisite accuracy, it is satisfactory to know, might be attained, and some day will be attained, by the judicious employment of chronometers, and other instruments now in the hands of every seaman.

The absolute longitude of those places, that is to say, their difference measured from the meridian of Greenwich, though not so material for the immediate or daily purposes of the navigator, is not without its share of importance in a geographical, as well as a nautical, point of view, and is one branch of the inquiry which would employ much of the attention of an officer sent upon this service. Collaterally it would become an object of peculiar interest to ascertain which one, of all the numerous methods for solving this problem, is the most applicable to practice, in a given time; and to determine with what degree of precision it can be obtained by the means at present in use. These points are far from being settled in the way they ought to be, either in the purely nautical case, where a ship is out of sight of land, or on shore, at stations where the sailor may have it in his power to erect a temporary observatory.

Under this head, therefore, would fall a series of experiments on the respective value of the various instruments in the hands of travellers, as well as of seamen. This is the more necessary, as there is at present a considerable difference of opinion amongst practical men, which leads to inconvenience, and ill-bestowed expence, and after all the object is not attained.

The difficulty of the longitude problem, or, to speak more correctly, the degree of care requisite in its determination, for there is no other difficulty in the matter, have, perhaps, by giving it an undue importance, thrown some other equally essential points too much out of sight, though in every respect of as much consequence in practice. This remark applies more particularly to the latitudes, and to the variation of the compass in different parts of the world. It often happens, absurdly enough, that, while much labour and discussion are bestowed upon a single mile, or half a mile of longitude, the neglected latitude is not determined within twice the amount, merely because it is more easily obtained. With the variation of the compass it is still worse: Yet it is obviously of the greatest importance, when steering for any port, especially at night, to know what reliance is to be placed on so fickle a guide as the compass—a guide, it may be remarked, whose tendency at every moment is to deceive—who never tells the same story twice—and who is drawn out of his path by a thousand attractions, which, if not duly watched and counteracted, render his services, like those of a drowsy pilot, the very means of our destruction.

This subject has only very recently been attended to in this hemisphere, scarcely at all in the other. It is, however, a question of such vital importance to navigation, that the experiments suggested by Professor Barlow, and since so ably followed up by Captain Parry and Lieutenant Foster during the recent expedition, should be carefully repeated in the south, and the practical efficacy of the correcting plate invented by the eminent philosopher alluded to, practically examined in remote places, and under various circumstances. We shall thus learn the full extent of this beautiful discovery, which removes the most distracting source of erroneous reckoning that has ever annoyed the navigator.

The phenomena of the winds, though less readily made the subject of observation than the points already alluded to, ought to be investigated in a manner they have never yet been. At first sight, the winds appear less under the influence of known laws than any other element with which the navigator has to concern himself. But experience seems to show, that it is otherwise, since a practised sailor, in a dull sailing ship, will generally make a better passage than one who is not experienced, though in a faster sailing vessel. In almost every part of the globe, the prevalent winds are found to be more or less under the influence of laws capable of being distinctly stated, but which have not as yet been recorded in such a manner as to be intelligible, and practically useful to the seaman. On the other hand, it has happened that theoretical men, by not taking into account local causes, of which, from want of actual experience, or any correct accounts, they could have no just knowledge, have rather contributed to embarrass than to relieve the navigator. Even the well-beaten track, where the trade-winds prevail, is imperfectly and often erroneously described in most books of navigation; and with respect to the winds in high latitudes, nothing accurate is recorded; or if recorded, is not put into that shape which is best suited to the comprehension of sailors. The whole of this apparently complex subject might perhaps be treated in a manner applicable to practice, thereby rendering almost all extensive voyages more expeditious and certain.

The mysterious subject of currents, though it may not differ essentially in its nature from that of the winds, differs materially from it in practical operation. Not one current in ten marked on our charts has any existence; and the chief office of these investigations would be the negative but useful one of removing such misstatements entirely. There can be no doubt, at all events, that the much-talked of current in the east of the Atlantic is imaginary, and that a belief of its existence arose entirely from the local attraction of the needle: it vanishes entirely the instant Professor Barlow's correcting plate is affixed to the steering-compass, and returns again whenever the plate is removed.

It may not be uninteresting to state how this curious effect is produced. The local attraction, which is the technical name given to the influence which the iron distributed over the hull exerts upon the needle of the compass, has, in most ships, the effect of drawing its north end forward, or towards the head of the vessel. In the southern hemisphere the reverse takes place. To shew how this produces an apparent current, let it be supposed that a ship steers from the British Channel towards Madeira on a SW. course, *by compass*, and that the navigator, guided by the best documents in his possession, allows two points westerly variation, it is clear he will suppose that his course made good is SSW. But, owing to the local attraction, the north end of the needle has been drawn, we shall suppose, half a point more to the westward, so that in strictness the variation allowed ought to have been 2½ points instead of 2. Thus, the course made good has in fact been S. by W. ½ W. instead of SSW.; and the difference of longitude between the dead reckoning and that shewn by chronometers, he naturally ascribes to a current setting to the eastward, towards the Straits of Gibraltar. On the return, that is to say, when he is steering *by compass* NE., and when, by making the *same* allowance of 2 points westerly variation, he conceives his course made good to be NNE. while in fact it is $\frac{1}{2}$ point more to the eastward, in consequence of the north end of the needle being drawn, as formerly, towards the ship's head, the effect of which would of course now be to diminish the westerly variation, just as much as the same cause acting in the opposite direction had augmented the variation, when the vessel's head was directed to the SW. Therefore, in this case, namely, with the vessel's head to the NE., the real course would be $\frac{1}{2}$ point more to the eastward than the navigator would allow for; and he would, as before, naturally ascribe the difference between his position by dead reckoning, and that by his chronometer, to a current setting to the eastward. I have never read or heard of any current setting towards the Straits of Gibraltar from the Atlantic which this theory would not fully explain. Certainly, however, an exact account of such undoubted currents as the Gulf Stream along the coast of North America, and that off the Cape of Good Hope, would be useful and interesting. Captain Sabine's researches in this respect have already given us some valuable information as to currents near the Equator.

A very useful branch of this class of subjects would be the measurement of the perpendicular rise and fall of the tides in harbours much frequented by shipping, and also the direction of the stream; both practical points of considerable moment, but which in most cases are known only to the pilots and fishermen of the spot, although there is no reason why it should not be known to strangers.

These seem the principal points under the first head of inquiry; but there are many others to which an officer having such objects constantly and exclusively in view, would of course direct his attention.

NAUTICAL SCIENCE.

Under this topic might be classed observations, such as those recently made by Lieutenant Foster at Port Bowen, on atmospherical refraction, the dip of the needle, and the diurnal variation of the magnet. Astronomical observations on the oppositions of the planets, occultations of the fixed stars by the moon, under favourable circumstances, and various other celestial phenomena, might be made to good purpose. Correspondent observations of Jupiter's satellites, and particularly correspondent observations of moon culminating stars, as well as of eclipses, would be very serviceable to the cause of nautical astronomy. It is desirable also to ascertain how far the method of occultations can be practised at sea, and to what magnitude of stars it may be useful to carry the computations in the nautical almanack. Men of science who have turned their attention to these pursuits, would probably furnish the commander of such an expedition with many hints for inquiry, which cannot be suggested by a practical man. There have as yet been no regular and systematic trials made at sea of the relative merits of the various instruments contrived for measuring the moon's distance from the sun and stars. Practical men are divided between the sextant, Troughton's circle, and the repeating circle, and much needless expence is often incurred by persons who can ill afford such outlay. The readiest, as well as the most exact methods of making lunar observations and chronometers mutually assist one another, have never yet been properly stated.

NAUTICAL SUPPLIES.

A wide field for the diligence of any officer so employed, is presented under this section, and, if duly explored, could not fail to prove highly beneficial to the country. The peculiar resources of the distant parts of the globe are extremely little known; indeed up to a recent period, it was of no great importance that they should be so. Now, however, that the trade of the eastern seas and of South America is thrown open, and that with China and Japan will soon undoubtedly follow, it becomes of the first consequence that our traders should have some further knowledge of the resources of ports far from home, independently of all objects merely commercial. A ship may be dismasted in the middle of her voyage, or spring a leak, or run short of provisions;—her crew may become sickly;—she may lose her anchors and cables, or split her sails; and it may become essential to the very existence of the whole enterprize, that some re-equipment should take place. But it is quite possible, that, under such circumstances, the master of the ship may be entirely ignorant in what direction he ought to proceed; he may, and in fact very often does, make the most ruinous mistakes. The remedy for this evil, which is of perpetual recurrence, lies in having distinct accounts properly arranged and methodised of the resources of all the chief ports of the world. It signifies nothing to tell the seaman or shipowner that there have been already hundreds of voyages written, and that the requisite information is somewhere upon record; for, although this may be true, still it is not to be had in a shape which seamen can avail themselves of. Either the circumstances under which those voyages have been written are materially altered, as in the case of all the South Sea Islands, New Holland, and South America, or the information is scattered over long works, written with no such views, and, like the nautical observations which most voyages contain, entangled with narratives, or other extraneous matter, from which it is impossible to free them, or turn them to account at the moment of need.

These remarks apply particularly to the necessities of trading ships; but it would be of use also to ascertain the resources suitable to King's ships in the same places, in the event of war.

Much vexatious delay is often caused abroad by the ignorance of traders as to the local regulations of the different ports; and it has sometimes happened, that unpleasant discussions have arisen even between the government of those places and the captains of his Majesty's ships, on points respecting which no previous diligence on their part could have given them information. Actual inquiries, regularly instituted on the spot, and for this express purpose, are the only means of obtaining the local knowledge which would prevent these embarrassments. Every one at all acquainted with remote foreign stations, knows how continually such difficulties are produced by ignorance of what is customary.

GENERAL SCIENCE.

In considering the scientific observations which might be made on such a voyage, those for determining the length of the seconds pendulum occupy the first place. The figure of the earth is a question which at present occupies much of the attention of the scientific world; and this method of determining the point is one which might be pursued with great advantage during the progress of these inquiries, without essentially interfering with the more practical and useful objects already adverted to. The ingenious contrivances of Captain Kater, have already been shewn to be available in the hands of seamen, and we know also, that the time requisite for the performance of these interesting experiments is not great.

There have already been a considerable number of such observations made by *different* observers, and with *different* instruments. But the nature of the experiment is such, that this circumstance, which in most other similar matters add to the value of the work as a whole, in this case are not quite so satisfactory; for the experiments with the invariable pendulum are so strictly comparative in their nature, that, in order to deduce any valuable conclusions from them, they ought to be used by the same observer under similar circumstances, but in very different situations; so that the object in view, the determination of the unequal figure of the earth, might be the sole cause of difference in the result. It would be highly desirable, therefore, to ascertain the length of the pendulum at stations both near to and remote from the equator, in the southern hemisphere, where the question is fully of as much importance as in this.

To investigate by actual trial the effect of local density, or that which is caused by the nature of the ground at the station, on the vibrations of a pendulum, has been considered a most interesting desideratum. To accomplish this, however, it is essential that the same instruments be used, swung at a series of stations, lying not in different latitudes, as in the first case alluded to, but along the same parallel, where, according to theory, the number of vibrations of the same pendulum, after allowance for temperature has been made, ought to be alike; and consequently the amount by which they should be ascertained to differ, would express the effect of this disturbing cause. Once ascertained, this would become a valuable element in the reductions, and would be applicable generally to every previous or subsequent experiment on the length of the pendulum.

The measurement of the height of mountains, by means of the barometer, in conjunction with levelling and trigonometrical operations, and in different climates, such, for example, as Teneriffe and Terra del Fuego, might, if done with care, furnish useful data in a very interesting branch of geographical inquiry. In a similar spirit, the sea might be fathomed, and water brought up from great depths,—the height and velocity of waves ascertained,—meteorological tables framed in different climates,—hygrometers and other instruments tried,—mineralogical, zoological and botanical collections of natural history, might also be made, without deviating from the path which an attention to the more useful objects of the voyage would prescribe. The ingenious and valuable theories of Mr Daniell on the constitution of the atmosphere, suggest many curious investigations to the voyager who should have leisure to follow them up.

Fifth Head, General Information.

It is difficult to say to what extent a popular account of the state of manners, domestic and political, might be rendered interesting or useful, if made to embrace so extensive a voyage as that here contemplated. But it can scarcely be doubted, that, in these days of curiosity and research, a simple statement of the characteristic traits of the inhabitants at the principal stations on the different coasts of the world, would not be deemed an unimportant addition to our knowledge. It would be curious, for example, to point out the operation of the causes which have been in action in the South Sea Islands since the days of Cook ; and, generally speaking, to mark the effect of our attempts to civilise and convert the ruder inhabitants of the globe.

It may be remarked, that there are already several detached expeditions sent by this country to different parts of the world. But their objects are all more or less particular, and, though highly useful in themselves, cannot either, jointly or singly, be expected to furnish the results contemplated here, the essential value of which lies in their being part of one connected series, performed by one course of service, and by means of a uniform set of instruments and the same observers. Indeed, it may possibly be true, that to give the detached surveys alluded to their full utility, their particular results ought to be connected by some such general plan as that which is here described.

It is difficult to say precisely what would be the best route to follow, but the following sketch includes most of the places, the geographical situation of which it seems desirable to ascertain more precisely than is at present known, while, at the same time, it takes in those stations at which the pendulum might be swung, and other scientific observations made, without interfering with the primary object of useful and practical investigation.

The first part of the voyage might include Madeira, Teneriffe, one of the Cape de Verds, Bahia, Rio de Janeiro, Monte Video, Buenos Ayres. The next would include the Falkland Islands, where there is a harbour exactly in the correspondent latitude of that of London; Cape Horn, where there is a secure port almost in the opposite latitude to that of Leith Port, and consequently affording stations well suited for swinging the pendulum, in order to have, as nearly as possible, similar observations in the southern as in the northern hemispheres; thence to the coasts of Chili, Peru, and Colombia, as far as the Equator, and also to the Gallapagos Islands. The third division would sweep the Pacific as far as New Holland, including the various groups of Islands in that interesting region. The next would take in various stations amongst the Islands of the Eastern Archipelago, lying between New South Wales and China. The fifth division would include the Straits of Malacca, the Presidencies of India, Ceylon, the Mauritius, and the Cape. The last would take in St Helena, Ascension, the West Indies, Bermuda, Charlestown, the Azores, and England.

With the exception of one or two, there is none of these places where it would not be useful to the practical seaman to be well acquainted with all, or most, of the points mentioned in the foregoing sketch. Some of the names of the places mentioned, however, have been introduced for the purpose of completing the important series of pendulum experiments, having the effect of local density for their object, and keeping in view the necessity of selecting stations along the same parallels of latitude, but differing as much as possible in the nature of the ground. The following may be stated as two parallels singularly well suited to establish the point in question.

Northern Series.		
Name.	Latitude.	Nature of the Ground.
Madeira,	32⅔	Insular, volcanic.
Bermuda,	32⅓	Do. calcareous.
Charlestown,	32¾	Continent, alluvial.
Mogadore, coast of Africa,	32½	Do. Sandy desert.

Southern Series.		
Names.	Latitude.	Nature of the Ground.
River Plate,	$34\frac{1}{4}$	Continent, alluvial.
Valparaiso,	$33\frac{1}{4}$	Do. primitive,
Juan Fernandez,	$33\frac{3}{4}$	Insular, volcanic.
New South Wales,	$33\frac{3}{4}$	Continent, sandstone.
Cape, -	$33\frac{1}{2}$	Do. granite.

There are other parallels in higher latitudes, where, if it were necessary, these experiments might be repeated, but none which offers such conveniencies as the above.

It will readily be admitted by practical men, that such an arduous course of service could only be properly executed by an officer whose sole duty it should be to devote his time and thoughts to its accomplishment. He would require to be supported by numerous and able assistants, and be left in a great measure to the exercise of his own discretion as to the details of the voyage, such as the ports he should touch at, and the periods of his stay at each. As it is well known that the ordinary course of naval duties on foreign stations, occupies the whole of the commanding officer's time, it would be essential to the success of any such voyage as this, that the commander should be left quite free, as far as the nature of the service would allow, from all extraneous duties unconnected with these objects. In war this is impossible,—in peace it is easy; and this is the only time, therefore, that such an enterprise can be thought of.

On Achmite, Hyalosiderite and Trachylyte. By Professor Breithaupt of Freyberg.

I. *Achmite.*

Professor Mitscherlich, in Schweigger's Journal of Chemistry, describes the Achmite, a Norwegian mineral, as a new species. On reading his account, I was immediately struck with the resemblance of this mineral to Augite. I soon had an opportunity of examining a small suite of this mineral, in the collection of Heyer in Dresden, and was convinced *that Achmite was a mere variety of Augite.* I could not find those differences in the magnitude of the lateral edges mentioned by Mitscherlich. The inclinations of both lateral cleavages, I found to be essentially the same as those which the latest measurements give of Augite. The specific gravity = 3.3820. It differs from Augite in being rather softer, much more easily frangible, and in having much less lustre on the compact fracture. It comes nearest in these characters to the Hedenbergite of Berzelius, which is also but a variety of Augite. These appearances alone are sufficient to shew, that the mineral is no more in a fresh condition, on the contrary, has undergone some change. In this way, we can explain the difference in chemical composition observed in Augite, but not of that change by which out of Augite green earth is formed. As Professor Mitscherlich states the specific gravity at 3 2, it is probable that the specimens he examined were more decayed than those I employed. It is also possible that the position of the planes of crystallization may have been altered by decomposition.

II. *Hyalosiderite.*

Professor Walchner has given a very accurate mineralogical description, and also a chemical analysis of this mineral in Schweigger's New Journal, b. ix. h. i. s. 63-80. Its locality is that remarkable conical hill, named Kaiserstuhl, in Baden, which is composed of members of the secondary trap series. At first sight, it might pass for a new mineral; but Professor Walchner communicated to me his doubts as to its being a new species, and remarked, that it was probably only a variety of Olivine. On examining some specimens, I found that it bore the same relation to Chrysolite that Achmite does to Augite, viz. having an inferior hardness, and very low lustre in the compact fractured surface. Measurement proved, that *the Hyalosiderite is a variety of Chrysolite*, but in a state of partial decomposition. This decomposed condition, explains the difference in chemical composition from Chrysolite. It is worthy of remark, that, when a mineral is altered by weathering, that the open cleavages remained but little affected. This is most striking with the felspar family, as in Orthoklase, which, when so much decomposed as to be easily pressed into a kind of porcelain earth between the fingers, yet retains its most obvious cleavages. But it is without lustre in the direction of the compact fracture. M. Kühn, inspector of the Royal Porcelain Manufacture at Meissen, has, with an economical view, undertaken a chemical examination of the Orthoclases, from Aue near Schneeberg. He finds, that, in those varieties which are the least decomposed, there is a smaller quantity of potash and more alumina, than in the fresh or unaltered varieties; while the more completely decomposed afford no potash, but more alumina. These examples, we think, are sufficient to prove, that a mineral can only be considered as a new species, when it possesses essential differences from all known species, and can be examined in a fresh state. It also leads to erroneous views as to composition, if the mineral is examined, not in a fresh, but in a decomposed condition.

III. *Trachylyte, probably a New Mineral Species.*

1. *Characters of Trachylyte.*—Colours velvet, brownish and greenish black; occurs massive and in plates; lustre vitreous, sometimes inclining to resinous; fracture generally small conchoidal, seldom uneven; no trace of cleavage; fragments sharp edged; opaque; streak dark ash grey; easily frangible; hardness = 8.5. (between orthoclase and quartz) specific gravity = 2.50 to 2.54.

2. *Observations.*—It resembles Obsidian more than any other mineral, but is distinguished from it by streak, greater specific gravity, &c. and certainly by its chemical composition. Both minerals appear members of the same genus. In colour, lustre, and fracture, the Trachylyts approaches very near to Gadolinite. Its appearance before the blowpipe is remarkable; it melts instantaneously with intumescence, into a brown and sometimes vesicular slag. Hence its name, which refers to its rapid melting.

Hitherto this mineral has only been found at Säsebühl, between Dransfeld and Göttingen, where it occurs in small massive and plate formed masses, imbedded in basalt and wacke. It has been confounded with conchoidal Augite *; but true conchoidal Augite is sufficiently distinguished from it, by specific gravity, which, in that of the Rhön, is 3.474, not to mention that it always exhibits traces of a cleavage in the direction of a primary rhombic prism.

* Hausmann's Handbuch der Mineralogie, s. 690.

The Destruction of Sodom and Gomorrah, occasioned by Volcanic Agency.

THE destruction of the five cities on the borders of the Lake Asphaltites or Dead Sea, can be attributed, I conceive, to nothing else than a volcanic eruption, judging both from the description given by Moses of the manner in which it took place *, and from the present aspect of the country itself.

I presume it is unnecessary to urge, that the reason assigned in Holy Writ for the destruction of the cities alluded to, does not exclude the operation of natural causes in bringing it about, and that there can be no greater impropriety in supposing a volcano to have executed the will of the Deity against the cities of Sodom and Gomorrah, than it would be to imagine, if such an idea were on other grounds admissible, that the sea might have been the instrument in the hands of the same Being for effecting the general destruction of the human race in the case of the deluge.

Whether indeed we chuse to suppose the fire which laid waste these places, to have originated from *above* or from *below*, the employment of secondary causes seems equally implied; and if it be urged, that the words of Genesis denote that it proceeded from the former quarter, it may, I think, be replied, that a volcanic eruption seen from a distance might be naturally mistaken for a shower of stones, and that we cannot expect from the sacred historian in the case before us, any greater insight into the real nature of such phenomena, than we attribute to him in the ana-

* The following are the words of Scripture: Gen. chap. xix.

"24. Then the Lord rained upon Sodom and Gomorrah brimstone and fire out of heaven.

"25. And he overthrew these cities, and all the plain, and all the inhabitants of these cities, and that which grew upon the ground.

"26. And he (Abraham) looked toward Sodom and Gomorrah, and toward all the land of the plain, and behold, and lo, the smoke of the country went up as the smoke of the furnace."

In Deut. chap. xxix. ver. 23. the neighbourhood of the Dead Sea is described as a country, "the land of which is brimstone, and salt, and burning, which is not sown nor beareth, nor has any grass growing therein."

logous instance, in which the sun is said to have stood still at the command of Joshua.

That the individuals, who witnessed the destruction of these places might have been impressed with this notion, will be more readily believed, when we reflect, that in most eruptions the greater part of the mischief occasioned proceeds from the matters ejected, which are often *perceived* only to fall from above ; and those who recollect the description given by the younger Pliny of that from Vesuvius, will admit, that a person who had fled from the neighbourhood of that volcano, as Lot is stated to have done from the one near the Dead Sea, at the commencement of the eruption, would probably have formed the same idea of what was taking place ; for it appears from the Roman writer, that it was long before he was enabled, even at Misenum, to determine, in the midst of the general obscurity, that the cloud of unusual appearance, which was the precursor of the volcanic phenomena, proceeded from the mountain itself.

When Livy mentions the shower of stones, which, according to common report, fell from heaven on Mount Albano, there can be little doubt, that the phenomenon that gave rise to such an idea was of an analogous description, and we shall see hereafter, that the volcanic action, of which there are such decided evidences in Phrygia, was attributed by some to heavenly meteors.

As, therefore, we have no authority for supposing Moses a natural historian, or for imagining that he possessed a knowledge of physics beyond that of the age in which he lived, we may venture to apply to his narrative of the destruction of these cities the same remark which Strabo has made respecting the indications of igneous action, presented by the country round Laodicea : "ουκ ευλογον υπο τοιουτων παθων την τοιαυτην χωραν εκπρησθηναι αθροως, αλλα μαλλον υπο γηγενους πυρος."

Volney's description of the present state of this country fully coincides with this view.

The south of Syria, (he remarks) that is, the hollow through which the Jordan flows, is a country of volcanoes : the bituminous and sulphureous sources of the lake Asphaltites, the lava, the pumice stones thrown upon its banks, and the hot-baths of Tabaria, demonstate, that this valley has been the seat of a subterraneous fire, which is not yet extinguished.

Clouds of smoke are often observed to issue from the lake, and new crevices to be formed upon its banks. If conjectures in such cases were not too liable to error, we might suspect, that the whole valley has been formed only by a violent sinking of a country which formerly poured the Jordan into the Mediterranean. It appears certain, at least, that the catastrophe of five cities destroyed by fire, must have been occasioned by the eruption of a volcano then burning. Strabo expressly says, " that the tradition of the inhabitants of the country (that is of the Jews themselves) was, that formerly the valley of the lake was peopled by thirteen flourishing cities, and that they were swallowed up by a volcano." This account seems to be confirmed by the quantities of ruins still found by travellers on the western border.

" The eruptions themselves have ceased long since, but the effects, which usually succeed them, still continue to be felt at intervals in this country. The coast in general is subject to earthquakes, and history notices several, which have changed the face of Antioch, Laodicea, Tripoli, Berytus, Tyre, and Sidon. In our time, in the year 1759, there happened one which caused the greatest ravages. It is said to have destroyed, in the valley of Balbec, upwards of twenty thousand persons ; a loss which has never been repaired. For three months the shock of it terrified the inhabitants of Lebanon so much, as to make them abandon their houses, and dwell under tents."

In addition to these remarks of Volney's, a recent traveller, Mr Legh, states, that, on the south-east side of the Dead Sea, on the right of the road that leads to Karrac, red and brown hornstone porphyry, in the latter of which the felspar is much decomposed, syenite, breccia, and a heavy black amygdaloid, containing white specks, apparently of zeolite, are the prevailing rocks. Not far from Shubac, (near the spot marked in D'Anville's map, Patriarchatus Hierosolymitanus), where there were formerly copper mines, he observed portions of scoriae. Near the fortress of Shubao, on the left, are two volcanic craters ; on the right, one.

The Roman road on the same side is formed of pieces of lava. Masses of volcanic rock also occur in the valley of Ellasar.

The chemical properties of the waters of the Dead Sea, rather lend countenance to the volganic origin of the surrounding country, as they contain scarcely any thing except muriatic salts, Dr Marcet's analysis giving in 100 parts of the water—

Muriate of lime, ...	3.920
Muriate of magnesia, . .	10.246
Muriate of soda, ...	10.360
Sulphate of lime, ...	0.054
	24.580

Now, we not only know that muriatic acid is commonly exhaled from volcanoes in a state of activity, but that muriatic salts are also frequent products of their eruption.

The other substances met with are no less corroborative of the cause assigned. Great quantities of asphaltum appear floating on the surface of the sea, and are driven by the winds to the east and west bank, where they remain fixed. Ancient writers inform us, that the neighbouring inhabitants went out in boats to collect this substance, and that it constituted a considerable branch of commerce. On the south-west bank are hot springs and deep gullies, dangerous to the traveller, were not their position indicated by small pyramidic edifices on the sides. Sulphur and bitumen are also met with on the mountains round.

On the shore of the lake Mr Maundrel found a kind of bituminous stone, which I infer from his description to be analogous to that of Ragusa in Sicily, noticed in my memoir on the Geology of that island.* "It is a black sort of pebble, which being held to the flame of a candle, soon burns, and yields a smoke of a most intolerable stench. It has this property, that it loses a part of its weight, but not of its bulk, by burning. The hills bordering on the lake are said to abound with this sort of sulphureous (bituminous?) stone. I saw pieces of it, adds our author, at the convent of St John in the wilderness, two feet square. They were carved in basso relievo, and polished to so high a lustre as black marble is capable of, and were designed for the ornament of the new church in the convent."

* I have since received a specimen of this stone, which turns out to be precisely similar to that of Ragusa.

It would appear, that, even antecedently to the eruption mentioned in Scripture, bitumen pits abounded in the plain of Siddim. Thus, in the account of the battle between the kings of Sodom and Gomorrah, and some of the neighbouring princes (Gen. ch. xiv) it is said,—*And the Vale of Siddim was full of slime-pits*, which a learned friend assures me ought to be translated *fountains of bitumen.*

Mr Henderson, in his Travels in Iceland, will have it, that phenomena similar to those of the geysers of Iceland, existed likewise in this neighbourhood. The word Siddim, he says, is derived from a Hebrew root, signifying "to gush out," which is the identical meaning of the Icelandic word geyser; and it is remarkable, that there exists in Iceland a valley called Geysadal, which signifies the Valley of Geysers, and consequently corresponds with the "Valley of Siddim." The latter, therefore, he thinks should be translated the Valley of the Gushing Mountains.

Mr Henderson further believes, that Sheddim, the object of the idolatrous worship of the Israelites, (Deut. xxxii. 17. Psalms cvi. 37) translated in our version "devils," were boiling springs derived from volcanoes; and I may add, as some little corroboration of this opinion, that somewhat similar phenomena at the Lucus Palicorum in Sicily, were the objects among the Greeks of peculiar and equally sanguinary superstition.

Mr Henderson thinks, that it was in imitation of these natural fountains, that Solomon caused to be constructed a number of jetting fountains (as he translates the passage), of which we read in Ecclesiasticus, cap. xi. viii. My ignorance of the Hebrew language precludes me from forming any opinions as to the probability of these conjectures; but the existence of hot springs in the valley, at a much later period than that to which he refers, is fully established.

But besides this volcanic eruption, which brought about the destruction of these cities, it would appear that the very plain itself in which they stood was obliterated, and that a lake was formed in its stead. This is collected, not only from the apparent non-existence of the valley in which these cities were placed, but likewise from the express words of Scripture, where, in speaking of the wars which took place between the Kings of

Sodom and Gomorrah, and certain adjoining tribes, it is added that the latter assembled in the Valley of Siddim which *is* the Salt, (*i. e.* the Dead) Sea. It is therefore supposed that the lake itself occupies the site of this once fertile valley; and in order to account for the change, Volney and others have imagined, that the destruction of the cities was followed by a tremendous earthquake, which sunk the whole country considerably below its former level.

But the sinking of a valley, besides that it is quite an unprecedented phenomenon in the extent assumed, would hardly account for the obliteration of the ancient bed of the Jordan, a river which, though now absorbed in the Dead Sea, from whence it is carried off by the mere influence of evaporation, must, before that lake existed, have continued its course either to the Red Sea or the Mediterranean.

Now, if the Dead Sea had been formed by the cause assigned, the waters I conceive would still continue to have discharged themselves by their old channel, unless, indeed, the subsidence had been very considerable; and then the course of the Jordan, just north of the Dead Sea, would have presented, what I believe no traveller, ancient or modern, has remarked, a succession of rapids and cataracts, proportionate to the greatness of the descent.

That the Jordan really did discharge its waters at one period into the Red Sea, is rendered extremely probable, by the late interesting researches of Mr Burckhardt, who has been the first to discover the existence of a great longitudinal valley, extending, in nearly a straight line south-west, from the Dead Sea as far as Akaba, at the extremity of the eastern branch of the Red Sea, and continuous with that in which the Jordan flows from its origin in the mountains near Damascus. It was probably through this very valley that the trade between Jerusalem and the Red Sea was in former times carried on. The caravans, loaded at Ezengeber with the treasures of Ophir, might, after a march of six or seven days, deposit their loads in the warehouses of Solomon.

This important discovery seems to place it beyond question, that if there ever was a time at which the Jordan was not received into a lake, which presented a surface considerable enough to carry off its waters by evaporation, the latter would have been discharged by this valley into the Red Sea, and hence every theory of the origin of the lake Asphaltitis must be regarded as imperfect, which does not account for the obliteration of this channel.

For my own part were I to offer a conjecture on the subject, I should suppose, that the same volcano which overwhelmed, with its ejected materials, the cities of the plain, threw out at the same time a current of lava sufficiently considerable to stop the course of the Jordan, the waters of which, unable to overcome this barrier, accumulated in the plain of Siddim until they converted it into the present lake. I do not know that any traveller has observed what is the ordinary depth of the Dead Sea; but if we only imagine a current of lava, like that which, in 1667, proceeded from Etna, and flowed into the sea above Catania, to have descended at right angles to the bed of the River Jordan, the lake need not be supposed very shallow.

Nor need we be startled at the magnitude of the effect that we find to have resulted from a cause which, comparatively speaking, appears so insignificant; for, if the little rivulet, that flows at the foot of the Puy de la Vache in Auvergne, was adequate to produce the lake of Aidat, there seems no disproportion, in attributing to a river of the size of Jordan, to say nothing of the other streams, nowise inconsiderable, which must have been affected by the same cause, the formation of a piece of water, which, according to the best authorities, is, after all, not more than twenty-four leagues in length, by six or seven in breadth.

That the volcanic eruption which destroyed the cities of the Pentrapolis, was accompanied by the flowing of a stream of lava, may be inferred, I think, from the very words of Scripture. Thus when Eliphaz reminds Job of this catastrophe, he makes use of the following expressions, according to Henderson's translation of the passage:

> " Hast thou observed the ancient tract
> That was trodden by wicked mortals?
> Who were arrested on a sudden;
> Whose foundation is a *molten flood.*
> Who said to God, depart from us,
> What can Shaddai do to us?

Though he had filled their houses with wealth,
(Far from me be the counsel of the wicked)
The righteous beheld and rejoiced,
The innocent laughed them to scorn;
Surely their substance was carried away,
And their riches devoured by fire."

Job, xxii. 15–20.

The same fact, Mr Henderson thinks, is implied in the description of the circumstances connected with Lot's escape.

"Why was he prohibited from lingering in any part of the low land, if not because he would be there exposed to the pestilential volcanic effluvia and to the lava? And what reason can be assigned for his obtaining leave to stop in Zoar, but its lying at some distance from the spot where the lava began to act, as likewise on an elevation whence he could survey the approaching ruin; and retire before the stream reached that place? We accordingly find, that however desirous he was to stay there at first, he quitted it before night, for a still more elevated and safe retreat;—"*And Lot went up out of Zoar, and dwelt in the mountain, for he feared to dwell in Zoar.*"—Gen. xix. 30.

How natural is the incrustation of his wife on this hypothesis! Remaining in a lower part of the valley, and looking with a wistful eye towards Sodom, she was surrounded, ere she was aware, by the lava, which, rising and swelling, at length reached her, and (whilst the volcanic effluvia deprived her of life) incrusted her where she stood, so that being, as it were, embalmed by the salso-bituminous mass, she became a conspicuous beacon, and admonitory example to future generations. The power of this asphaltic substance in preserving from corruption is evident, from its being employed by the Egyptians for embalming their mummies." . . . .

"She is said to have been converted into a pillar of *salt*, on account of the quantity of that substance which appeared on the crust; and its abundance in those countries is notorious, both from sacred and profane history; so much so, that the lake which now fills the caverns made by the earthquake, has, among other names, that of the Salt Sea."

I know not what opinion may be entertained with regard to this explanation of the disaster that awaited Lot's wife, but it will at least be allowed, that the eruption of a stream of lava, which might have interfered with the course of the river Jordan, is not only in itself a probable circumstance, but one that derives some support from the sacred writings themselves.

Much, however, it is confessed, remains to be explored, before this or any other theory can be finally adopted; and it is to be hoped, that the first individual who has spirit and resolution enough to venture into these inhospitable regions, will pay attention to the physical structure of the country.

He should, in particular, search the rocks which bound the Dead Sea, in order to discover, if possible, the crater of the volcano which was in a state of eruption at the period alluded to; he should ascertain, whether there are any proofs of that sinking of the ground, which, notwithstanding Volney's authority, I have regarded as so problematical; whether traces of the ancient bed of the river can be discovered south of the lake, or of a barrier of lava stretching across it; nor should he omit to examine, whether the vestiges of these devoted cities have been submerged, as some have stated, beneath the waters, or are buried, like Pompeii, under heaps of the ejected materials.—*From Dr Daubeny's lately published work on Volcanoes.*

Notice on Oil in the Human Blood, by Dr Adam; *and on the effects of the Bite of the Ceylon Leech,* by John Tytler, Esq. Assistant-Surgeon, Garrison of Monghyr.

Oil in Human Blood.

The following brief notice may prove interesting, as it relates to a peculiarity in the human subject, which I have not hitherto met with; nor do I remember to have read of a similar occurrence in medical writings. The body of Serjeant Macdonald was sent from the garrison to the general hospital, for inspection; as certain circumstances had created a suspicion regarding the manner of his death. He had gone to bed in the barrack-room apparently in good health, and was found in the morning lying dead on his couch. He had had a quarrel, it was stated, the preceding evening, with some of his comrades, and, it was currently surmised, had met with his death by violence through their means. Under this impression, the body was directed to be examined with great care, and a report made of the appearances on dissection.

The subject was rather corpulent, and, from incipient putrefaction, much swelling and discoloration existed about the head and neck. On removing the scull-cap, some blood, which escaped from a sinus wounded in the dissection, was observed to present a singular oily appearance on its surface. When minutely examined, this was found to proceed from an oil swimming about in the fluid, in the form of small globules. In consistence it resembled olive-oil; but in colour approached more to that of amber, or of hot-drawn castor-oil. In the substance of the brain, slight indications of congestion presented themselves, but no decided inflammatory appearance. The abdomen was opened, and the blood in the cava ascendens found to contain the same oily matter in great abundance, as was also the case with the femoral, and other vessels of the lower extremity; and it evidently pervaded the whole venous system. In proportion to the mass of blood, it existed in considerable quantity, and might be collected by means of a spoon, with great ease. A quantity of the oil thus procured, with some adherent blood, was set aside for analysis; but putrefaction speedily taking place, prevented the examination. No visible disease existed in any of the viscera, whether of the thorax or abdomen. It was afterwards ascertained that this man had been intoxicated the night previous to his decease; but he was in general of sober habits, and enjoyed a perfectly sound and healthy frame.*

* Since the above notice was presented to the Calcutta Medical and Physical Society, I have observed in the Edinburgh Philosophical and Medical Journals, that a similar oil is described as having been found in the blood of the living subject, by Dr S. Trail of Liverpool. The oil in these instances was combined with the serum in the form of an emulsion; and it is not improbable, that during life the same union existed in the case now detailed. Putrefaction, however, having commenced before the body was opened, we had no opportunity of witnessing the natural appearance of the fluid, or of ascertaining the relations which its elementary parts may have borne to each other. Judging from its appearance, I should say it was much more abundant than the proportion stated by Dr Trail in his cases. The blood, too,

On the Bite of the Ceylon Leech.

Though an invalid station does not generally afford opportunities of seeing disease in a great variety of forms, yet it possesses one advantage not always obtainable in places where medical practice is more extensive; I mean that of seeing the last stage and termination of maladies that have been very long protracted, and on which a variety of plans of treatment have from time to time been tried. To the above observations I have been led, by having an opportunity at this place of seeing some cases of men who have been bitten by poisonous leeches in the island of Ceylon; and as the nature of the wounds inflicted by those animals is not, I believe, very well known, perhaps the Society may be a little interested by hearing the history of their cases, as far as can be gathered from their own statement, and an account of their present condition.

Bhawani Deen, sipahee, three years ago, when sleeping on the ground in the kingdom of Candy, was bitten by a leech, just behind the inner ankle of the right foot. When he awoke, the animal was gone, but blood continued to flow for some time. He describes the leeches there as being about four inches long, slender and black, and living in stony places and among trees; from which habitations they issue in great numbers, when a shower of rain falls. In about two months, the wound skinned over; but in its place a tumour arose, filled with pus. This was opened by his surgeon, and the matter discharged. The orifice degenerated into a foul unhealthy ulcer, on account of which it was finally necessary to send him to this place Monghyr. I saw him first in last August: the ulcer was then open, since which it has gradually healed; but there is a considerable loss of substance; the skin all around is drawn in and puckered, and has lost its black colour, that is, no doubt, by the loss of

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was of a thicker consistence, and considerably darker colour than usual; and the oil which was swimming on the surface, as stated above, could with ease be separated from the general mass. It may be worthy of remark, that on the evening this notice was made to the Society, a member then present, Mr Veterinary-Surgeon Hodgson, stated, that he had more than once observed a similar oil in the blood of the horse; but although his attention was particularly attracted to the circumstance at the time, he was totally at a loss to account for it.—T. A.

the rete mucosum. The muscles of the leg, particularly the gastrocnemii, are so much wasted, as to render him a complete cripple, and he walks only by the help of a staff.

Meer Wilaet Alee, drummer, was bitten in the same country, and about the same time, in the outer ankle of the left foot. He describes the leeches as the former patient, excepting differing as to their size, which by this man's account is not above two inches. On seeing the leech on his foot, he tore it off, and flung it away; and to this circumstance he ascribes the peculiar malignity of the wound he received. A small ulcer appeared, which in hospital was speedily cured; but as soon as he returned to duty, again broke out. He was again cured in hospital, and again the ulcer reappeared on his discharge; and this was repeated several times. Three times the surgeon cut out the edge of the ulcer all around its circumference, with a view, no doubt, of removing the diseased or infected parts: but not the least benefit resulted from the operation. The ulcer is now exceedingly foul, with a great destruction of substance, and a constant and copious discharge of sanies. On the upper part of the foot, its size and shape is like that of two rupees laid lengthways; and it has eaten into the sole, and made there an indentation of about two inches long, and one broad, very deep and foul. This man is of course totally a cripple. He states it to be the general belief, that if these leeches, upon fixing on a part, are allowed to gorge themselves, and come off of their own accord, their bite is harmless; but that if rudely torn off, they leave their teeth in the wound, and the above mischievous consequences ensue. Supposing this account of the effects of disturbing these animals to be true, is the above account of its cause also to be admitted, or may it be allowed to conjecture, that those leeches have, like snakes, two sets of teeth, one of which they employ as instruments in receiving their food, and the other as weapons of injury, when they find themselves attacked?

Kesri Sing, sipahee, was bitten on the upper part of the great toe. His description of the leech exactly agrees with that of the last patient. Ulceration took place, which healed, and was succeeded by a tumour containing pus. On being opened, this degenerated into a sloughing ulcer, out of which came a large portion of the extensor tendon of the toe. The ulcer is at length healed; but a very large cicatrix remains, and the patient has as yet by no means recovered the perfect use of his foot.

Thus we see three men perfectly hale in other respects, rendered totally useless by this accident. It would be very satisfactory, could some correct information be got about the reptiles which possess the power of causing so much mischief, and the best means of preventing or alleviating the consequences of their bite. —*Transactions of the Medical and Physical Society of Calcutta.*

A Series of Observations on the Temperature of the Sea at the Mouth of the Thames, in the year 1824. By Mr J. Frembly, R. N. Communicated by the Author.

Place of Observation.	Date and Phases of the Moon.	Time of Observation.	Temperature of Air and Surface. Air.	Surface	Diff.	State of the Surface.	State of the Tide.	Winds, Direction and Force.
Aldborough Bay,	Apr. 28.	8 0 P. M.	48.5	44.0	— 4.5	ruffled,	½ flood,	SSW. fresh.
		10 0	47.5	44.0	— 3.5	do.	¾ flood,	... do.
	29.	8 0 A. M.	52.0	45.0	— 7.0	ruffled,	½ flood,	S. fresh.
		9 0	51.5	45.0	— 6.5	do.	do.	... do.
		Noon,	55.0	45.0	— 10.0	rough,	H. W.	... strong.
		9 0 P. M.	50.0	46.0	— 4.0	ruffled,	½ flood,	... fresh.
		10 0	52.0	46.0	— 6.0	do.	¾ do.	... do.
	30.	8 0 A. M.	53.0	46.0	— 7.0	ruffled,	¼ flood,	SSW. fresh.
		10 0	55.0	46.0	— 9.0	do.	½ flood,	... do.
		1 0 P. M.	56.0	46.0	— 10.0	do.	H. W.	SSE. do.
		5 0	57.0	48.0	— 9.0	do.	¾ ebb,	... do.
		10 0	50.0	46.0	— 4.0	rough,	½ flood,	SSW strong
	May 1.	8 0 A. M.	54.0	47.0	— 7.0	ruffled,	¼ flood,	SSW. fresh.
		7 0	54.0	48.0	— 6.0	do.	¾ ebb,	... do.
		11 0	50.0	47.0	— 3.0	do.	¾ flood,	... do.
	2.	9 0 A. M.	51.0	47.0	— 4.0	ruffled,	¼ flood.	
		12 30 P. M.	49.0	47.0	— 2.0	do.	¾ flood,	
Hollesley Bay,		6 0	48.25	49.0	+ 0.75	do.	½ ebb,	
		10 0	48.0	47.0	— 1.0	do.	¼ flood,	
Harwich Harbour,	4.	8 0 A. M.	44.5	50.0	+ 5.5	rough,	L. W.	
		4 0 P. M.	47.0	50.0	+ 3.0	do.	¼ ebb,	
		6 0	46.0	51.0	+ 5.0	do.	½ ebb,	
		11 0	43.5	51.0	+ 7.5	do.	½ flood,	
	5.	8 30 A. M.	49.0	50.0	+ 1.0	ruffled,	¾ ebb,	
	6.	8 30 A. M.	56.0	51.0	— 5.0	ruffled,	¾ ebb,	
	12.	8 0 A. M.	47.0	51.5	+ 4.5	ruffled,	¾ flood,	
		3 0 P. M.	52.0	52.0	0.0	do.	¼ ebb,	
		11 0	44.0	50.5	+ 6.5	do.	¼ ebb,	

Place of Observation.	Date and Phases of the Moon.	Time of Observation.	Temperature of Air and Surface.			State of the Surface.	State of the Tide.	Winds, Direction and Force.
			Air.	Surface	Diff.			
Harwich	May 13.	8 0 A. M.	48.0	51.0	+ 3.0	ruffled,	½ flood,	E.bS. fresh.
Harbour,		2 0 P. M.	51.0	49.5	— 1.5	rough,	¼ ebb,	... strong.
Hollesley	27.	10 0 A. M.	62.0	52.0	— 10.0	calm,	H.W.	ESE. light.
Bay,		8 0 P. M.	51.0	50.25	— 0.75	do.	½ flood,	ENE. do.
	28.	8 0 A. M.	55.25	51.0	— 4.0	ruffled,	½ flood,	S. light.
		10 0 P. M.	48.0	50.0	+ 2.0	calm,	¾ do.	Calm.
	29.	8 0 A. M.	58.0	51.0	— 7.0	calm,	¼ flood,	East, light.
Outside of		8 0 P. M.	50.5	49.5	— 1.0	ruffled,	¼ do.	... do.
Shipwash S.								
Hollesley	June 1.	9 0 A. M.	59.0	52.0	— 7.0	ruffled,	¼ flood,	NE.
Bay,		6 0 P. M.	56.0	53.5	— 2.5	do.	¾ ebb,	...
Harwich	5.	10 0 A. M.	53.5	56.0	+ 2.5	ruffled,	¾ ebb,	NNE. mod.
Harbour,		Noon,	58.0	57.0	— 1.0	do.	¼ flood,	... do.
		5 0 P. M.	54.3	55.5	+ 1.2	do.	H.W.	... do.
		8 0 ...	52.0	55.5	+ 3.5	calm,	½ ebb,	East^y. light.
	6.	10 0 A. M.	57.5	56.0	— 1.5	ruffled,	¾ ebb,	NNE.
		1 0 P. M.	62.5	58.0	— 4.5	do.	¼ flood,	...
		9 0 ...	53.0	55.0	+ 2.0	do.	½ ebb,	...
		11 0 ...	56.0	56.5	+ 0.5	calm,	¾ ebb,	Easterly.
	7.	11 0 A. M.	61.0	57.0	— 4.0	calm,	½ ebb,	SE. light.
		2 0 P. M.	57.0	56.5	— 0.5	ruffled,	¼ flood,	... do.
Off Felix-		4 0 ...	55.5	54.0	— 1.5	do.	½ flood,	... do.
stow,		7 0 ...	51.0	55.0	+ 4.0	do.	H.W.	... do.
		10 0 ...	49.5	54.0	+ 4.5	do.	½ ebb,	... do.
	8.	9 0 A. M.	58.0	54.0	— 4.0	calm,		SE. light.
Orford Ha-		10 0 P. M.	49.0	54.0	+ 5.0	ruffled,		ESE. do.
ven,								
Harwich	15.	9 0 A. M.	56.0	55.5	— 0.5	ruffled,		SSE. fresh.
Harbour,		1 0 P. M.	57.0	55.3	— 1.7	do.		... do.
		5 0 ...	57.0	56.0	— 1.0	do.		South, do.
	16.	10 0 A. M.	62.0	57.5	— 4.5	calm,		Calm.
Entrance do		4 30 P. M.	57.0	55.0	— 2.0	ruffled,		ENE. light.
Off Felix-		6 0 ...	55.5	55.0	— 0.5	do.		... do.
stow,		9 0 ...	53.0	54.0	+ 1.0	do.		... do.
Off Baudsey	17.	6 0 A. M.	53.0	54.0	+ 1.0	v. rough,		NE. strong.
Entrance of		Noon,	60.0	55.0	— 5.0	rough,		... do.
Harwich		5 0 P. M.	56.5	55.5	— 1.0	do.		NNE. do.
Harbour,		10 0 ...	50.0	56.0	+ 6.0	ruffled,		... fresh.
	18.	9 0 A. M.	54.0	56.0	+ 2.0	ruffled,		NNW. mod
Hollesley		11 0 ...	55.5	54.0	+ 1.5	do.		... do.
Bay,		1 0 P. M.	57.0	54.0	— 3.0	do.		... do.
		3 0 ...	57.5	54.0	— 3.5	do.		ESE. do.
		7 0 ...	52.5	54.0	+ 1.5	do.		... do.
	19.	9 0 A. M.	52.5	52.0	— 0.5	rough,		
Outside of		1 0 P. M.	53.0	52.0	— 1.0	v. rough,		
Shipwash S.	23.	9 0 A. M.	56.0	56.0	0.0	rough,		
Holles. Bay		7 0 P. M.	56.0	58.0	+ 2.0	ruffled,		
Shottley Ferry,	24.	10 0 A. M.	59.0	58.0	— 1.0	ruffled,		SE. mod.
		11 0 ...	58.0	58.0	0.0	do.		... do.

Place of Observation.	Date and Phases of the Moon.	Time of Observation.	Temperature of Air and Surface. Air.	Surface	Diff.	State of the Surface.	Winds, Direction and Force.
Harwich H.	June 26.	8 0 A. M.	57.0	58.0	+ 1.0	ruffled,	WNW. mo.
Entrance do		9 0 ...	60.0	57.5	— 2.5	do.	... do.
Shipway,		11 0 ...	65.5	57.5	— 8.0	do.	SW. do.
		Noon,	65.5	57.0	— 8.5	do.	... do.
		3 0 P. M.	62.0	56.0	— 6.0	do.	... do.
Outside of Shipwash S.		7 0 ...	66.0	55.0	— 11.0	do.	... do.
Hollesley Bay,	27.	10 0 A. M.	64.0	56.5	— 7.5	ruffled,	SW. do.
Outside of Shipwash S.	28.	Noon,	64.0	57.5	— 6.5	ruffled,	SSW. mod.
Near the	29.	Noon,	59.0	55.5	— 3.5	ruffled †,	SW. mod.
Gabbard		2 0 P. M.	58.0	55.5	— 2.5	do.	...
Sands *,		6 0 ...	65.0	55.7	— 9.3	do.	... fresh.
	30.	9 0 A. M.	60.0	55.5	— 4.5	v. rough,	
Outside of	July 9.	10 0 A. M.	62.0	59.0	— 3.0	ruffled,	SW. mod.
Shipwash		2 0 P. M.	63.5	59.0	— 3.5	do.	... do.
Sand,		4 0 ...	61.0	58.5	— 2.5	do.	... do.
		8 0 ...	61.0	58.5	— 2.5	do.	South, do.
		10 30 ...	60.0	59.0	— 1.0	do.	... do.
On Inner	10	10 0 A. M.	64.0	59.0	— 5.0	ruffled.	
Gabbard S.		Noon,	68.0	60.0	— 8.0	do.	
		8 0 P. M.	59.0	58.0	— 1.0	rough.	
Near Inner	11.	5 0 A. M.	55.0	57.5	+ 2.5	rough.	
Gabbard S.		9 0 P. M.	61.0	58.0	— 3.0	do.	
12 miles off	18.	8 0 A. M.	61.0	60.5	— 0.5	ruffled,	NE. light.
Orfordness,		10 0 ...	62.0	60.0	— 2.0	do.	... do.
Near Inner		11 0 ...	62.0	60.5	— 1.5	do.	... do.
Gabbard, On do.		Noon,	62.0	60.5	— 1.5	do.	... do.
Near the	19.	11 0 A. M.	60.0	59.0	— 1.0	v. rough,	NE. strong.
Gabbards,		3 0 P. M.	74.5	59.0	— 15.0	calm,	calm.
		5 0 ...	70.0	59.0	— 11.0	do.	do.
		8 0 ...	59.5	59.0	— 0.5	ruffled,	
	20.	7 0 A. M.	59.0	59.0	0.0	rough,	
		11 0 ...	62.5	59.5	— 3.0	calm,	calm.
		6 0 P. M.	62.0	59.0	— 3.0	do.	do.
		7 0 ...	62.0	59.0	— 3.0	do. ‡	do.
		9 0 ...	59.0	59.0	0.0	do.	do.
	21.	8 0 A. M.	62.5	59.0	— 3.5	ruffled,	NbW. light
		10 0 ...	63.0	59.5	— 3.5	do.	... do.
		Noon,	65.0	59.7	— 5.3	do.	NE. do.
		9 0 P. M.	59.7	59.0	— 0.7	do.	... do.
	22.	8 0 A. M.	60.0	59.0	— 1.0	ruffled,	NE. light.
		3 0 P. M.	61.0	61.5	+ 0.5	calm,	... do.
		7 0 ...	62.0	61.5	+ 0.5	ruffled,	SSW. do.

* Two dangerous shoals about 15 and 20 miles SSE. ½ E. from Orfordness.

† At the depth of 17 fathoms the temperature was found to be the same as at the surface.

‡ At the depth of 16 fathoms, the temperature was found to be the same as at the surface.

Observations made during a Visit to Madeira, and a Residence in the Canary Islands. By Baron LEOPOLD VON BUCH.

WHEN my intelligent and amiable friend, the distinguished botanist Christian Smith of Drammen in Norway, and I were detained in London in the winter of 1814, the similarity of our pursuits soon produced a close intimacy between us. We met frequently, and visited many places together. Every thing we saw and heard, and, perhaps, my friend's peculiar susceptibility also, were continually transporting our imaginations to the splendid phenomena of nature in warmer climates; and we witnessed with the liveliest emotions the great facility with which people were wafted from this immense port to every quarter of the globe. Our desire, therefore, became so engrossing, that we believed it to be only fulfilling our duty, when we endeavoured to profit by such an opportunity of acquiring some knowledge, however small, of tropical vegetation. While continually occupied with these thoughts, the William and Mary, a ship lying in the Thames, and quite prepared for setting out on her voyage, finally fixed our almost settled resolution. We resolved to visit the Canary Islands.

The ship was ready to sail, and we were prepared to accompany her as early as February, that we might not miss the delicious winter of these happy islands. But the ratification of peace with America, which would cause the American privateers to abandon the coast, being still unconcluded, the vessel, to our mortification, was detained in the harbour. We embarked at Spithead, near Portsmouth, on 31st March 1815. Contrary winds, and a search of the press for the seamen on board, obliged us to remain some days longer in Yarmouth in the Isle of Wight. On 8th April, we at length left the Channel, gained the main ocean without difficulty or hardship, discovered the island Porto Santo on 20th, and on the 21st landed at Funchal in Madeira.

Captivated by the powerful fascination of every object around him, Smith was no longer inactive. In a fit of transport, he rushed towards the Cactus bushes which covered the rocks in the most fantastic forms, to ascertain whether it was reality or deception: he leaped walls to reach the woods of Donax, whose summits the breezes waved gently and delightfully over the vines that grew among them. As he ran enthusiastically from flower to flower, it was scarcely possible to prevail upon him to enter the town. On an elevated situation, appeared a lawn of lofty trees, of Justicia, Melia Azederach, and Datura arborea, completely covered with gorgeous and gigantic flowers, that loaded the air with perfumes. The large leaves of the Banana were waving over the walls, and the splendid palm trees rose high above the houses. The singular shape of the Dragon tree, the all-pervading fragrance of the blossoms, and the massive leaves of the Orange trees, attracted us involuntarily to the gardens. Here the Coffee trees form hedges and copses, enclosing large beds, in which Ananas without number are cultivated in the open air. Mimosas, Encalyptus, Melaleuca, Protea, Mamea, Clitoria and Eugenia, all plants of which we observe only mere fragments in our hot-houses, are here elevated to tall and stately trees, displaying their far glittering blossoms in the most delightful climate upon earth.

"How shall I relate to you," said Smith, in a letter to his friends in Norway, "how shall I express what I have seen and felt—how can I convey to you an idea of the variety and singularity of these forms, of the beauty and brilliancy of these colours, and the general glorious aspect of nature with which I am surrounded! We have climbed the declivity of the mountains that environ the lovely Funchal;—we have at length seated ourselves on the margin of a rivulet which leaps from fall to fall through bushes of rosemary, jessamine, laurel and myrtle. The town, with its fortifications, its churchs, its gardens, and its vessels in the road-stead, are lying at our feet. Groves of chesnut and pine trees are stretched above us, among which are scattered flowers of spartium and lavender. The vast number of Canary birds among the branches are filling the air with their warblings; and the snow, sometimes appearing through the clouds that wrap the summits of the mountains, is the only object that can recall my native land."

Every step was instructive, every plant between the stones of the pavement a new discovery. The light-hearted children of the neighbourhood collected, and accompanied the industrious botanist, leaping with joyous agility amongst the rocks. They brought flowers to him from every quarter; they gathered together in close groups, waited silently and attentively to learn if the flowers would excite his attention. As soon as they were deposited in the boxes, a general shout of joy arose, and the group bounded back, with a thousand leaps, to cull new flowers among the rocks. From the opposite declivity, the abodes of hospitality glittered through the close foliage of the encircling vines; the waving bananas formed the roof of the porch; a foaming stream rushed among the banana roots, and lost itself among the large leaves of the Colocasia, that adorned the declivity with their lively verdure. A young woman with her distaff in her hand, sat upon a bank among the bananas: her husband stood before her with his guitar, to anticipate her wishes with tunes and songs, after the finished labours of the day; and the neighbours were collected, to encourage the song and the sport with their applause.

The Island of Madeira was still the same as in former years, when it was described by Camoens the poet:

> Nam'd from her woods, with fragrant bowers adorn'd,
> From fair Madeira's purple coast we turn'd.
> Cyprus' and Paphos's vales, the smiling loves
> Might leave with joy, for fair Madeira's groves;
> A shore so flowery, and so sweet an air,
> Venus might build her dearest temple there.
>
> MICKLE, *Lusiad*, B. v.

We remained only twelve days on this charming island. It was the rainy season, and, on account of the rains, many a day passed which we would have gladly devoted to the prosecution of our pursuits. The mountains half-way down were continually involved in clouds; and on the higher parts of them, the snows were not yet dissolved. We nevertheless resolved to ascend as high as possible, to obtain a survey, however superficial, of the decrease of vegetation on the heights.

We left Funchal on the 16th April at day-break, and soon reached the magnificent church of Senhora de Monte, which commands one of the most beautiful prospects in the world, and from a great distance serves as a land-mark to direct ships into the harbour. According to the barometer, its height is 1774 French feet above the sea. The gardens are elevated to the same height, but there were no more African forms, no more Palms, no arborescent Euphorbias, no more Agavas or Cacalia Kleinii; and the Opuntia that rose highest was already left behind at the elevation of 1005 feet.

After another hour's continual climbing, we reached the greatest height of the rocks in the immediate vicinity of Funchal; it is a stone visible from below, and 2435 feet above the sea. Immediately behind this height, we entered a thick grove of splendid *Laurus Indica*, whose wood almost rivals the beauty of mahogany. Among them stood lofty trees of *Laurus nobilis* the laurel of the poets, and of *Laurus Til (fœtens)*, one of the largest trees of the island, which no axe touches or wounds with impunity. The stench emitted by the wood is so violent, that it compels the woodman to take to flight; so that a tree can be felled only in a number of days, and after long intervals. If it is not touched or injured, its ample foliage and its wide spread branches, render it a real ornament of the woods. We observed also arborescent heaths, *Erica scopana* and *Erica arborea*. The road to St Anna, upon the north side of the island, and from that to the top of the mountains, is here separated by a waterfall. This point, by the barometer, was 3251 feet high. The fog now appearing, covered every surrounding object, and we were obliged to continue our journey enveloped in thick mist. It was still possible, however, at least, at first to see so far before us, as in some measure to trace the direction of the road. At one o'clock we attained an elevation of 4162 feet, and at a little distance we discovered through the fog a mountain valley adorned with bushes; it was the Val Ganana. We entered, and found, to our no small astonishment, that it was an entire wood of billberries in blossom *(Vaccinium arctystaphyllos)*, small trees from 16 to 20 feet high, which we were obliged to examine minutely, before we could be satisfied that they were not the common billberry of our woods *(Vaccinium myrtillus)*, grown to an unusual size. Not far from the height stood the last majestic laurel, an ancient tree, covered with moss, and completely distorted. It stood at the height of 4769 feet. In the opposite valley, we came up to several trees of *Erica arborea*, which were 6 feet in circumference, and more than 30 feet high. After half an hour's walk towards the west, there appeared, beneath a little crag opposite a precipice facing towards the north, a magnificent spring, as copious as a rivulet, and rushing violently. It was carefully inclosed with a wall. Its temperature was 5°.75 R. (7°.25. C., 45°. F.) The top of it, and likewise of the whole surrounding declivity, was in no place covered with snow. The spring had the temperature of the interior, and reminded us of the temperature of northern climates. *Vaccinium arctystaphyllos* creeped up the declivity upon the north side, but did not reach the summit; and, in our farther progress towards the height, it was no longer visible. The rocks above the spring rose to the height of 4849 feet above the sea.

The fog was now so dense, that we could not see a few steps before us. Even in this darkness, however, we ventured to climb still higher; for, being placed upon a sharp ridge, with vast and precipitous sides, we were in little danger, as long as it continued, of wandering in a wrong direction. When we reached the first continued snow, the barometer shewed an elevation of 5148 feet. The ridge now turned suddenly from its former westerly direction, and ran from north to south, forming a large projecting bastion, surrounded with horrible and inaccessible precipices. The snow lay far down on the declivity. The highest peak was now not far distant, for even amidst this darkness it was distinguished by the pyramid of stones erected upon it, and which rose through the surrounding snow. The barometer was fixed on this pyramid, and carefully observed; and the height of the peak, which is called Cima de Tourigas, was, by this mode of measurement, found to be 5484 French feet.

(*To be Continued.*)

List of Rare Plants which have Flowered in the Royal Botanic Garden, Edinburgh, during the last three months; with Descriptions of several New Plants. Communicated by Dr Graham.

10th September 1826.

Asclepias tuberosa.

Flowered in the open border in front of one of the stoves.

Banksia æmula.

This plant is at present flowering very freely in the greenhouse. The young branches and leaves are covered with a rusty pubescence.

Callicarpa cana.

The yellow anthers, and the decurrent leaves with branching veins, of the plant figured in Bot. Mag. t. 2107., make it doubtful whether our plant is the same; but I think it safest at present to consider them so, as in other respects they seem extremely alike. I add, however, the character and description of our specimen.

C. cana; foliis petiolatis, lanceolatis acuminatis, dentatis, basi cuneatis, integerrimis, præcipue supra nervos, subtus, ramisque tomentosis; cymis axillaribus, petiolos excedentibus.

Descript.—*Shrub* erect, stem round, grey. *Branches* decussating, suberect, young shoots covered with a dense, short, soft tomentum. *Buds* small, pointed, tomentose. *Leaves* opposite, petioled, spreading, deciduous, about three pairs near the extremity of the branch remain longer than the rest, lanceolate, acuminate, 4–5 inches long, 2–2½ broad, bluntly toothed, entire, and somewhat wedgeshaped at the base, in no degree decurrent on the petiole, wrinkled, tomentose, especially on the back, green above, white on the back; primary veins little branched, and, as well as the middle rib, woolly on both sides, and prominent behind. *Petiole* ½ inch long, stout, flat above, densely tomentose. *Cymes* axillary, situated near the extremities of the shoots, on peduncles equal in length to the petiole, dichotomous, divaricated. *Bracteas* small, awl-shaped. *Calyx* 4-toothed, tomentose, green, persisting, teeth pointed. *Corolla* deciduous, twice the length of the calyx, 4-cleft, segments rounded. *Stamens* 4; *filaments* twice the length of the corolla, inserted into the back of the roundish, flat, bilocular anther; *pollen* whitish. *Pistil* single; *germen* globular, green; *style* filiform, swelling under the stigma, longer than the filaments; *stigma* flat, obscurely bilobular.

All the parts of the flower, except the germen and pollen, lilac. *Tomentum* every where upon the plant cream-coloured, except on the back of the leaf, where it is nearly white: on the cyme it becomes lighter upwards to the flowers.

The plant was raised from seed sent by Dr Wallich from India in 1823, and marked "Nepaul." It has been kept in the stove.

Campanula dichotoma.

——— grandiflora.

Capparis spinosa, *Caper bush.*

In the open border, in front of one of the stoves.

Commelina cyanea.

Draba alpina β, siliculæ pilosæ.

Br. Supplement to Appendix of Captain Parry's First Voyage. The seeds of this and several other arctic plants were given to me by Mr Fisher, after Captain Parry's Second Voyage. Some of the plants could not be preserved after they had germinated; but this is fully established.

Glycine mollis.

Iris verna.

Sweet's Brit. Fl. Garden, t. 68.

Ixora incarnata.

Lobelia corymbosa.

L. corymbosa; caule fruticuloso; foliis sparsis, lanceolato-spathulatis, inciso-serratis, concavis, decurrentibns; corymbis (demum spicis) axillaribus terminalibusque versus fines ramuolrum congestis.

DESCRIPT.—*Root* perennial, fibrous. *Stem* somewhat angular, procumbent, brown, branched. *Branches* scattered, spreading, green. *Leaves* lanceolato-spathulate, inciso-serrated, concave, smooth, obscurely veined, decurrent, serratures acute. *Flowers* small, fetid, numerous, in flattish corymbs, afterwards elongated into ovato-cylindrical spikes, which are axillary and terminal, and collected at the extremities of the branches. *Pedicels* in the axils of small, pointed, green bracteas, and equal to them in length. *Calyx* 5-parted, segments equal, pointed, at first applied to the tube of the corolla, afterwards spreading. *Corolla* white or pale pink, with two rows of deep reddish-purple spots on the inside of the limb at its base, marcescent; *limb* 5-parted, segments pointed, and slightly bent back, three middle segments nearly parallel, the two lateral ones spreading; *tube* cleft to the base, as long as the segments of the calyx. *Filaments* as long as the tube of the corolla, nearly colourless. *Tube of anthers* dark leaden-coloured, half the length of the filaments, with two spreading awns at the apex; *style* purple, as long as the stamens; *stigma* very small.

The specific name I have adopted, was suggested by Dr Hooker, and is that under which, it is believed, he will presently figure the plant in his excellent Exotic Flora, a work which has certainly no equal among those in course of publication in Britain.

Lonicera flexuosa.

Lotus decumbens.

Sm. Engl. Flor.—*L. minor*, Bishop, in Edin. Phil. Journal, Jan. 1826. This plant we had from Mr Bishop himself, and I cannot hesitate in considering it the *L. decumbens* of Smith.

Magnolia grandiflora.

Flowered freely on the open wall.

Martynia proboscidea.

The seeds were brought from Mexico by Mr Mair, and the plant is ripening fruit.

Musa sapientum.

Nelumbium speciosum.

Nicotiana vincæflora.

Nymphæa alba, var. canadensis.

This is easily distinguished from the European plant by the longer divisions of the stigma, by the very unequal calyx; by the outer petals being green on the outside; and by the rounded overlapping lobes of the leaves.

A *Nuphar* from Canada also flowered in the pond this season. It seemed certainly new; but no memoranda having been taken at the time, little can be said except that the flowers very nearly resembled the *N. advena*, while the habit of the plant was that of the *N. lutea;* the leaves are not raised above the surface of the water.

Both these plants were presented to the Botanic Garden by the Countess of Dalhousie, and both flowered in July.

Persoonia lanceolata.

Polygala affinis.

Pycnostachys cœrulea.

Ruellia strepens.

Spatalla bracteata.

Stachys angustifolia.

Thunbergia alata.

———— angulata.

Valeriana alliarifolia.

Yucca filamentosa.

Zephyranthes rosea.

In the last Number of this Journal, two species of *Conospermum* were erroneously stated to have been sent by Mr Fraser from New South Wales. We owe the possession of them to the often experienced liberality of Mr Aiton.

Celestial Phenomena from October 1. 1826 *to January* 1. 1827, *calculated for the Meridian of Edinburgh, Mean Time.* By Mr George Innes, Aberdeen.

The times are inserted according to the Civil reckoning, the day beginning at midnight. —The Conjunctions of the Moon with the Stars are given in *Right Ascension.*

OCTOBER.

D.	H.	′	″	
1.	15	6	26	● New Moon.
2.	13	22	26	☌ ☽ α ♍
2.	14	9	50	☌ ☽ i ♍
4.	19	57	14	☌ ☽ κ ♎
4.	23	56	43	☌ ☽ ♀
5.	0	25	5	☌ ☽ λ ♎
5.	5	1	23	☌ ☽ 1 β ♏
5.	5	2	44	☌ ☽ 2 β ♏
5.	7	35	10	☌ ☽ ν ♏
6.	10	16	11	☌ ☽ ρ Oph.
7.	3	43	43	☌ ☽ ♂
7.	7	9	25	☌ ☽ 1 μ ♐
7.	7	45	7	☌ ☽ 2 μ ♐
7.	14	16	8	☌ ♀ δ ♏
8.	5	4	8	☌ ♀ 2 β ♏
8.	6	44	29	☽ First Quarter.
8.	9	28	36	☌ ☽ d ♐
8.	17	38	57	☌ ☽ ♅
9.	13	10	54	☌ ☽ β ♑
12.	23	37	20	Inf. ☌ ☉ ☿
13.				☿ greatest elong.
14.	12	28	30	☌ ♀ α ♏
15.	5	44	54	☌ ♂ λ ♐
15.	21	18	48	○ Full Moon.
20.	7	10	22	☌ ☽ ι ♉
20.	23	32	–	☌ ☽ ζ ♉
21.	23	49	40	☌ ☽ ν ♊
22.	3	14	8	☌ ☽ ♄
22.	5	7	33	Im. I. sat. ♃
23.	20	4	24	☌ ♃ η ♍
23.	22	19	38	☉ enters ♏
24.	2	20	27	☾ Last Quarter.
24.	22	4	1	☌ ☽ 1 α ♋
24.	23	16	59	☌ ☽ 2 α ♋
25.	9	20	30	☌ ♀ A Oph.
28.	18	29	7	☌ ☽ ♃
30.	0	22	30	☌ ☽ α ♍
30.	0	59	39	☌ ☽ i ♍
30.	2	36	12	☌ ♂ ♃
31.	0	50	52	● New Moon.
31.	20	28	30	☌ ☽ ☿

NOVEMBER.

D.	H.	′	″	
1.	5	42	–	☌ ☽ κ ♎
1.	9	57	57	☌ ☽ λ ♎
1.	14	29	25	☌ ☽ 1 β ♏
1.	14	30	44	☌ ☽ 2 β ♏
1.	16	58	16	☌ ☽ ν ♏
2.	18	45	5	☌ ☽ ρ Oph.
3.	5	44	53	☌ ☽ ♀
3.	14	55	10	☌ ☽ 1 μ ♐
3.	15	29	38	☌ ☽ 2 μ ♐
4.	16	25	3	☌ ☽ d ♐
5.	0	26	27	☌ ☽ ♅
5.	19	26	18	☌ ☽ β ♑
6.	4	12	26	Im. II. sat. ♃
6.	16	56	16	☽ First Quarter.
7.	6	32	50	☌ ♂ ♅
7.	23	16	–	☿ very near δ ♍
14.	5	20	–	Im. I. sat. ♃
14.	15	40	52	☉ Full Moon.
16.	13	30	47	☌ ☽ ι ♉
17.	5	48	10	☌ ☽ ζ ♉
18.	6	6	56	☌ ☽ ν ♊
18.	7	56	18	☌ ☽ ♄
20.	8	27	–	☌ ♂ A Oph.
21.	5	16	15	☌ ☽ 1 α ♋
21.	6	30	53	☌ ☽ 2 α ♋
22.	17	33	24	☾ Last Quarter.
22.	18	46	54	☉ enters ♐
25.	13	20	26	☌ ☽ ♃
26.	11	18	45	☌ ☽ α ♍
26.	11	55	38	☌ ☽ i ♍
28.				☿ greatest elong.
28.	17	8	16	☌ ☽ κ ♎
28.	21	22	35	☌ ☽ λ ♎
29.	11	32	42	● New Moon.
29.	15	0	–	☌ ☽ ♀
30.	3	35	43	Im. I. sat. ♃
30.	5	37	46	☌ ☽ ρ Oph.
30.	22	48	50	☌ ☽ ☿
31.	1	16	26	☌ ☽ 1 μ ♐
31.	1	49	51	☌ ☽ 2 μ ♐
31.	5	7	42	Em. III. sat. ♃

DECEMBER.

D.	H.	′	″	
2.	1	55	48	☌ ☽ δ ♐
3.	11	23	20	☌ ☽ ♅
3.	3	58	55	☌ ☽ β ♑
3.	19	56	31	☌ ☽ ♂
6.	6	51	28	☽ First Quarter.
7.	5	29	16	Im. I. sat. ♃
8.	3	40	44	Im. II. sat. ♃
8.	6	11	56	Im. III. sat. ♃
13.	19	38	29	☌ ☽ ι ♉
14.	11	13	3	○ Full Moon.
14.	11	54	48	☌ ☽ ζ ♉
15.	6	13	33	Im. I. sat. ♃
15.	10	8	5	☌ ☽ ♄
15.	12	5	30	☌ ☽ ν ♊
16.	5	45	–	☌ ☉ ☿
18.	11	0	16	☌ ☽ 1 α ♋
18.	12	15	11	☌ ☽ 2 α ♋
22.	6	21	25	☾ Last Quarter.
22.	7	28	56	☉ enters ♑
23.	2	8	47	Im. IV. sat. ♃
23.	3	44	33	Im. I. sat. ♃
23.	4	9	38	Em. IV. sat. ♃
23.	4	12	8	☌ ☽ ♃
23.	20	10	4	☌ ☽ α ♍
23.	20	49	26	☌ ☽ i ♍
24.	3	2	–	Inf. ☌ ☉ ♀
24.	21	50	32	☍ ☉ ♄
26.	3	51	41	☌ ☽ κ ♎
26.	8	12	55	☌ ☽ λ ♎
26.	12	48	8	☌ ☽ 1 β ♏
26.	12	49	27	☌ ☽ 2 β ♏
26.	18	18	40	☌ ☽ ν ♏
27.	12	53	37	☌ ☽ ☿
27.	17	0	55	☌ ☽ ρ Oph.
28.	10	50	–	☌ ☽ ♀
28.	22	10	21	● New Moon.
29.	13	5	33	☌ ☽ d ♐
30.	0	55	55	☌ ☽ ♅
30.	5	37	57	Im. I. sat. ♃
30.	14	35	16	☌ ☽ β ♑

Times of the Planets passing the Meridian.

OCTOBER.

D.	Mercury. H. ′	Venus. H. ′	Mars. H. ′	Jupiter. H. ′	Saturn. H. ′	Georgian. H. ′
1	11 20	14 45	16 56	11 15	5 47	18 48
5	11 31	14 46	16 53	11 2	5 32	18 32
10	11 42	14 48	16 48	10 46	5 13	18 13
15	11 51	14 50	16 44	10 31	4 54	17 53
20	12 4	14 51	16 40	10 18	4 34	17 34
25	12 15	14 52	16 36	9 58	4 14	17 15

NOVEMBER.

D.	Mercury. H. ′	Venus. H. ′	Mars. H. ′	Jupiter. H. ′	Saturn. H. ′	Georgian. H. ′
1	12 30	14 52	16 32	9 36	3 46	16 52
5	12 39	14 50	16 29	9 23	3 30	16 32
10	12 49	14 47	16 24	9 7	3 10	16 13
15	12 59	14 41	16 21	8 52	2 50	15 54
20	13 12	14 34	16 16	8 36	2 30	15 37
25	13 18	14 21	16 13	8 18	2 8	15 18

DECEMBER.

D.	Mercury. H. ′	Venus. H. ′	Mars. H. ′	Jupiter. H. ′	Saturn. H. ′	Georgian. H. ′
1	13 19	14 2	16 8	7 58	1 42	14 54
5	13 11	13 46	16 5	7 45	1 25	14 40
10	12 47	13 20	15 58	7 27	1 1	14 21
15	12 10	12 54	15 55	7 6	0 37	14 2
20	11 18	12 22	15 52	6 52	0 21	13 44
25	10 46	11 48	15 46	6 35	23 55	13 25

On the 14th of November there will be an Eclipse of the Moon, which will be *partly visible:*

	D.	H. ′ ″
The Eclipse begins,	Nov. 14.	13 47 33
Beginning of total darkness,	-	14 55 18
Moon rises totally eclipsed,	-	15 36 32
Ecliptic opposition,	-	15 40 54
Middle of the eclipse,	-	15 43 8
End of total darkness,	-	16 30 57
End of the eclipse,	-	17 38 42

Digits eclipsed, 17° 25′ 50″ from the north side of the Earth's shadow.

On the 29th of November there will be an Eclipse of the Sun, which will be visible if the weather prove favourable. A complete calculation of the Lunar Elements, using the Tables of *Damoiseau*, and the Solar Elements as obtained by using the Solar Tables of *Delambre*, with the results of the principal steps of a calculation for Edinburgh, was published in the *Edinburgh Philosophical Journal* for April 1826. The following are the final results, as inserted in that number:

	D.	Mean Time. H. ′ ″	Apparent Time. H. ′ ″
The Eclipse begins,	Nov. 29.	9 33 59,9	9 45 32,4
Greatest obscuration,	-	10 37 37,7	10 49 9,9
Visible conjunction,	-	10 38 45,0	10 50 17,2
End of the eclipse,	-	11 43 9,5	11 54 40,9

Digits eclipsed 6° 58′ 10″,4, on the north part of the Sun's disc. The Moon will enter the Sun's disc on the west limb, at 37° 56′ 11″ from his zenith, in reference to the horizon.

SCIENTIFIC INTELLIGENCE.

ASTRONOMY.

1. *The Moon and its Inhabitants.*—Olbers considers it as very probable that the moon is inhabited by rational creatures, and that its surface is more or less covered with a vegetation not very dissimilar to that of our own earth. Gruithuisen maintains, that he has discovered, by means of his telescope, great artificial works in the moon, erected by the Lunarians; and very lately, another observer maintains, from actual observation, that great edifices do exist in the moon. Noggerath, the geologist, does not deny the accuracy of the descriptions published by Gruithuisen, but maintains that all these appearance are owing to

vast whin-dikes or trap veins rising above the general lunar surface. Gruithuisen, in a conversation with the great astronomer Gauss, after describing the regular figures he had discovered in the moon, spoke of the possibility of a correspondence with the inhabitants of the moon. He brought, he says, to Gauss's recollection, the idea he had communicated many years ago to Zimmerman. Gaus answered, that the plan of erecting a geometrical figure on the plains of Siberia corresponded with his opinion, because, according to his view, a correspondence with the inhabitants of the moon could only be begun by means of such mathematical contemplations and ideas, which we and they must have in common. The vast circular hollows in the moon have been by some considered as evidences of volcanic action, but they differ so much in form and structure from volcanic craters, that many are now of opinion, and with reason, that they are vast circular valleys.

METEOROLOGY.

2. *Transmission of Sound.*—" The extreme facility with which sounds are heard at a considerable distance, in severely cold weather, has often been a subject of remark ; but a circumstance occurred at Port Bowen, which deserves to be noticed, as affording a sort of measure of this facility. Lieutenant Foster having occasion to send a man from the Observatory to the opposite shore of the harbour, a measured distance of 6696 feet, or about one statute mile and two-tenths, in order to fix a meridian mark, had placed a person half way between to repeat his directions ; but he found, on trial, that this precaution was unnecessary, as he could, without difficulty, keep up a conversation with the man at the distant station."—*Parry.*

3. *Showers of Blood in Britain.*—In the Historian of Llanearam and the Saxon Chronicle, it is said, " It rained blood in Britain and Ireland, that butter and milk became ruddy, and the moon became red." These rains fell in the reign of Prince Egfrid, in 684.

4. *Bitsberg Meteoric Stone.*—According to Stromeyer, it contains, iron 81.8 ; nickel 11.9 ; cobalt 1.0 ; manganese 0.2 ; sulphur 5.1 = 100.0. Stromeyer had not examined it for chrome, but intended to do so.

5. *Morichini on Magnetism.*—It results from the experiments of this distinguished philosopher, that there very probably exists a magnetic power in light, particularly in the exterior edge of the violet ray; and also, that this power is to be ascribed more to the chemical or deoxydising rays, than to the violet ray itself. If this newly discovered property of light shall be confirmed by the experiments of others, we must not, as some are disposed to do, abandon the idea of the earth's magnetism. The earth, as Morichini remarks, will absorb the magnetic fluid of the solar rays, as it absorbs heat and light. Iron will bear the same relation to the magnetic fluid, as pyrophorus to caloric and phosphorus, by isolation, to light.

6. *Luminous Meteor.*—Edinburgh. On Sunday, August 27th, about nine o'clock in the evening, a meteor shot over this city, in a direction from SW. to NE., which was visible for a few seconds, and brightly illuminated the sky in its track. It resembled a great sky-rocket.—Falkirk. Sunday last was marked for the sudden rise which the thermometer experienced, rendering the atmosphere so sultry that we were reminded of the late great heats, and which was not diminished by the peals of distant thunder that continued to grumble during the afternoon. At a quarter to nine o'clock in the evening, one of the grandest celestial phenomena that has occurred in the memory of the oldest person was exhibited. The air was quite calm; but there was a heaviness which indicated a surcharge of electric matter. A vivid glare of light, tinging every object with a pale blue colour, suddenly blazed forth in the heavens, rendering the minutest object visible as at noonday. The eyes of every person in the street were instantly directed to the east, where a most sublime sight met their gaze. A large body of fire, in shape like a jargonelle pear, and apparently of the size of a bee-hive, was moving in a direction from SW. to NE. with a rushing noise, something similar to that of a rocket. It left behind it a very long train, not of sparks, but fluid-like, and of the most resplendent prismatic colours. It continued visible for nearly fifteen seconds, having gone over a space of about forty-five degrees, and descended apparently so low that it actually seemed to approach within a hundred feet of the earth. Having assumed a deep crimson tint, it was extin-

guished without any explosion, several pieces of red matter, like cinders, falling perpendicularly downwards, which were evidently the burnt remains of the nucleus.—St Andrew's. On Sunday evening last, at about a quarter before nine, there was seen in this city (St Andrew's), a highly luminous meteor to the south-east of the city. When it was first observed, it had the appearance of a comet of transcendent brightness, having a nucleus of about half a degree in diameter. It appeared to shoot forth in a direction from SW. to NE. over a circular path of about 35°, and gradually diminishing in magnitude, until it finally disappeared. What was perhaps most remarkable in this meteor was, that in its orbit it did not present an unbroken volume of light, but appeared to throw out bright sparks in all directions, resembling, in some degree, a sky-rocket. The same appearance was observed at Cupar at the same time.—Bridlington. Sunday evening 27th, about nine o'clock, a luminous meteor of dazzling brilliancy was seen at Bridlington, for several seconds, in a NNE. direction; in disappearing, which might be compared to bursting, it presented bright sparklings of a reddish yellow colour. The night was beautifully clear and serene.

7. *Remarkable Rainbow.*—On the 18th May of this year, 1826, at six o'clock P. M., lightning appeared in the eastern part of the heavens, and a little rain fell. There, where it was darkest, I, and many of the inhabitants of Lengsfeldt in Eisenach, observed a very remarkable rainbow. We saw not only, as is commonly the case, the feebly coloured interior rainbow, and the darker coloured exterior rainbow, with all their transition of colours, but among these also the following threefold repetition of them in the following order:—Most exterior rainbow, violet, blue, green, yellow, and red; under a dark layer, and below these with diminished intensity of colour, first the common interior bow, with red, orange, yellow, green, blue, violet; then the following *three*; purple, orange, green, violet; purple, orange, green, violet; purple, orange, and finally a dull green arched stripe.—*Kärsten Archiv.*

CHEMISTRY.

8. *Chemical Action of Diffused Silica.*—The clay and pulverised flints are combined for the use of the potter, by being

first separately diffused in water to the consistence of thick cream, and, when mixed in due proportion, are reduced to a proper consistence by evaporation. During this process, if the evaporation be not rapid and immediate, or if the ingredients are left to act on each other, even for twenty-four hours, the flinty particles unite into sandy grains, and this mass becomes unfit for the manufacturer. In this case there is apparently a chemical action.

9. *Chloride of Lime as an Antiseptic.* — The chloride of lime is remarkable for its antiseptic powers: thus, if an animal body, already offensive owing to putrefaction, is drenched in an aqueous solution of this salt, the smell entirely disappears; further, if fresh flesh is drenched in it soon, that is in a few days, it becomes converted into a mummy-like whitish substance, and does not give out any unpleasant smell; hence it has been recommended to use chloride of lime, in preference to all other substances, in the embalming of bodies.

10. *Ammoniac in Alder Water.*—Mr Gleetsmann has detected ammonia in the aquæ distillatæ Sambuci. In a former Number we mentioned the occurrence of ammonia in Chenopodium fœtidum, Viola odorata, the flower of Stapelia, &c. &c.

11. *Acids and Salts of Soil.*—Dr C. Sprengel, private teacher of chemistry and economics in Gottingen, has published in Karsten's Archiv, a long memoir on the characters of vegetable soil; on the peculiar acid it contains, especially when in the state of peat, and on the various natural combinations of this acid of soil, met with in soils of different descriptions.

GEOLOGY.

12. *Quader Sandstone belongs to the Greensand.*—Hausmann and Von Schlotheim have ascertained that the quader sandstone of Pirna, Quedlenburg, Blankenburg, &c. belongs to the greensand formation, and is essentially different from the sandstone with coal on the Weser, which is a lias sandstone.

13. *Structure of the Swiss Alps.*—From the foot of the Cevennes, by Marseilles, Gap, Grenoble, Geneva and Bex, similar and very simple geognostical relations occur. The lowest rock is blackish marly limestone, which, from its fossils, and other characters, appears to be a lias limestone; to this succeeds a

white, compact, often oolitic limestone, which is Jura limestone, and is often covered with clay, sandstone, marl, &c. that belong to the quader sandstone and green sandstone. The valleys are often filled with Molasse. The Swiss Alps are, in all probability, similarly constructed. The dark transition limestone, with its subordinate beds of gypsum, belong to the lias formation; the true alpine limestone to the Jura limestone; the green sand and quader sandstone form the highest ridges of the calcareous alps, as on the Mount Saleve, Diablerets, &c. It seems problematical if true transition limestone occurs in this part of the Alps. If the view now given be correct, says Kefferstein, the calcareous alps and the Jura exhibit the same geognostical structure and composition, and probably were at one time connected together (as is the case at present in the south of France), forming an extensive plateau, which, at a period not very remote, suffered violent elevations and depressions, by which the green sand, for example, was raised to the height of 10,000 or 12,000 feet. These changes, which have given the present form to the Alps, may have taken place during or after the deposition of the chalk formation.

14. *Apatite in Secondary Greenstone.*—The Greenstone of Salisbury Crags, in our vicinity, contains crystals of Apatite. The well known secondary greenstone of the Blaue Kuppe, near Eschwege, in Germany, has also been found to contain, along with crystals of magnetic iron ore, crystals of apatite or phosphate of lime.

MINERALOGY.

15. *Sulphate of Strontian and Sulphate of Barytes confounded.*—Several writers have mentioned sulphate of strontian as occurring in veins and cavities in different places, where only sulphate of barytes is met with. To those who may not be willing to use the mineralogical characters for distinguishing them, the following chemical properties will answer: Every combination of strontian colours the flame of the blowpipe purplish-red, —every combination of barytes yellowish-green. The caustic or hepatic smell before the blowpipe, determines the kind of acid which existed in combination with the earth before the experiment.

16. *Telluric Bismuth.*—Berzelius has analysed a mineral, of

a silver white colour, broad foliated fracture, and shining metallic lustre, from Riddarhytta, and found it to be a telluric bismuth. It occurs in the mine of Bastnäs.—*Poggendorff Journal.*

17. *Vesuvian of Mussa.*—According to Dr Kobell, in Kärtner's Archiv. b. vii. heft. 4., the Vesuvian of Mussa contains Silica 34.848; Alumina 21.933; Lime 33.609; and Oxydule of Iron 5.400 = 97.790.—*Vesuvian of Montzoni*, Silica 37.644; Alumina 16.688; Lime 38.240; Oxydule of Iron 6.420 = 98.972. Rather more than 1 per cent of phosphoric acid was found in these Vesuvians; but whether it was a regular or accidental part, was not determined.

18. *Garnet.*—Kobell in Kärsten's Archiv, b. v., in a Memoir on Garnet, maintains, that cinnamon-stone, the Hessonite of Haüy, is a variety of garnet, and is disposed to consider Helvin also as a variety of garnet. The hyacinth-red, and orange-red garnets of Piedmont, he says, are crystallised varieties of cinnamon-stone.

19. *Natural Alum.*—Professor Breithaupt has met with natural alum crystallized in regular octahedrons, in a slaty-clay, near to Wetzelstein in Germany.—*Kärsten, Archiv*, b. vii. h. i. s. 115.

ZOOLOGY.

20. *Entomology.*—The Highlands of Scotland are rich in insects. Last summer, Mr John Curtis, the editor of British Entomology, made a six weeks tour in Scotland; and among the Lepidoptera alone he added to his cabinet, which already contained 1200 British species, thirty species that were new to him, and no fewer than *thirteen* of these *non-descript*. At the base of Shehallien he found the rare *Biston trepidaria.*

21. *Mastodon found in Bahama.*—In a collection of objects of natural history, lately sent from Bahama to Professor Jameson, there is a fossil grinder of a mastodon, the first instance we recollect of the remains of that genus having been found in that quarter.

22. *Mammoth at Hudson's Bay.*—Professor Jameson has in his possession a fine fossil grinder of the mammoth, which was found on the shore of Hudson's Bay, by the then Chief of that country, William Auld, Esq.

23. *Whale-Fishery at Van Dieman's Land.*—Whales had very frequently been seen in the estuary of the Derwent and in the bays adjacent, and one or two had been occasionally killed; but the first attempt to make their capture a regular branch of trade, took place in May 1824. Mr Kelly, an enterprizing resident at Hobart Town, resolved to employ a colonial built schooner in this undertaking. She was only fifteen tons burthen, was manned with twenty-two hands, and had five whale-boats attached, furnished with the requisite implements. With this little vessel, in the short space of thirteen days, Mr Kelly contrived to capture five whales, the blubber of which yielded forty-five tons of pure black oil. As soon as a whale was killed, the schooner was run up to the carcase, and the *flensing* commenced; when the blubber was stowed into the casks, the vessel (being tolerably well loaded with the produce of one sizable whale) was immediately steered for the harbour, from which she was seldom more than eight or ten miles distant, frequently not more than four or five. The cargo being discharged, the schooner was again at her post in the offing within a few hours.

24. *Fossil Insects.*—Fossil insects occur in amber and in some other minerals. Those met with in amber vary much in species, according to locality. The amber of Sicily contains different *Coleoptera*, that of the Baltic sea contains many *Diptera* and *Neuroptera*. The following genera have been found in amber: *Platypus*, *Aractoceros*, *Gryllus*, *Mantis*, larvæ of butterflies; *Phryganea*, *Ephemera*, *Perea*, *Formica*, *Evania*, *Tipula*, *Bibio*, *Empis*, *Scolopendra*, *Chironomus*, and many *Arachnidæa*. Of fossil insects in other substances, Parkinson mentions larvæ of *Libellulæ* in limestone, and some *Melolonthæ* and Polistes have been found in slate.

BOTANY.

25. *Nardus or Spikenard.*—From a species of Nardus, which grows in vast abundance all over the Malivah in India, Dr Maxwell, in the Transactions of the Medical and Physical Society of Calcutta, which has just reached Europe, informs us, there is extracted a highly pungent essential oil, which he strongly recommends to be used in the way of friction in rheumatism, because he has found it very efficacious in greatly alleviating, or entirely removing, that disease. Dr Wallich says, this plant, the

nardus or spikenard of the ancients, is either the Andropogon Ivarancura of Dr Blane, or the Andropogon Martini of Roxburgh: its characters shew it to be different from Andropogon schænanthus, Fl. In. Dr Wallich adds, "Over and above the three species of Andropogon, (viz. Schœnanthus, Ivarancura and Martini,) which are considered as the spikenard of the ancients. I beg to observe, that *Valeriana Johomouri*, (Vide Fl. Ind. vol. i. p. 265.), is also taken to be a sort of spikenard. Now, two more distinct things do not exist than those two genera; and the root of the Valeriana Johomouri is very little inferior in fragrance to our common valerian, (Val. offic.) which smells abominably.

26. *On the Oshac, or Gum Ammoniac Plvnt.*—Captain Hart of the 5th Battalion Native Regiment, Bombay, gives the following information as to this interesting plant, in vol. i. of the Transactions of the Medical and Physical Society of Calcutta. "It having been intimated to me, while at Bushire, by the President, Captain Bruce, that the plant which produces the gum ammoniac, called by the Persians Oshac, would be acceptable to botanists, as it was but imperfectly known, I procured the accompanying piece of stem, leaf and flower, and took a drawing of one of the finest plants. Its height was 7 feet 2 inches, and the circumference of the lower part of the stem 4 inches. It grows principally in the plain between Yorde-Kaust and Kumisha, in the province of Nauk, without cultivation. The gum is so abundant, that, upon the slightest puncture being made, it instantly oozes forth, even at the ends of the leaves. When the plant has attained perfection, innumerable beetles pierce it in all directions; it soon becomes dry; it is then picked off, and sent via Bushire to India, and various parts of the world, and is an article of considerable export. I am of opinion that it might be cultivated with success in many parts of Kattywar, and the experiment might be worth the attention of Government. The gum might easily be procured by artificial means, which would answer the purpose equally well."

27. *The bark of the stem of the Pomegranate, a specific in cure of Tænia or Tape Worm.*—P. Breton, Esq. says, "I have repeatedly put to the test of trial, in cases of tænia, with uniform success, the dried bark of the stem of the pomegranate

shrub, both in decoction and in powder, without exciting any other sensations than those which arise from the exhibition of the fresh bark of the root of the plant. I have also ascertained, by frequent trials, that the virtues of the bark may be preserved several years; a circumstance favourable to its transmission to Europe. Some bark of the stem, which I have had upwards of four years packed in a deal box, I have recently tried in several cases of tænia with perfect success; so that I have no hesitation whatever in recommending this drug, not only as a safe, but as a perfectly certain remedy for the expulsion of tænia. This drug is equally efficacious in expelling from the lower animals, (especially dogs) tænia, to which they are very subject in this country. To full grown dogs may be given the same dose as that taken by adults. The powder mixed with butter or minced meat, is as good a form as any; some dogs will of themselves eat it when prepared in this manner. The powder may also be given in balls, or the decoction may be substituted with equal effect. We are indebted, it seems, for our knowledge of this invaluable remedy for the tape worm to a mussulman fakeer, named Azim Shah, who, in 1804, having relieved, in a few hours, Mr Robert Home of Calcutta of a tænia, which measured 36 feet in length, was prevailed on by a reward of two gold mohars, to disclose the secret."—*Transactions of the Medical and Physical Society of Calcutta*, vol. i.

ANTHROPOLOGY.

28. *Account of a singularly small Child*, by T. E. Baker, Esq. of Buxar.—The child is the daughter of a Mrs Green, the wife of the riding-master of the 5th Native Cavalry, and is now with the mother, living at this station with Mr Edwards, an overseer to the Honourable Company's depot; it has been seen by Mr Surgeon Gibb, the superintendant of the stud; by Thompson, the civil surgeon of Arrah, by Captain J. Mackenzie, and other residents at the station. The mother was coming by water from Agra, and was confined near Bandah, when she thought herself about six months and a half gone with child, and attributed her premature confinement to having over-exerted herself in removing some boxes, &c. On this day (May 24th) the child is one month and twenty days old; it weighs exactly one pound and thirteen ounces, and is fourteen inches in length.

The following are the dimensions of the principal parts of the body:—

	Inches.
Circumference of the head (longest diameter), - - -	10
Ditto ditto (shortest diameter), - - - - - -	9.1
Ditto of the chest, - - - - - -	9
Ditto of the body, - - - - - -	8
Ditto of the thigh, midway between the knee and the hip-joint,	2.6
Ditto of the fore-arm, midway between the wrist and elbow, -	1.7

I much regret the weight and dimensions of the child were not taken when it was first born, for the mother informs me it has grown considerably since that time. At first it would not take to the breast, but it now sucks very well. The bones of the head are rather loose, and the anterior and posterior fontanels are large in proportion to the size of the head.—*Transactions of the Medical and Physical Society of Calcutta*, vol. i.

MENSURATION.

29. *Tables for converting Scotch Land Measure into Imperial Land Measure, and for finding the Rent, Produce, or Value of an English Acre, having given that of a Scots Acre* *.—Before the act for ascertaining and establishing uniformity of weights and measures was passed, there was no certain rule for determining the proportion of the Scots to the English acre, on account of the want of agreement among surveyors as to the exact length of the Scotch ell. Now, however, the length of the ell has been ascertained by a careful and scientific measurement, and the result as well as the proportion of the Scots to the English acre declared by a Jury appointed by the Sheriff-depute of the county of Edinburgh. Their verdict, which is dated 4th February 1826, finds, that the standard Scots ell, at the temperature of 62° of Fahrenheit, contains 37.0598 Imperial standard inches; and, consequently, that the Scots chain contains 74.1196 Imperial standard feet, and that the English or Imperial acre has to the Scots acre the proportion of 1 to 1.26118345. From these data, the two following concise Tables have been constructed. The first serves to convert any number of Scots acres, roods, falls, and ells, into Imperial acres and the decimal fraction of an acre; and by the second, having given

* Mr Elgen of Aberdeen sent us for insertion in the Journal interesting Tables of the same general nature with those here given. These Tables were examined by an eminent mathematician, who constructed those now published, which he considers more convenient.

the rent or value of the produce of one, or any number of Scots acres, the rent or value of the produce of the same number of imperial acres may be found. Their construction is sufficiently obvious, and their application must be manifest from the examples which follow them.

Table for converting Scots Acres, Roods, &c. into Imperial Acres.

Scots Acre.	Imperial Acres.	Scots Roods.	Imperial Acre.	Scots Falls.	Imperial Acre.	Scots Ells.	Imperial Acre.
1	1.26118345	1	.31530	1	.007882	1	.000219
2	2.52236690	2	.63059	2	.015765	2	.000438
3	3.78355035	3	.94589	3	.023647	3	.00067
4	5.04473380			4	.03153	4	.00088
5	6.30591725			5	.03941	5	.00109
6	7.56710070			6	.04729	6	.00131
7	8.82828415			7	.05518	7	.00153
8	10.08946760			8	.06306	8	.00175
9	11.35065105			9	.07094	9	.00197

Table for finding the Rent Produce of an Imperial Acre, having given those of a Scotch Acre.

Rent, Produce, &c.		Rent, Produce, &c.		Rent, Produce, &c.	
Scots Acre.	Imperial Acre.	Scots Acre.	Imperial Acre.	Scots Acre.	Imperial Acre.
£	£	s.	£	d.	£
1	.79291	1	.0396	1	.0033
2	1.58581	2	.0793	2	.0066
3	2.37872	3	.1189	3	.0099
4	3.17162	4	.1586	4	.0132
5	3.96453	5	.1982	5	.0165
6	4.75744	6	.2379	6	.0198
7	5.55034	7	.2775	7	.0231
8	6.34325	8	.3172	8	.0264
9	7.13615	9	.3568	9	.0297
10	7.92906	10	.3965	10	.0330
				11	.0363

Example of use of Table I.—Convert 3258 Scots Acres 2 R. 31 F. 28 E. into Imperial Acres :

			Imperial Acres.
3000	Scots Acres	=	3783.55035
200			252.23669
50			63.05917
8			10.08947
2	Roods	=	.63059
30	Falls	=	.23647
1			.00788
20	Ells	=	.00438
8			.00175
	Imperial Acres,		4109.81675

= 4109 A. 3 R. 10 P. 20.6 Y.

Example of use of Table II.—A Scots Acre was sold for £ 82 : 12 : 9 ; hence find the value of an Imperial Acre ?

80	Pounds	=	£ 63.4325
2			1.5858
10	Shill.	=	.3965
2			.0793
9	Pence	=	.0297
	Value of Imp. A.	=	£ 65.5238

= £ 65 : 10 : $5\frac{71}{100}$.

It may be useful to surveyors to know, that the exact length of the Imperial Chain has been laid down on the parapet in front of the Edinburgh University buildings.

NOTICES OF NEW BOOKS.

29. *Daubeny on Volcanoes.*—This truly excellent work has afforded us during its perusal, much unmixed pleasure and delight. We have nothing equal to it on volcanoes in the English language. The excellence of its arrangement, the accuracy of its details, the extensive array of facts by which it is distinguished, the general judiciousness of Dr Daubeny's conclusions, all concur in rendering it a most valuable addition to the geological literature of Great Britain. Dr Daubeny is already advantageously known to the public by his excellent memoirs in the Edinburgh Philosophical Journal. His work on Volcanoes gives him high rank among the geologists of this country, and, we trust, is but the precursor of other geological achievements.

30. *Lothian's County Atlas of Scotland.*—This work, which is now in progress of publication, in quarto size, we consider deserving of public encouragement, on account of its general accuracy, neatness of engraving, convenient form, and cheapness. We shall notice it again when completed.

31. *Dr Fyfe's Manual of Chemistry.*—This work, in one volume of moderate size, and illustrated with numerous, very useful, wooden cuts, we recommend to the student of chemistry, from its accuracy, perspicuity, and the practical details with which it abounds. We have not met with any English work which contains in the same space more useful matter than the Manual of Dr Fyfe. The wooden cuts, also, give a character of utility to the work, which will be most particularly felt and prized by the student of chemistry, for whose use alone this work has been written.

32. *Captain Parry's New Work.*—Of this work, just published in London, no copies have as yet reached Edinburgh, so that we are deprived of an opportunity of noticing it.

List of Patents granted in England from 26th May to 9th September 1826.

1826.

May 8. L. ZACHARIAH jun. of Portsea, pawnbroker, for a combination of materials to be used as fuel.

23. D. DUNN, King's Row, Pentonville, manufacturer of essence of coffee and spices, for improvements upon the screw press used in the pressing of paper, books, tobacco, or bale goods, and in the expressing of oil, extracts, or tinctures, and for various other purposes, in which great pressure is required.

T. HUGHES, Newbury, Berks, miller, for improvements in the method of restoring foul or smutty wheat, and rendering the same fit for use.

F. MOLINEUX, Stoke Saint Mary, Somersetshire, for an improvement in machinery for spinning and twisting silk and wool, and for roving, spinning, and twisting flax, hemp, cotton, and other fibrous substances.

T. P. BIRT, Strand, coach-maker, for improvements in wheel-carriages.

J. PARKER, Knightsbridge, iron and wire-fence manufacturer, for improvements to park or other gates.

D. P. DEURBROUCQ, Leicester Square, for an apparatus to cool wort, and also for the purpose of condensing the steam arising from stills during the process of distillation.

May 23. W. H. GIBBS, Castle Court, Lawrence Lane, warehouseman, and A. DIXON, Huddersfield, manufacturer, for a new kind of piece goods formed by a combination of threads of two or more colours, the manner of combining and displaying such colours in such piece goods constituting the novelty thereof.

J. SMITH, Tiverton, Devonshire, lace manufacturer, for an improvement on the stocking-frame.

J. LOACH, Birmingham, brass-founder, for a self-acting sash-fastener, which fastening is applicable to other purposes.

R. SLAGG, Kilnhurst Forge, near Doncaster, steel manufacturer, for an improvement in the manufacture of springs chiefly applicable to carriages.

L. J. MARIE, Marquis de Combis, Liecester Square, for improvements in the construction of rotatory steam-engines, and the apparatus connected therewith.

J. B. FERNANDEZ, Norfolk Street, Strand, for improvements in the construction of blinds or shades for windows, or other purposes.

R. MICKLEHAM, Furnival's Inn, civil engineer and architect, for improvements in engines, moved by the pressure, elasticity, or expansion of steam gas or air, by which a great saving in fuel will be effected.

H. R. FANSHAW, Addle Street, silk embossor, for an improved winding machine.

J. HAM, Holton Street, Bristol, vinegar-maker, for an improved process for promoting the action of acetic acid on metallic bodies.

June 13. To T. J. KNOWLYS, Trinity College, Oxford, for "a new Manufacture of Ornamental Metal."

22. To T. HALAHAN, York Street, Dublin, Lieutenant in the Royal Navy, for "Machinery or Apparatus for working Ordnance."

July 4. To L. AUBREY, Two Waters, Herts, engineer, for "an Improvement or Improvements in the Web or Wire for making Paper."

To J. POOLE, Sheffield, shop-keeper, for "Improvements in the Steam-engine Boilers, or Steam-generators, applicable also to the evaporation of other fluids."

1826.

July 4. To D. Freeman, Wakefield, sadler, for "Improvements in measuring for, and making Collars for horses and other cattle."

To P. Groves, Liverpool Street, for "Improvements in manufacturing or making White Lead."

To R. Wornam, Wigmore Street, Cavendish Square, pianoforte maker, for Improvements on Pianofortes."

10. To P. Groves, Liverpool Street, for "Improvements in making Paint or Pigment, for preparing or combining a substance or material with oil, turpentine, and other ingredients."

14. To B. Lowe, Birmingham, gilt toy manufacturer, for "Improvements in useful and ornamental Dressing-pins."

To J. Guy and J. Harrison, Workington, Cumberland, straw-hat manufacturer, for "an Improved method of preparing straw and grass, to be used in the manufacture of Hats and Bonnets."

14. To J. P. De la Fous, George Street, Hanover Square, dentist, and W. Littlewart, Saint Mary Axe, mathematical instrument maker, for "an Improvement in securing or mooring ships and other floating bodies, and Apparatus for performing the same."

To E. Bayliffe, Kendall, Westmoreland, worsted-spinner, for "Improvements in the Machinery used for the operations of drawing, roving, and spinning of sheep and lambs' wool."

To J. L. Higgins, Oxford Street, for "Improvements in the construction of Cat-blocks and Fish-hooks, and in the application thereof."

24. To J. Barron, Birmingham, brassfounder and venetian blind-maker, for a "Combination of Machinery for feeding fire with fuel."

To W. Johnston, Caroline Street, Bedford Square, jeweller, for "Improvements on Ink-holders."

To W. Robinson, Craven Street, Strand, for a "New method of propelling Vessels by steam."

To W. Parsons, Dock Yard, Portsmouth, naval architect, for "Improvements in Building Ships, which are calculated to lessen the dangerous effects of internal or external violence."

Aug. 1. To W. Davidson, Glasgow, surgeon and druggist, for "Processes for bleaching or whitening of Bees'wax, Myrtle-wax and Animal Tallow."

To T. J. Knowlys, Trinity College, Oxford, and W. Duesbury, Bousal, Derbyshire, collar manufacturer, for "Improvements in Tanning."

List of Patents granted in Scotland from 26th May to 9th September 1826.

1826.

June 12. To Richard Mee Raikes of London Wall, in the city of London, Esq., for an invention communicated to him by a foreigner residing abroad, for "a Method of applying Steam without pressure to Pans, Boilers, Coppers, Stills, Pipes, and Machinery, in order to produce, transmit, and regulate various temperatures of heat in the several processes of Boiling, Distilling, Evaporating, Inspissating, Drying and Warming, and also to produce Power."

17. To Thomas John Knowlys of Trinity College, Oxford, Esq. for an Invention communicated to him by a foreigner residing abroad, "of a new Manufacture of Ornamental Metal or Metals."

1826.

June 26. To Francis Halliday of Ham, in the county of Surrey, Esq., for "certain Improvements on Machinery to be operated upon by Steam."

29. To William Thomson, Cabinetmaker and Joiner, residing in Fountainbridge Street, Edinburgh, and Malcolm Muir of the Glasgow Veneer Saw Mills, for "certain Machines and Improvements on Machines and Instruments or Tools applicable to the performance of Cabinetmaker's Work, Joiner's Work, Carpenter's Work, and to other similar purposes."

July 12. To Louis Joseph Marie, Marquis de Cambis, a native of France, but now residing in Leicester Square, in the parish of St Martin in the Fields, and county of Middlesex, for an Invention communicated to him by a foreigner residing abroad, "of certain improvements in the construction of Rotatory Steam Engines, and in the Apparatus connected therewith."

21. To Henry Anthony Koymans of Warnford Court, Throgmorton Street, in the city of London, Merchant, for an Invention communicated to him by a foreigner residing abroad, "of certain Improvements in the construction and use of Apparatus and Works for Inland Navigation."

Aug. 7. To Moses Poole of the Patent Office, Lincoln's Inn, in the county of Middlesex, gentleman, for an invention communicated to him by a foreigner residing abroad, "of certain improvements in the Machines used for carding, slubbing, slivering, roving, or spinning wool, cotton, waste silk, short stapled hemp and flax, or any other fibrous materials, or mixtures thereof."

Sept. 5. To John Guy and Jacob Harrison, both of the parish of Workington, in the county of Cumberland, straw hat manufacturers, for "an improved method of Preparing Straw and Grass to be used in the manufacture of Hats and Bonnets."

9. To Francis Halliday of Ham, in the county of Surrey, Esq., for "certain Improvements in Engines or Machinery to be actuated by Steam, which Improvements in Machinery with or without the aid of Steam, are applicable to the raising or forcing of water."

9. To the said Francis Halliday for "an Apparatus or Machinery for preventing the inconvenience arising from Smoke in Chimneys, which he denominates a Wind Guard."

LIST OF PLATES.

INDEX.

P. Neill, *Printer.*