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The Canadian Journal.

TORONTO, FEBRUARY, 1854.

Preliminary Account and Results of the Expedition of Dr. Richard Lepsius to Egypt, Ethiopia, and the Peninsula of Sinai.*

In the year 1842, in accordance with the proposal of Eichhorn, at that time Minister of Instruction, and at the recommendation of M. M. Alexander, V. Humboldt, and Bunsen, his Majesty King Frederic William 4th, of Prussia, determined to send a scientific expedition to investigate the remains of ancient Egyptian and Ethiopian civilization still in preservation in the Nile valley and the adjacent countries. The direction of the undertaking was entrusted to me, after the detailed plans of the proposed expedition had been minutely examined by the Royal Academy of Sciences, and in all points graciously approved by the King.

The land-surveyor, G. Erbkam, from Berlin, and the draughtsmen and painters, Ernest and Max Weidenbach, from Naumberg, and J. Frey, from Basle, were appointed to make the drawings and colored representations, as well as those architectonic plans, which had to be executed on the spot. When J. Frey was obliged to return to Europe from Lower Egypt, on account of the injurious climate, he was replaced by the painter O. Georgi, from Leipzig. Two English artists, also J. Bonomi, who, from the interest he took in the journey, became attached to our party while we were in London, and the architect J. Wild, who joined us of his own accord, took an active part in the expedition as long as it remained in Lower Egypt. Lastly, during nearly the whole of the journey we enjoyed the society of the present Counsellor of Legation, H. Abeken, who accompanied us voluntarily and on an independant footing, and who in various ways promoted the antiquarian objects of the journey. We were also provided with the means of obtaining plaster casts of those representations that were best qualified for the purpose, by the addition of Franke the moulder.

The different members of the expedition arriving by various roads, met in Alexandria on the 18th September, 1842. On the 9th November we encamped near the great Pyramids of Gizeh. What we obtained on that spot as well as from the adjoining Pyramid fields of Abusir, Saqara, and Daschur, which are situated to the south, occupied us exclusively and uninterruptedly for more than six months. The inexhaustible number of important and instructive monuments and representations which we met with in these Necropoli, the most ancient that have existed in any country, surpassed every expectation we had been entitled to hold concerning them, and accounts for our long abode in this part of the country, which is the first approached and visited, but has, notwithstanding, been very little investigated. If we except the celebrated and well known examination of the Pyramids in the year 1837, by Colonel Howard Vyse, assisted by the accomplished architect Perring, little had been done to promote a more minute investigation of this remarkable spot; the French-Tuscan expedition in particular did little more than pass through it. Nevertheless, the innumerable tombs of private individuals grouped about those royal Pyramids, partly constructed of massive square blocks, partly hewn into the living rock, contain, almost exclusively, representations belonging to the old Egyptian Monarchy, which terminated between two and three thousand years before Christ; indeed, most of them belong to the fourth and fifth Manethonic Dynasties, therefore between three and four thousand years before Christ. The wonderful age of these Pyramids, and of the surrounding tombs, is no longer generally denied by intelligent enquirers, and in the first volume of my "Egyptian Chronology," which has lately appeared, I have endeavoured to furnish a critical proof of the certain foundations we possess for a more special determination of time as far back as that period. But were any one only to believe in the lowest acceptation of modern scholars concerning the age of the first Egyptian Dynasties, he would still be compelled to yield priority to those monuments before any other Egyptian remains of art, and generally before all artistic remains belonging to the whole race of man, to which we can historically refer. It is only to this that we can attribute the wonderful growth in the interest which we attach partly to the monuments themselves, as proofs of the earliest activity shewn in art, partly to the various representations of the manner of living in those primitive times.

On the western border of the desert, which stretches from the most northerly groups of Pyramids at Abur Roasch, past the ruins of the old capital of Memphis, to the Oasis-peninsula of the "Faium," we discovered the remains of sixty-seven Pyramids, which with a few exceptions, were only destined for kings, and in the neighbourhood of the principal groups we investigated still more minutely 130 tombs of private individuals, which deserve to be more particularly recorded. A great many of these sepulchral chambers, richly adorned with representations and inscriptions, could only be reached by excavations. Most of them belonged to the highest functionaries of those flourishing Dynasties, among whom were also thirteen princes and seven princesses.

After we had taken the most careful topographical plans of all the fields of the Pyramids, and had noted down the architectonic ground plans, and sections of the most important tombs, and after we had, in the most complete manner, drawn or taken paper impressions of their pictures and inscriptions, as far as they were accessible to us, we had accomplished more completely than we ever hoped to do, the first and most important task of our journey, since we had acquired a basis for our knowledge concerning the monuments of the oldest Egyptian Monarchy.

On the 19th May, 1843, we proceeded still farther, and encamped on the 23rd in the Faium, upon the ruins of the Labyrinth. Its true position was long ago conjectured; and our first view dissipated all our doubts concerning it. The interesting discovery of the actual site of the ancient Lake Mœris was made about the same time, by the distinguished French architect Linant, which we had the opportunity of confirming on the spot. This greatly facilitated the means of comprehending the topographical and historical conditions of this province, so remarkable in all its features. The magnificent schemes which converted this originally desolate Oasis into one of the most productive parts of Egypt, were intimately connected with each other and must have belonged, if not to a single king, still to one epoch of time. The most important result we obtained by our investigations of the Labyrinth and of the adjoining Pyramids, was the determination of the historical position of the original founder; this we obtained by excavations which occupied a considerable time. We discovered that the king, who was erroneously called Mœris by the Greeks, from Lake Mere, (*i.e.*,) from the Lake of the Nile inundation, lived at the end of the 12th Manethonic Dynasty, shortly before the invasion of the Hyksos, and was called Amenemhe by Manetho Amenemes the third of his name. His prede-

* Extracted from "Letters from Egypt, Ethiopia, and the Peninsula of Sinai," by Dr. Richard Lepsius.

cessors in the same Dynasty had already founded the town of Crocodilopis, in the centre of the Faium, which is proved by some ruins that still exist belonging to that period; and they probably conducted the Nile Canal, Bahr-Jusef, which branches off from Derut-Scherif, into the basin of the desert. That part of the basin which is most advanced and situated highest, terminated in a lake formed by means of gigantic dams, many of which still exist; and the connection of the canal was regulated by sluices in such a manner, that in the dry season the reserved water could flow back again into the valley of the Nile, and irrigate the country around the capital long after the Nile had retreated within its banks. Amenemhe built his Pyramid upon the shore of the lake, and a splendid temple in front of it. It afterwards formed the centre of the Labyrinth whose many hundred chambers, forming three regular masses of buildings, surrounded the oldest portion, and according to Herodotus, were destined by the Dodecarchs for the general diets. The ruins of the Labyrinth had never yet been correctly represented, not even in their general arrangement. An Arabian canal, which was carried through it at a later period, had drawn away the attention of passing travellers from that portion of the chambers which was in best preservation. We have made the most exact ground plan, accompanied by sections and views. A journey round the province, as far as Birqet-el-Qorn, and beyond it, to the ruins of Diméh and Qasr Queun, induced us to remain several months in this neighbourhood.

On the 23rd August we embarked at Beni-suef, visited a small rock temple of King Sethos 1st, at Surarieh, on the eastern shore, and farther on the remains of later monuments in the neighbourhood of Tehneh. At Kum-ahmar, a little to the south of Zauiet-el-meitin we examined a series of nineteen rock-tombs belonging to the 6th Manethonic Dynasty. The group of tombs which are scattered about a few days' journey to the south, at Schech-Said, El-Harib, Wadi-Selin, and still farther on, at Qasr-e-Saiat, also belonging to this period, which, in point of age, was immediately connected with the flourishing time of the great builder of the Pyramids. If we judge by the remains now extant, it appears that there were, at that early period especially, in this portion of Central Egypt a number of flourishing cities. Royal kindred are frequently met with among the ancient possessors of the tombs, but no sons or daughters of the king, because there was no royal residence in that neighbourhood. But we found the last flourishing period of the old Monarchy, the 12th Manethonic Dynasty, represented in this part of Egypt by the most beautiful and most considerable remains. The rock-tombs of Beni Hassan, so remarkable for their architecture, as well as for the various paintings on their walls, peculiarly belong to this period. The town to which they appertained, the residence of a governor of the eastern province, has entirely disappeared all except the name, which is preserved in the inscriptions. It appears that it only flourished a short time during this Dynasty and again declined at the invasion of the Hyksos. In the neighbouring Berscheh also, and farther on, among the Lybian rocks, behind the town of Siut, which was as important 4000 years ago as it is at present, we again found the same plans of tombs on as magnificent a scale, whose period of erection might be recognised even at a distance.

It is a singular fact, that in point of age the greater proportion of the remains of the Egyptian monuments become more modern the higher we ascend the Nile valley, the reverse of what might have been expected from a large view of the subject; according to which the Egyptian civilization of the Nile valley extended from south to north. While the Pyramids of Lower Egypt, with the monuments around them, had displayed the oldest civilization of the 3rd, 4th, and 5th Dynasties in such wonderful abundance, we found the 6th Dynasty, and the most flourishing period of the 12th, the last of the old Monarchy, especially represented in Central Egypt. Thebes was the brilliant capital of the new Monarchy, especially of their first Dynasties, surpassing all other places in the number of its wonderful monuments, and even now it offers us a reflection of the splendour of Egypt in her greatest times. Art, which still created magnificent things even in its decline, under the Ptolemies and the Roman Emperors, has left considerable monuments behind it, consisting of a series of stately temples in Dendera, Erment, Esneh, Edfu, Kum-Ombo, Debod, Kalabscheh, Dendur, Dakkeh, which are all, with the exception of Dendera, in the southern part of the Thebaid, or in Lower Nubia. Lastly, those monuments of the Nile valley which are situated most to the south, especially those of the "Island" of Meroe, are the latest of all, and most of them belong to the centuries after the Christian era.

We hastened immediately from the monuments of the old Monarchy in central Egypt to Thebes, and deferred till our return the examination of the well-preserved, but modern temple of Dendera, the ruins of Abydos, and several other places. But of Thebes also, we took but a preliminary survey, for we only remained there twelve days, from the 6th to the 18th of October.

We were impatient to commence immediately our second fresh task, which consisted in the investigation of the Ethiopian countries, situated higher up the river. The French-Tuscan expedition did not go beyond Wadi Halfa; Wilkinson's careful description of the Nile land and its monuments, which contains so much information, only extends a little higher up, as far as Semneh. The most various conjectures were still entertained concerning the monuments of Gebel, Barkal, and Meroe, with reference to their age and their signification. It was necessary to obtain a general view of the true relation between the History and civilization of Egypt and Ethiopia, founded upon a complete examination of the remains which are still extant. Therefore, after a cursory visit to the temple ruins, as far up as Wadi Halfa, we returned to Korusko, from which place we started on the 8th of January, 1844, through the great desert to Abu-Hammed, and the upper Nile countries, on the 16th of January we arrived at Abu-Hammed, on the other side of the desert; on the 28th, at Begerauieh, near to which the Pyramids of Meroe are situated. From Schendi, which lies more to the south, we visited the temple ruins of Naga and Wadi e Sofra, far on in the interior of the eastern desert. On the 5th of February we reached Chartum at the confluence of the White and the Blue Nile. From this place, accompanied by Abeken, I descended the Blue River, passed the ruins of Soba and Sennar, as far as the 13° of N. Lat.; whilst the other members of the expedition returned from Chartum to the Pyramids of Meroe. The tropical countries of the Nile, when contrasted with those northern ones devoid of rain, extending south as far as the 17°, and the plants and animals now almost exclusively confined to South Ethiopia, when compared with individual representations of the ancient Egyptian monuments, were rendered still more interesting by the discovery of some monuments, with inscriptions upon them, near Soba, by which we obtained traces of the ancient vernacular language of those districts in a written character resembling the Coptic.

I also made use of our residence in these districts to be instructed by the natives of the adjacent countries in the grammar and vocabulary of their languages.

On the 5th of April, I returned with Abeken to the other members of the expedition at Begerauieh. After drawings had been made of all that still existed which peculiarly represented the state of civilization in Ethiopia, and after we had taken the most exact plans of the localities, we proceeded in six days, by the desert Gilif to Gebel Barkal, where we arrived on the 6th of May. Here was the more northern, the more ancient, and, to judge by the remains, also the more important capital of the state of Meroe. At the foot of this single mass of rock, which rises in an imposing manner, and is called there, in the hieroglyphical inscriptions, "The Sacred Mountain," is situated Napata. The history of this place, which we may still derive from its ruins, gives us at once a key to the relations which subsisted in general between Ethiopia and Egypt, as regards the history of their civilization. We find that the most ancient epoch of art in Ethiopia was purely Egyptian. It is as early as the period of the great Ramses, who, of all the Pharaohs, extended his power farthest, not only towards the north, but also towards the south, and testified this by monuments. At an early period he built a great temple here. The second epoch begins with King Tahraka, also known as the ruler of Egypt, the Thirhaka of the Bible. This spot was adorned with several magnificent monuments by him and his immediate successors, and though they were built in a style now employed by native kings, it is, nevertheless, only a faithful copy of the Egyptian style. Lastly, the third epoch is that of the kings of Meroe, whose dominion extended as far as Philæ, and was manifested also at Gebel Barkal by numerous monuments. On an intermediate journey into the Cataract country, situated farther up the river, which we had cut off by the desert journey, I found only middle-age, but no ancient Ethiopian remains of buildings.

(*To be continued.*)

Atmospherical Electricity.

BY PROFESSOR JOSEPH LOVERING, OF HARVARD UNIVERSITY.

If we allow ourselves to be instructed by the analogies of the friction electrical machine, the Leyden jar, or the voltaic battery, we shall find that the essential condition for maintaining a charge of electricity, is the existence of two bodies or portions of the same body (which are generally conductors) separated from each other by a non-conducting medium. An electrical charge implies the presence of two bodies in opposite electrical states; and the well-known attraction mutually exerted by two such bodies would lead soon to a discharge, if they were not separated by the insulating medium. There is no reason why the solid earth should not play the part of one of these bodies, while the other is represented by the upper regions of the atmosphere or by the clouds floating therein. As the surface of the solid earth is separated from the region of clouds by the non-conducting air, an electrical charge may be maintained by the earth on the one hand, and by the clouds on the other, and this charge will be limited in intensity only by the dryness of the intervening air. Thus the whole earth resembles a Leyden jar, or more exactly, on account of the large distance between the clouds and the earth, an electrical machine, in which the rubber is moved from the prime conductor by a larger space than that which separates the two coatings of the jar, and in which, therefore, the electricity is more free than in the jar.

Observation shows that this electrical charge which the planet is capable of sustaining, it generally does sustain to a greater or less degree. As every change in the condition of matter, whether mechanical, physical, or chemical, places it in the electrical state—as heat, both directly and by leading to combustion and evaporation, provokes this electrical state.—We are at no loss for exciting agents which shall give to the earth and clouds the whole or a part of the electricity which they are designed to hold.

I shall consider,—1. The ways in which the electrical state of the atmosphere is investigated. 2. The results to which this investigation conducts. 3. The probable causes of atmospherical electricity. And 4. The effects, or the phenomena occurring in meteorology or elsewhere which originate in electrical action.

One way in which the electrical state of the air is examined is by erecting a metallic rod, insulating it from its supports, pointing it at the top, and connecting the lower end with an electrometer. It was on such a rod, erected at Marly-la-Ville according to the directions of Franklin, that Coiffier, the servant of Dalibard, first obtained by a premeditated experiment sparks of atmospherical electricity such as were anticipated from Franklin's prediction. Sometimes the apparatus well known under the name of "the electrical chime of bells" is attached to rods, which have been elevated either for the purpose of studying or of guiding atmospherical electricity, and, by the peal which it sends forth when the electricity descends, this secret of nature is betrayed to all within hearing of the sound, and the attention of the observer is called to his duty. Murray speaks of seeing a set of these electrical bells attached to a lightning-rod near a gateway in Zug, the capital of the Canton, and another in a garden on the route from Zurich to Basle.

When it is desired to make experiments upon greater heights than can be reached by rods, Saussure proposed to throw a ball into the air by means of an arrow or otherwise. A fine wire was attached by one end to this ball, and was carried up with it. The other end was connected with an electrometer. A long wire suspended from a balloon may be used for the same purpose, as was done by Gay-Lussac and Biot, in their celebrated scientific excursions into the air. Becquerel and Breschet employed Saussure's method in their experiments made on the top of the Great St. Bernard. Having spread out upon the ground a piece of gummed sarcenet about eight feet square, upon which they enrolled two hundred and fifty feet of silk cord interlaced with fine wire, they sent it up on the tail of an arrow. The motion of the arrow through the air would not produce of itself any electricity, unless the air were moist. To be certain, however, that no electricity produced by the mode of making the experiment should come in to vitiate the results, these observers first sent the arrow in a horizontal direction, without being able to effect the electroscope.

Another method, at first so striking but now so trite, of making experiments upon atmospherical electricity, is by flying the kite. Here, indeed, was philosophy in sport made science in earnest. Franklin first made this bold experiment, of enticing down the lightning upon the kite-string, familiar to the world on the 15th of June, 1752. Science, poetry, patriotism, will repeat the thread-bare story of the strips of cedar united into a cross and covered with a silk handkerchief, of the key, of the silk ribbon by which he held the string, of his early anxiety and his first disappointment while the string was dry, and his final exultation when the rain wetted it, the hempen fibres began to fly apart, and he drew the first spark of lightning on his knuckles. Romas, for whom Martins has unaccountably claimed priority in the kite experiment attempted to repeat it on the 14th of May, 1753. The weather seemed propitious for the object, but he could get no spark. On the 17th of June he raised a kite with 780 feet of string 550 feet high in the air, and having taken the precaution to twist a fine wire into his kite string he succeeded in obtaining sparks three inches long and one quarter of an inch in thickness.

On the 16th of August, 1757, he performed the experiment with magnificent success, obtaining sparks of lightning one inch thick and ten feet in length. Charles, it is said, did most to give popularity and fame to the kite experiment.

Charles, who was fortunate in having Fresnel as his successor and Fourier as his eulogist in the French Academy, was born at at Baugency on the 12th of November, 1746. He was inspired to undertake physical investigations by the brilliancy of Franklin's career. To this end he left the public service, and lectured on science for thirty years, being honored sometimes by the presence of Franklin and Volta. Franklin complimented his experimental skill by confessing that Nature refused nothing to him, but obeyed him as her master. It is worth remembering, as being perhaps partly the secret of his success, that he studied the minutest points of his lectures with remarkable care; and often expended days in preparing an experiment in his laboratory which flashed off before the public in a few minutes. Among several who experimented with the kite, we may mention Cavallo, who discovered as Islington, in 1775, a large amount of electricity in the air when there was no thunder, and only here and there a solitary cloud. About 1800, Cuthbertson tried experiments on atmospherical electricity with a kite. He made the remarkable observation that the spark was very pungent when a long string was used, and from experiments with an electrical machine he came to the accurate conclusion, that the increased intensity was caused in some way (now better understood) by the length of the string as such, and not by the greater elevation of which a long string admitted. When a jar was slightly charged and the spark was only one tenth of an inch in length, it gave a smart shock if the charge was sent through a long string. For attaining unusual elevations, Cuthbertson conceived the idea of sending out one kite after another, in tandem style, sometimes to the number of three, each with five hundred feet of wire. The opposite currents, which are often encountered at different heights, make this experiment a very difficult one. Sturgeon, of Woolwich, England, made four hundred kite experiments, extending over a period of six years. He describes at length an experiment at Addiscombe in March, 1824. When he had half a mile of string out, he obtained a rapid series of sparks, through a plate of air one and a half inches thick. In the afternoon he attached the lower end of this string to the back of another kite, so as to let out one quarter of a mile more of string. Now the sparks became painful. At other times, even with three kites deployed in line, the electrical effects were insignificant. In hot and sultry weather, Sturgeon found the shocks violent when the kite had risen no higher than a church-steeple, and the string not even insulated. Sometimes they became so intolerable, that he could not pay out the string through the hand, and was obliged to use a reel. Electric disturbances were felt often when the kite was not within a quarter of a mile of any cloud. These were the effects of electrical induction. Sturgeon remarks that "Sergeant Rudd, of the Royal Artillery, if still alive, remembers well the effect of an electrical wave. Having presented his hand to the kite-string several times without experiencing even a spark, in the Artillery Barrack grounds at Woolwich, he began to laugh at the idea of electric shocks from the air. Shortly, however, I espied a cloud making its appearance behind the Repository, and on its approach asked the Sergeant to try again. He did so, but before he got his hand near to the string, a discharge struck it and sent the sceptic reeling, to the great amusement of his brother non-commissioned officers who were present." On the 29th of March, 1842, Sturgeon floated his kite with three hundred yards of wired cord just before the approach of a hail-storm, when he obtained a rapid succession of sparks through an interval of air six inches in length, or a constant stream of fire through a length of three inches. It was no unusual sight for the string and reel to bristle with purple light, and the blades of grass for yards around to be tipped with fire. Once Sturgeon lost a kite by the melting of the wire nine hundred feet from the ground. A cloud was visible, but no thunder was heard. In 1834 a man received a severe shock from a kite-string which he touched with a stick four feet long. This occurred during a hail-storm. On one occasion, Sturgeon received a shock through three feet of dry ribbon, attached as a handle to the kite-string, when no visible cloud was within a mile. The end of the string was tied to a tree, and it was not possible to take down the kite until a cloud far to the windward had passed over to the leeward. And generally, the presence of a cloud makes a decided effect on the electrical activity of the atmosphere. Franklin and Saussure were under the persuasion that lightning never issued from a lone cloud. But Arago has adduced five cases in which destruction to trees and animals has come forth from this source. As such a cloud approaches the kite, the electrical sparks drawn from the string increase in length and intensity.

Weekes has objected to the kite experiment as a proper means of studying atmospherical electricity, because it is calculated to give only local phenomena. He thinks that the more general features of the case would be better obtained by horizontal wires of great length, and presenting a large amount of surface to the influence of the air. About 1841, Weekes erected a wire for this purpose at Sandwich, on the south-east coast of England. This wire was stretched over the town, a distance of 1095 feet, and one end was attached to the vane-spindle on the tower of St. Peter, and the other to the vane-spindle on the tower of St. Clement. The elevation of the wire at the two extremities was one hundred and thirty-six feet above a base line running between the two edifices. Its average elevation above the sea was fifty-five feet. A vertical wire was attached to the middle of this horizontal wire, and descended into the room of the observer. Provision was made to carry the charge, in whole or in part, to a distant well, whenever it became dangerous in magnitude or suited the purpose of the observer to do so. Weekes observes, that, "even the light and feathery aggregations of the summer cloud are sufficient to effect the electroscope, through their inductive action on the outstretched wire. And when thunder-clouds were forming, the action was so potent that liquids were chemically decomposed, metals were deflagrated, and large quantities of coated surface were charged and discharged in a few seconds. Some inconvenience arose from the weight of birds, particularly of swallows, which settled on the wire. Sometimes they occupied the whole length of wire in a protracted session, debating as it might seem in relation to their autumnal departure for fairer climes. Weekes remarked, that on the 16th of September, 1840, during a sudden rain, there were witnessed furious discharges of sparks from ball to ball of his apparatus, though there was but little thunder, and an interval of five or six seconds between the flash and the report showed that that little was a mile distant. Weekes after a time found it necessary to confine the horizontal wire near the middle, to protect it from the violence of the winds. Before he did so, it gave out music, as the telegraph-wires are known to do, like a vast Æolian string. His neighbors regarded these sounds with superstitious awe, and predicted that no good would come of them. No good did come to Weekes; for they persecuted him in all the little ways which are still possible in an age of freedom and intelligence.

The apparatus and experiments of Weekes have served to attract attention to observations which Crosse had been making on the same subject at Broomfield for thirty years. Crosse's atmospheric apparatus consists of wire, one third of a mile in length, insulated upon poles or upon the tops of trees in his park. By the slight motion of a lever, the electricity from the air is introduced into his study or dismissed into a safety channel which is connected with the ground. Crosse's wire is higher above the level of the sea than Weekes's apparatus, but it does not stand so high above the ground underneath, and hence it did not manifest so energetic symptoms of electricity. But even this sufficed to charge and discharge a Leyden battery with seventy-three feet of coated surface, twenty times in a minute, and with a report as loud as that of a cannon. Strangers ran away, and an exaggerated report was spread, that the neighborhood was filled all the time with thunder and lightning. This alarm had the advantage of protecting the fruit-trees of Crosse from the depredations of vagrants. Crosse is a retired country gentleman, and has spent fifteen thousand dollars on his apparatus, although he is his own mechanic. In spite of his own modesty he has obtained celebrity from those experiments, on which the author of the "Vestiges of Creation" has laid stress. Sir Richard Philips has given some account of a visit which he paid to Crosse's scientific establishment. He found there his voltaic magazine, consisting of 2500 pairs of voltaic elements, 2,000 of which were in operation at one time.

The immense length of telegraph-wire standing in this country and elsewhere has entirely eclipsed the apparatus of Weekes and Crosse, though not originally intended, nor often used, for studying atmospherical electricity. Even when the wire is not struck, it is electrified by induction, and the lightning begins to make the record on its own account. Sometimes this induced action is felt at the distance of twenty miles. A storm at Baltimore has set the magnets in motion at Washington. Professor Henry has recorded a case, where the writing part of the telegraph began to work at one end of the line, from the influence of a snow-storm at the other end. The presence of induced electricity on these wires will also betray itself by a spark wherever there is a break.

I have finished the general description which I intended to furnish of the various appliances to which observers have resorted, in testing the presence and character of atmospherical electricity. And I am now ready to give some of the results of their investigations: such, at least, as have not been already anticipated. The first and most fundamental of these results was the discovery of the reality of atmospherical electricity; the determination, that is, of the identity between lightning and electricity. This identity, speculatively dreamed by Gilbert and revived in the minds of Hawksbee, Wall, Winkler, Gray, Nollet, was apprehended by Franklin with a clearness and force of conviction which did not let him rest until he had settled the question experimentally. The proof of this identity consisted in drawing down the lightning from the skies in moderate quantities, and performing with it the common experiments of electricity. As the science of electricity has acquired a wider range by the discovery of voltaic electricity and electro-magnetism, an opportunity has been afforded for placing the identity of atmospheric and common electricity upon a broader basis. While, therefore, Franklin and his contemporaries charged the Leyden jar with lightning, and showed the shock, the spark, the heat, of electricity, Sturgeon, Colladon, and Peltier have used it to magnetize steel needles and to deflect the galvanometer.

Other results which have been experimentally obtained are in answer to such questions as these:—Is the electricity of the atmosphere and of the clouds positive or negative? How is it distributed? What relation does it bear to times and seasons? How is it produced? What are its effects?

With regard to the character of the electricity, it may be said that the earth is generally charged negatively, and the atmosphere positively; the intensity of the positive charge increasing with the elevation of the stratum observed. Any discrepances between observers in respect to this point may be referred to local action. Peltier has proved the negative character of the solid earth as compared with its atmosphere by means of the galvanometer. One end of the multiplier was joined to a pointed rod of metal and raised into the air, the other end being soldered to a metallic plate which was buried in the earth. As the electricity under examination possesses considerable tension, the the strands of the multiplier must be insulated from each other with unusual care. Sturgeon found the electricity of the air most positive during the cold northeast winds of March. Weekes observed that the electricity was strong when there was a breeze from the eastward. Cuthbertson states that he always found the electricity of the air positive. Crosse, on the other hand, thought the air was always negative. Davy, too, in his Agricultural Chemistry, seems to imply that the air is negative. In some of the observations, probably, the requisite precautions were not taken to guard against deception. Pine cautions the observer against making his experiment near a tree. The free electricity of the air, positive in character and increasing with the elevation of the spot observed, is not found in the interior of buildings. The air of rooms vitiated by respiration is negative according to Murray. He also states that the air at Orbitello and in the Pontine Marshes is negative. The most intense charge is observed in open places, such as quays, bridges, and squares. In such localities as Geneva, where low fogs prevail, it is particularly intense. A persistent series of systematic observations in electrical meteorology may perhaps bring these discordant and anomalous results of observation into harmony with each other. It is no small part of the difficulty, that the instruments which report of the electrical state of the air may, like those which measure its temperature, or its moisture, or its winds, respond more promptly to local than to general influences, and so give an uncertain sound, instead of registering that state, as the barometer registers the physical element to which it is adapted, in its most general character. A series of daily observations made by Schubler, at Stuttgard, from May, 1811, to June, 1812, in all kinds of weather, may throw some light upon the subject. He reached the following results:—1. The charge of electricity is more intense in storms of rain, or hail, or snow, than when the sky is fair. 2. At such times the charge is as often negative as positive. 3. The character in this respect often changes suddenly. 4. In cloudy weather, without any storm, the charge is positive. 5 The intensity of the charge is greater in winter than in summer. Schubler also studied the electrical phases of the atmosphere at different periods of the day, and discovered some correspondence between the diurnal variation of the magnet and the daily curve of electrical intensity. The minima of intensity occurred before sunrise and again two or three hours after noon, and the maxima two or three hours after sunrise and after sunset. The range of the daily change increased from July to January, and decreased from January to July. In 1830, Arago repeated at Paris the same series of observations on the daily curve, and with similar results.

As a body becomes positively charged only at the expense of another which loses electricity and is therefore negatively charged, the electricity of the air and of the clouds, whether in fact positive or negative, implies the existence of an opposite charge in the earth itself. The solid earth, *with* its atmosphere, has the same average fund of electricity always. There is no proof that it ever borrows electricity of foreign orbs or makes to them a loan of its own. The phenomena under consideration are purely meteorological, and not cosmical. It is by a change in the distribution of this normal quantity of electricity that one part of the planet acquires an excess while another is deficient. But it is not so easy to prove by direct experiment that the earth is negatively charged, as to draw down and handle the positive electricity of the clouds. The unequal amount of evaporation in different parts of the earth's surface, and a partial distribution of moist winds, will produce charges of electricity in the air much larger at some places than at others, and the imperfect conducting power of the air will be unfavourable to a speedy equalization. On this account the electricity of the air will be in a large sense of a local character. The opposite and corresponding charge of the solid earth will more easily spread over its whole surface. With the ample range thus afforded to its own inherent diffusiveness, it will retain only a feeble power at any one place. It is not surprising, therefore, that the electrical charge of the solid earth is rarely recognized by the senses. Sometimes, and in some places, geographical locality may be opposed to an immediate diffusion of the electricity, so that if the exciting cause is active, a sufficient charge may accumulate to attract attention. In such cases, the electricity, following so far as it can spread the usual laws of distribution, will concentrate its forces around the sharp peaks of mountain-tops, which are the natural and appointed dischargers to the planet. Hence positive clouds are seen to congregate as if by electrical attraction around the pinnacled battery of the earth. The electricity of the earth shows itself, if at all, by a brush or star of light on pointed objects resting on the earth, and projecting into the air. The records of these displays have accumulated with years, and are found in the literature and common language of every age and country. The ancients distinguished them by the name of Castor and Pollux. In modern times, and around the shores of the Mediterranean, they are hailed as the light of St. Clare, St. Nicolas, St. Helena, and elsewhere they bear the appellation of St. Barbe or St. Elmo. The Portuguese call them Corpo Santo, and the English, Comazants. These lambent flames, as they appear, have been seen blazing from the summits of the Himalaya and Cordillera mountains. They are frequently seen tipping with fire the masts and spars of ships. We are told that in the voyage of Columbus, as soon as St. Elmo appeared with his wax tapers, the sailors began to sing, thinking that the storm was over. The electricity of the earth while in the act of discharging itself into the air has been seen edging with light the manes of horses, the metal trimmings of their harness, the lashes ot whips, the brims of hats, the tops and edges of umbrellas, the sharp points of swords and lances, the extremities of hair and whiskers, the corners of chapeaux, the buttons upon the coat, filaments of straw, the beaks of birds, and the myriad needle-like terminations of vegetable growth, with that incomparable point and finish which they took from Nature's own hands. In 1778 these electrical brushes embellished the crosses upon the steeples in Rouen, as well as other points of eminence. At the siege of Kingsall, in 1601, the sentinel saw electrical tapers burning on the points of lances and swords. Guyan says, that they are often noticed on the bayonets of the soldiers at Fort Gowraya, Bougie, 2200 feet above the level of the sea. During a thunder-storm they have appeared like the work of induction, gleaming upon the points of the fire-arms in the armory of the Tower of London. In Poland, Captain Bourdet was astonished to see, in December, 1806, the electrical glow upon the ears of the horses, on the metallic knobs of their harness, and on the whiskers of the troops. On the 25th of January, 1822, the tops of the trees at Freyburg were touched with light during a snow-storm. In 1824, a load of straw became animated and danced the electrical hop, each straw standing on end, and shining at the top. In 1825, Sir William Hooker and a party of botanists who were upon Ben Nevis, shed the electrical light from their hair when they lifted their hats. In May, 1831, the hair of the officers at Algiers stood erect, decked out with fire. Walker, the English electrician, on the 8th of September, 1842, saw the same light on the top of his own lightning-rod. On the 17th of January, 1817, an extensive snow-storm was experienced in Maine, Vermont, Massachusetts, and even in Pennsylvania and Georgia. Professor Cleaveland says, that upon this occasion three persons, crossing the bridge over the Androscoggin, observed the borders of their hats to be luminous, and the ends of their fingers, though covered with gloves, were radiant with light. Professor Dewey of Williamstown relates, that upon the same occasion a physician saw the light upon the ears and hair of his horse. A gentleman tried to brush it from his hat, thus reminding one of the sailor who was sent to the top-mast to bring the fire of St. Elmo down. In both cases the experiment was attended with the same success. The light spread more widely for being disturbed. Other persons witnessed the same brightness on the trees, fences, and logs. It was reported that a hiss was heard when the hand was presented to these objects. Moreover, the lightning was frequent. A young man in Vermont described the phenomenon after this wise. It appeared as a star or spark oftener than as a brush. A sound could be heard at the distance of six or eight feet resembling that of water in a tea-kettle just before it boils. The effect was greater on high ground than on low, so that the light was then seen on the hat and shoulders. The brush was sometimes two inches in length, and three quarters of an inch in diameter. To spit was to emit from the mouth a luminous stream of fire. At Shelburn, Massachusetts, a similar light was seen upon a well-pole: when the end came down the light disappeared, and was kindled again when it went up. Arago mentions other cases where the spit was luminous, and one at least has come within my personal observation at Cambridge. In 1767, Tupper and Lantiar observed near Mount Etna, that by moving their hands through the snowy air they produced sounds which could be heard at the distance of forty feet. In 1781, Saussure, the great Alpine observer, felt a cobweb sensation among his fingers, and his attendants were able to draw sparks from a gold button on his chapeau. The beaks of birds have appeared luminous during storms, and it has been suggested that the eagle by some preeminence in this respect acquired its cognomen of the minister of the thunder-bolt. We may introduce here an experience of Sabine and James C. Ross, during an arctic voyage, as indicating possibly the electrical condition of the earth or air. They entered a luminous track, about four hundred metres long, and while in it they could see the tops of their masts, the sails and cordage of their ship, and when they left it they passed suddenly into outer darkness.

Arago has collected, with amazing industry, passages from the classics which may possibly contain allusions to the electrical light. Thus Cæsar, in the African War, says that the lances of the fifth legion seemed on fire during a night of hail-storms. Livy states, that the javelin of Lucius Atreus cast forth flames for two hours without being consumed. Plutarch records the fact, that when the fleet of Lysander was on the point of attacking the Athenians, Castor and Pollux arose and stood on the two sides of the galley of the Lacedemonian admiral. He refers to similar observations in Sardinia and Sicily. Pliny had seen just such lights on the points of the soldiers' pikes. Seneca alludes to a star which reposed on the iron part of the lance of Gylippus, near Syracuse. And then there was the fire around the head of Ascanius.

(*To be continued.*)

Francois Arago.*

Death has recently made grievous inroads into the ranks of French science. We have seen the fall, successively, of Laurent, Auguste de St. Hilaire, the Botanist, Adrien de Jussieu, the last male descendant of the brilliant dynasty of the Jussieus, who died in July last, President of the Academy of Sciences, and member of the Botanical Section. A loss, still more recent, has increased this list of the dead—a loss irreparable, for it is that of a man, who was at the same time an illustrious philosopher, a champion of popular progress, and a distinguished citizen.

Francois Arago was born on the 26th of February, 1786, at Estagel, a small village of 3000 inhabitants, situated near Perpignan (Eastern Pyrenees). His father was Treasurer of Perpignan. With a moderate patrimony, and a numerous family, he could not give his children a liberal education; but Madam Arago was able to supply it, and devoted herself to their instruction; and she afterwards had the richest recompense which a mother can look for: her sons were all men of distinction. Besides Francois, who immortalized himself by his discoveries, we see Jacques and Etienne, who are distinguished in literature; Jean and Joseph, who were brave officers in the Mexican service; and last, Victor Arago, the youngest, now commandant of the Artillery.

The appearance of Francois Arago on the arena of Science was most opportune. His father had destined him to the law; but the young man had other tastes. He met one day an officer of engineering drawing a plan on the ramparts of the city, and enquired of him how he could obtain the right of wearing so fine a uniform. "Become a scholar of the Ecole Polytechnique," was the reply. From that time the career of the young man was determined. Having no instructors, he gave himself to books, and in 1803, at the age of 17 years, he entered this National School.

At the end of a year he had left behind him all his fellow students, and was attached by Monge to the Observatory of Paris, where he commenced his researches in Physics and Astronomy.

In 1806, he left for Spain, where he continued under the direction of M. Biot, the measure of the meridian of France, which had been interrupted by the death of Mecham. On the demand of the National Convention which established the Decimal system, Delambre and Mecham undertook the measurement of an arc of the meridian between Dunkerque and Barcelona. It was this measurement that MM. Biot and Arago continued to the Balearic Islands. This journey in Spain was full of dramatic incidents to Arago. Encamped on the summits of the elevated peaks of Catalonia, our observer had to contend in turn with the wind, the cold, and hunger, and also with brigands, the chief of whom ended by becoming the Protector of our young savants.

A year after their departure for Spain, MM. Biot and Arago had nearly completed the measurements as regards Spain. The former then returned to Paris, and Arago went on to Majorca to continue his operations. But the war was on the point of breaking out between France and Spain; and the night signals, the instruments, and the movements of the young Frenchmen who remained at work about the summit of Galatzo, rendered him an object of suspicion to the Majoreans, and Arago was arrested and thrown into the citadel of Belver. He managed to escape, and embarked with his papers and instruments for Algiers. The French Consul made him reembark for Marseilles, but at the moment of entering the Gulf of Lyons, the vessel was captured by a Spanish corsair and conducted to Rosas; Arago and his companions were at first imprisoned and then thrown into the Pontoons of Palamos. At last, through the reclamation of the Dey of Algiers, to whom the vessel belonged, Arago and his associates were returned to Algiers. But a revolution had there taken place, and the Dey had just been decapitated; the new Dey was unwilling to let Arago go away, whom he supposed to be possessed of treasures, and under the direction of the Danish Consul, Arago was consequently thrown into slavery. Finally, after a series of vicissitudes of various kinds, he succeeded again in quitting Algiers, and on the 2nd of July, 1809, he entered the Lazaretto of Marseilles, with all his instruments which he had succeeded in preserving.

France had believed him dead. The first letter which arrived for him at the Lazaretto was one from Humboldt, who knew him only from his misfortunes, and from that time a friendship commenced between these two great men which continued to the end. On the 17th of the September following, Arago entered the Institute: he was then 23 years old. Already he had made with Biot an extensive work on the determination of the coefficient for tables of Astronomical refraction; he had measured the refraction of different gases, a research that before had not been attempted; he had determined the relation between the weight of air and that of mercury, and found a specific value for the coefficient in the formula for calculating the heights of mountains from barometric observations; he had also made an important investigation on the velocity of light, and numerous observations towards the verification of the laws of libration; and finally he completed the triangulation prolonging the meridian of France to the island of Formentosa.

In 1812, the Bureau des Longitudes charged him with the delivery of a course of lectures on Astronomy at the Observatory, which was continued until 1847, presenting in them the most arduous details of the science. On the 7th of June, 1830, he was named perpetual Secretary of the Academy of Sciences, replacing Fourier. From this moment a new life actuated the Academy, and it was under the impulse received from Arago that this illustrious society attained in a great degree to that distinguished standing and authority now accorded to it by the scientific world.

The revolution of 1830 broke out, and Arago entered political life. Named a member of the Chamber of Deputies, he took his seat among the republicans; and being a great orator, he was not slow to acquire influence in the parliamentary debates. It was on his Report, that a national recompense was voted to Daguerre, the inventor of Photography, and to Vicat, the inventor of hydraulic cements. He voted the printing of the works of La Place and those of Fermat; he defended the railroads against the coalition of the "maitres de porte;" he protected electric telegraphs against the adverse intentions of the administration represented in the Chamber of Deputies by M. Pouillet, the physicist; in a word, in all circumstances, Arago was at the head of Progress.

The revolution of 1848 brought Arago into the Provisional Government. He had just completed his eulogy of Bailey, the Astronomer, the friend of Franklin, who took an active part in the revolution of 1789, of which he was a victim. Reasoning by analogy, Arago looked for a like fate. This fear was happily exaggerated. Times had changed as well as circumstances, and the only analogy between the two men, Bailey and Arago is that both were astronomers and both perpetual Secretaries of the Academy of Sciences.

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* Correspondence of M. Jerome Nickles. Silliman's Journal.

After the coup d'etat of December 2, 1851, Arago refused to take the oath of allegiance, which was required of him in his capacity of director of the Observatory, and thus made manifest once more that politics ought to be kept aloof from Science.

A life of so much labour had worn down his health. Although attacked with diabetes, he still contemplated putting the last touch to his unfinished works. Bright's malady set in and aggravated his situation, which was complicated with dropsy of the abdomen, attended with effusions, and swelling of the extremities. All announced his approaching end: yet his mind was not for a moment obscured. Shortly before his death, although blind, he superintended in some difficult researches; he asked M. Babinet to prepare for him a table of more accurately determined numbers for the lengths of undulations, that he might bring to completion a memoir of interferences; and he finished the editing of his Physical researches on the Planets, &c. &c. He died in the midst of these arduous occupations, on the 2nd of October, at the age of 67½ years, a few minutes after having shaken the hand of M. Biot.

We have mentioned some of the works which Arago accomplished in his younger days, These works were completely eclipsed by the discoveries to which his name has since become attached, which embrace the following principles:—

1. The discovery of chromatic and rotary polarization.

2. That of Electro-magnets.

3. That of the magnetism which is developed when bodies are revolved near a magnet.

Arago was an Encyclopædic genius. Science, Literature, Political and Social economy, his vast intelligence embraced all with equal ability. His powerful faculty of assimilation, popularization, and of application of principles, placed him everywhere in the first rank. Whether Orator or Professor, he shone with brilliancy both in political and scientific assemblages. He was distinguished for the perspicuity and elegance of his style, and occupies an eminent place among the prose writers of France.

In the midst of so much grandeur, Arago led a most modest life. He considered as lazy whoever did not work fourteen hours a day; and such days were for him days of repose. Although so absorbed with his occupations, he still found time to appear in the society of Paris as one of its most spirited conversationists.

While devoted to continued labor, he completely forgot his own interests, and had only what was barely necessary for the support of his family He left two children, one Emanuel Arago, an eloquent orator of the bar of Paris and of Republican assemblies, the other Alfred Arago, a distinguished painter. If he has not bequeathed to them a fortune, he has left an immortal name: he has created by his genius a renown more illustrious than all the renown ever gained by arms—which for a long time enjoyed the privilege of giving fame, but now yields the right to the peaceful conquests of science.

Geology of Gold.

The geology of gold may now be considered as tolerably well understood. *In situ*, it is found in the primitive rocks, granite, gneiss, mica slate, clay-slate, and porphyry; and having been freed from its original bed by the decomposition and disintegration of the rocks, and washed out by the rains, it is found in the beds of mountain streams and rivers, and in many alluvial soils in flat countries, through which mountain torrents occasionally flow. It is most frequently associated with quartz and oxides of iron, and with iron pyrites, sometimes with felspar, hornstone, calcareous spar, barytes, red silver ore, silver glance, sulphuret of copper, peacock copper ore, malachite, the various ores of lead, sulphuret of zinc, grey ore of antimony, cobalt, manganese, copper nickel, arsenical pyrites, orpiment; and this information will enable parties in possession of mineral lands to form a judgment whether specimens from them are worthy of a trial for the production of the precious metal In addition to Australia, and the developement of gold in Great Britain and Ireland, it is the opinion of Mr. Calvert, and many explorers in Canada, that the gold deposits discovered in the valley, and in the sands of the Chaudiere River, will lead to the developement of other highly important results in that colony, and we would here remark, that although Mr. Calvert's exertions are not duly appreciated in some quarters as they deserve, he undoubtedly is entitled to all credit as the principal pioneer in the present movement.

Central Africa.

Dr. Vogel in a letter addressed to Colonel Sabine dated Mourzuk, October 14th, 1853, says:—

"There is no regular rainy season at Mourzuk; but slight showers occur sometimes in the winter and spring; seldom in the autumn. Heavy rain is considered as a great calamity, as it destroys all the houses, which are built of mud dried in the sun. It also kills the date-trees, by dissolving the salt which exists in large quantities in the soil. About 12 years ago about 12,000 date-trees perished in the neighbourhood of Mourzuk, on account of rain which continued for seven days. The prevailing winds are south and east; the strongest generally west or north-west. I have seen whirlwinds two or three times pass through the town,—a phenomenon which was common in the desert between Bencolua and Mourzuk: all the whirlwinds which I observed turned from the east to north, and went to south

"In December and during the first half of January, the thermometer falls at sunrise, at Mourzuk, as low as 42°, and in places exposed to the wind water freezes during the night. At Sakna, I could not find any one who could remember having seen snow. At Tripoli we had heavy dews at night, and I observed the same until we had passed a small chain of mountains fifteen miles north of Sakna. Thence we had no dew, and it was often impossible to obtain the dew point with Daniell's hygrometer. In the desert the thermometer generally rose till 4 P. M., from the sand (which was sometimes heated to 140°,) giving out its heat. Earthquakes are sometimes felt. Great numbers of shooting stars were observed on the 7th, 8th, and 31st of July; very few on the evenings of the 9th, 10th, and 11th of August; but they were again very numerous on the 1st, 2nd, and 3rd of October."

On the Food of Man.*

BY DR. LYON PLAYFAIR, C.B., F.R.S.

The author commenced by adverting to our very imperfect acquaintance with the statistics of Food. We are still ignorant regarding the quantity of the different proximate constituents of aliment necessary for man's sustenance, even in his healthy and normal condition. If the question were asked—How much carbon should an adult man consume daily?—there would be scarcely more than one reliable answer, viz., that the soldiers of the body-guard of the Duke of Darmstadt eat about 11 oz.† of carbon in the daily supply of food.

*This is an Abstract of a Lecture given at the Weekly Evening Meeting at the Royal Institution, Friday, May 6, 1853.

†Liebig states it at a higher amount, but this is a re-calculation from the new food table.

If again the question were asked—How much flesh-forming matter supports an adult man in a normal condition?—no positive answer could be given. Even, as respects the relation between the carbon in the flesh-forming matter and that of the heat-givers, we have no reliable information. It is true that certain theoretical conclusions on this head have been drawn from the composition of flour, but no real statistical answer deduced from actual experience exists.

When we inquire into the cause of our ignorance on these points, it is found that the progress to knowledge is surrounded with difficulties. Neither chemistry nor physiology is in a sufficiently advanced state to grapple satisfactorily with the subject of nutrition. For example, we know that albumen in an egg is the starting-point for a whole series of tissues; that out of the egg come feathers, claws, fibrine, membranes, cells, blood corpuscles, nerves, &c., but only the result is known to us; the intermediate changes and their causes are quite unknown. After all, this is but a rude and unsatisfactory knowledge. Hence, when we approach the subject it is only to deal with very rough generalities. Admitting that the experience of man in diet is worth something, it is possible to arrive at some conclusions by the *statistical* method—that is, by accepting experience in diet and analyzing that experience. Take, for example, the one general line of Pauper Diet for the English counties placed in the table at the end of this notice. The mode of arriving at the result of experience, in the case of paupers, was to collect it from *every* workhouse in the kingdom, and then to reduce it to one line. But the labour of this is immense. In the preparation of this one line the following work had to be performed in acquiring the data:

Number of Unions applied to	542
Number of Explanatory letters sent to them	700
Number of Calculations to reduce the results	47,696
Number of Additions of the above calculations	6,868
Number of Extra hours, *beyond the office hours*, paid to a Clerk for the reduction	1,248

The statistical method, besides being very laborious, is extremely tedious, and has thus deterred persons from encountering it. In giving, therefore, an example of some of the results which have been collected within the last few years, they will represent much labour, but very little or no originality.

The lecturer then alluded shortly to the conditions in nutrition, which must be borne in mind in looking at these results. It was now admitted that the heat of the body was due to the combustion of the unazotised ingredients of food. Man inspires annually about 7 cwt. of oxygen, and about one-fifth of this burns some constituent and produces heat. The whole carbon in the blood would thus be burned away in about three days, unless new fuel were introduced as food. The amount of food necessary depends upon the number of respirations, the rapidity of the pulsations, and the relative capacity of the lungs. Cold increases the number of respirations and heat diminishes them; and the lecturer cited well known cases of the voracity of residents in Arctic Regions, although he admitted, as an anomaly, that the inhabitants of tropical climates often show a predilection for fatty or carbonaceous bodies. He then drew attention to the extraordinary records of Arctic dietaries shown in the table, which, admitting that they are extreme cases, even in the Arctic Regions, are nevertheless very surprising.

Dr. Playfair then alluded to the second great class of food ingredients, viz., those of the same composition as flesh. Beccaria, in 1742, pointed to the close resemblance between these ingredients of flesh, and asked "Is it not true that we are composed of the same substances which serve as our nourishment?" In fact the simplicity of this view is now generally acknowledged; and albumen, gluten, casein, &c., are now recognized as flesh-formers in the same sense that any animal aliment is. After alluding to the mineral ingredients, attention was directed to a diet-table, which contained some modifications, but was based on the one published in the *Agricultural Cyclopædia* under the article *Diet;* the table as shown being used in the calculation of the dietaries.

The old mode of estimating the value of dietaries, by merely giving the total number of ounces of solid food used daily or weekly, and quite irrespective of its composition, was shown to be quite erroneous; and an instance was given of an agricultural labourer in Gloucestershire, who in the year of the potato famine subsisted chiefly on flour, consuming 163 ounces weekly, which contained 26 ounces of flesh-formers. When potatoes cheapened, he returned to a potato-diet, and now eat 321 ounces weekly, although his true nutriment in flesh-formers was only about eight or ten ounces. He showed thus further, by calling attention to the six pauper dietaries formerly recommended, to the difference between the salt and fresh meat dietary of the sailor, &c., all of which, relying on absolute weight alone, had in reality no relation in equivalent nutritive value.

Attention was now directed to the diagrams exemplifying dietaries. Taking the soldier and sailor as illustrating healthy adult men, they consumed weekly about 35 ounces of flesh-formers, 70 to 74 ounces of carbon, the relation of the carbon in the flesh-formers to that of the heat-givers being 1 : 3. If the dietaries of the aged were contrasted with this, it would be found that they consumed less flesh-formers (25—30 ounces,) but rather more heat-givers (72—78 ounces;) the relation of carbon in the former to that of the latter being about 1 : 5. The young boy, about ten or twelve years of age, consumed about 17 ounces weekly, or about half the flesh-formers of the adult man; the carbon being about 58 ounces weekly, and the relation of the two carbons being nearly 1 : 5½. The circumstances under which persons are placed influence these proportions considerably. In workhouses and prisons the warmth renders less necessary a large amount of food-fuel to the body; while the relative amount of labour determines the greater or less amount of flesh-formers. Accordingly it is observed that the latter are increased to the prisoners exposed to hard labour, From the quantity of flesh-formers in the food, we may estimate approximately the rate of change in the body. Now a man weighing 140 lbs. has about 4 lbs. of flesh in blood, 27½ lbs in his muscular substance, &c., and about 5 lbs. of nitrogenous matter in the bones. These 37 lbs. would be received in food in about eighteen weeks; or, in other words, that period might represent the time required for the change of the tissues, if all changed with equal rapidity, which is, however, not at all probable.

All the carbon taken as food is not burned in the body, part of it being excreted with the waste matter. Supposing the respirations to be 18 per minute, a man expires about 8.59 oz. of carbon daily, the remainder of the carbon appearing in the excreted matter.

In conclusion, Dr. Playfair explained how the dietary-tables elucidated the various admixtures of food common to cookery, and how they might even be made to bear on certain national characteristics, which were in no small degree influenced by the aliments of different nations.

EXAMPLES OF DIETARIES AS SHOWN IN THE DIAGRAMS.

REMARKS	Weight in Ounces per Week.	Nitrogenous Ingredients	Substances free from Nitrogen.	Mineral Matter.	Carbon.	Proportion between Carbon in Flesh-Formers.	Carbon in Heat-Givers.
Dietaries of Soldiers and Sailors.							
English Soldier	378	36.15	127.18	4.92	71.68	1	3.66a
Ditto in India	261	34.15	103.19	2.39	66.32	1	3.58a
English Sailor (Fresh Meat)	302	34.82	102.89	3.17	70.55	1	3.70a
Ditto (Salt Meat)	290	40.83	132.20	6.03	87.40	1	3.94a
Dutch Soldier, in War	198	35.21	102.08	1.85	74.08	1	3.87b
Ditto in Peace	383	24.52	106.80	4.15	70.77	1	5.32b
French Soldier	347	33.24	127.76	4.62	85.25	1	4.72c
Bavarian ditto	242	21.08	102.10	3.32	62.45	1	5.47c
Hessian ditto	423	23.0	136.0	...	77.0	1	6.16d
Dietaries of the Young.							
Christ's Hospital, Hertford	216	17.16	61.27	2.47	39,18	1	4.21e
Ditto ... London	242	17.27	76.82	2.84	46.95	1	5.02e
Chelsea Hospital, Boys School	245	12.89	93.28	5.93	57.67	1	8.29e
Greenwich Hospital, ditto	231	18.43	86.73	2.62	52.87	1	5.29e
Dietaries of the Aged.							
Greenwich Pensioners	269	24.46	122.21	3.54	72.43	1	5.46f
Chelsea ditto	332	29.95	112.64	4.65	78.03	1	4.80f
Gillespie Hospital, Edinburgh	156	21.02	92.32	2.35	71.39	1	6.26f
Trinity Hospital, ditto	192	19.63	97.34	3.33	57.30	1	5.38f
Old Pauper Dietaries.							
Class 1.	...	20.21	88.61	3.27	54.30	1	4.95g
" 2.	...	14.96	89.59	2.89	51.10	1	6.31g
" 3.	...	15.78	99.88	3.91	55.43	1	6.50g
" 4.	...	19.22	116.84	3.96	67.87	1	6.50g
" 5.	...	15.49	96.51	3,58	54.72	1	6.53g
" 6.	...	14.67	88.03	2.84	49.57	1	6.25g
Average of all English Counties in 1851	...	22.0	99.0	...	58.0	1	4.85h
St. Cuthbert's Edinburgh	175	14.80	89.37	3.31	46.98	1	5.85 i
City Workhouse, ditto	107	13.30	49.99	1.74	31.48	1	4.36 i
English Prison Dietaries.							
Class 2. Males	206½	15.28	111.85	3.46	59.23	1	7.13j
" 3. ditto	276	18.26	123.60	4.05	67.53	1	6.81k
" 4, 8 and 9. ditto	229	20.97	159,98	5.03	69.88	1	6.13l
" 5. ditto	326	20.29	130,57	4.23	73.31	1	6.65m
" 6. and 7. ditto	271½	20.97	125.98	5.03	69.88	1	6.13n
Bengal Prison Dietaries.							
Non-Labouring Convicts	224	18.43	163.16	2.08	76.35	1	7.62o
Working Convicts	296	28.16	191.12	2.97	91.07	1	5,96o
Contractor's insufficient Diet	167½	12.70	135,95	1.30	61.33	1	8.88o
Bombay Prison Dietaries.							
All Classes of Prisoners not on Hard Labour	182	28.00	101.50	2.03	68.81	1	4.52o
Hard Labour	224	35,63	128.80	2.45	87.22	1	4.50o
Arctic and other Dietaries.							
Esquimaux	...	250.0	1280.0	...	1125.0p	—	—
Yacut	...	999.0	640.0	...	966.0p	—	—
Bosjesmen	...	574.0	368.0	...	555.0p	—	—
Hottentot	...	424.0	400.0	...	604.0p	—	—
Agricultural Labourer, England	163.6	26.64	106.57	1.10	74.70q	—	—
Ditto ... ditto	114.6	20.39	72.46	1.18	51.72q	—	—
Ditto ... India	218.0	14.02	138.27	2.41	61.54r	—	—

a Public Dietaries. b Mulder. c Special return obtained.
d Liebig. e Special Returns obtained. f Special returns obtained.
g The Six Dietaries recommended as equivalent by the Poor Law Commissioners.
h Specially reduced from all the Unions of 1851. i Special returns.
j Convicted Prisoners exceeding 7 days, but not exceeding 21 days.
k Convicted Prisoners, Hard Labour, exceeding 21 days but not more than 6 weeks.
l Convicted Prisoners, Hard Labour, above 6 weeks and not more than 4 months
m Convicted Prisoners, Hard Labour, for terms exceeding 4 months.
n Solitary Confinement.
o From information supplied from the India House.
p These probably represent Extreme cases, mentioned by the following authorities:—Ross, 1835, p. 448. Parry, 1823, p. 413. Cochrane, p. 255. Saritcheff. Barrow, pp. 152, 258. Richardson, vide Agric. Cyc. article Ind.
q Gloucestershire and Dorsetshire. See Agric. Cyclopædia.
r Dharwar, Bombay—Return in Bombay Prison Dietaries.

On Cider and Perry Making.

Communicated by T. W. Booker, Esq., M. P. to the Journal of the Society of Arts.

At the recent Agricultural Meeting at Ledbury I made a few remarks on the production of Cider and Perry, which induced some of my constituents, there assembled, to seek a conversation with me afterwards on the subject, during which they requested me to "write another letter," with reference to the proper season for gathering the fruit and the mode of managing the fermentation of the liquor. If the remarks which I have to make shall awaken due attention on the part of the cider and perry producers of our country, I feel convinced of this, that, to use the words of one who wrote on the subject two hundred years ago, Dr. John Beale, a Fellow of the Royal Society, "these parts of England will be some hundreds of thousands of pounds sterling the better for it."

That the whole subject may be before us, I will beg you to copy the following, which is a reprint from the *Bath Chronicle* —a newspaper having extensive circulation in the Cider Counties of the West of England, the editor of which copied it from the *Hereford Journal*, and struck it off for gratuitous distribution, and to whose obliging courtesy I am indebted for the copy I send you:

"CIDER.—T. W. Booker, Esq., M.P., recently addressed a letter to the *Hereford Journal*, stating that his relative, Mr. Blakemore, of the Leys, Herefordshire, had, sometime before, conversed with a German Baron, who has large estates on the banks of the Rhine, where hock and other celebrated wines are produced, and that the Baron said that many sorts of the Herefordsire apples were capable of producing as valuable and desirable a beverage as the hock grapes, if a different process of making the liquor were adopted. The result of the Baron's observations is contained in the following extracts from Mr. Booker's letter:—

"Our liquors,' said the Baron, 'after the fruit is pressed, are strained, so as to separate the course muss from the liquor, which is then put into large vessels, when shortly afterwards fermentation commences. This fermentation we watch with the utmost care and attention, considering that upon it everything depends connected with the future quality and richness and value of the wine; in the course of a few days, the finer muss that remains in the liquor after the straining above alluded to, drops to the bottom, and the liquor becomes perfectly clear and transparent, retaining all its original saccharine matter, with all its strength, richness, and flavor. At this critical period, upon which we consider the quality of our wines depend, we adopt the process of racking. This racking must be effected in such a manner as to prevent any part of the liquor coming into contact with the atmospheric air; should it do so, fresh fermentation, in all probability, will take place, and by the same means, the like causes repeated will operate and be followed by the same results—repeated fermentation—until the flavor and richness of the origina, liquor are destroyed, and the liquor, instead of becoming winel would become as worthless as your inferior cider.'"

"The reason for this Rhenish caution (writes Mr. Booker) in preventing the liquor from coming into contact with the atmospheric air during the process of racking, is this. The first fermentation is what is termed vinous fermentation, and results in the liquor subjected to it be[coming] wine, if repeated fermentations are allowed to follow, t[hey] are what are termed acetous fermentations, and they result in the liquor parting with its vinous and saccharine properties, and imbibing acid or acetous ones, and it is converted into vinegar. Now the atmosphere is the laboratory from which the liquor absorbs the chemical agent which produces these distinct and separate fermentations.

"And now practically to apply these observations. One fermentation is all that is wanted to convert the juice of the apple into wholesome cider.

"The plan to ensure this which I recommend is as follows:— First—Grind the apples in the cider-mill, and squeeze the juice from the pulp, as is done at present. Second—Run or pour the liquor, after being squeezed or strained, into a vat, capable of containing three or four or even more hogsheads. This vat must be placed in an elevated position, at least five or six feet above the floor, to admit the hogshead or cask, in which the liquor is to be ultimately secured, to be placed under it. At the bottom of the large vat let there be a hole of from one-and-a-half to two inches in diameter, for the purpose of a tube being passed through this hole into the hogshead or cask under it. This tube or pipe should be of a sufficient length to pass through the muss or sediment which deposits itself in the large vat, and to reach at least six inches above it into the clear liquor, and it should be of sufficient length to pass through the hogshead or cask placed below or under the vat, into which the liquor is to be passed, nearly to the bottom. While this process of fermentation is going on, the top of this tube should be corked or plugged up. When the liquor in the vat has dropped fine, the cork or plug being withdrawn, the process of racking commences and is accomplished, and the fine liquor will run from the large vat through the tube into the hogshead or cask placed under it, the liquor retaining all its original saccharine qualities.

"And now the work is done: and the result will be found to be a liquor wholesome and palatable, full of spirit, richness, and flavor, and of value proportioned to the descriptions or sorts of apples which are cultivated in our orchards. My own firm conviction is, that the difference in value, in the market, of all the cider produced in Herefordshire by these simple means, over and above that produced by our present careless and slovenly means, would amount to many tens of thousands of pounds a year, and would be so much clear gain and profit to all those who make cider, to say nothing of the health and pleasure of those who drink it."

Since I wrote the foregoing, I have been favoured by a highly-valued and intelligent friend of mine, resident in our county, with the following admirable "Treatise on Cider-making:" it was written many years ago for the Farmers' Club at Ross, and is so comprehensive, and full of the most practical information, and, moreover, gives it in so much better language than any I can use, that I feel I cannot do better than place it before the public.

"The production of good cider must depend upon the description of fruit of which it is made, the season, and state of the apples when they are crushed, and the management of the juice whilst it is fermenting. It will therefore be proper to consider the subject under these three heads separately.

The kind of Apple which makes the best Cider.

"The acid which gives the peculiar quick and sharp feeling upon the palate in good cider, having first been noticed in the apple, although it exists in many other fruits, has been termed malic acid. It may not be too much to say, that it is the due combination of this acid with saccharine matter, namely, the sugar of the apple, properly fermented, which is the object to be aimed at in the manufacture of cider. In the selection of the fruit will depend the proportion of malic acid contained in the liquor. The crab has a much greater quantity of this acid than the cultivated fruit: and, generally speaking, in proportion as we obtain sweetness by culture, we deprive the apple of its malic acid.

"Hence it follows that some delicious table fruits will not make good cider; this rule, however, is not invariable, as the golden pippin and some other fine apples appear to contain the proper admixture of acid and sweetness which is desirable in the liquor. Mr. Knight recommends that the different sorts of fruit be kept separate; and considers that only those apples which are yellow, or mixed with red make good cider; and that the fruit of which the fresh or rind is green, are very inferior. He recommends that the apples should be perfectly ripe—even mellow, but never decayed—before they are crushed.

"There was a curious manuscript written by Dr. John Beale, a fellow of the Royal Society in 1657, upon the subject, of which the following are extracts:—'Crabs and wild pears, such as grow in the wildest and barren cliffs, and on hills, make the richest, strongest, the most pleasant, and lasting wines that England yet yields, or is ever likely to yield. I have so well proved it already by so many hundred experiments in Herefordshire, that wise men tell me that these parts of England are some hundred thousand pounds sterling the better for the knowledge of it.' He mentions of these kinds of austere fruit the Bromsbury crab, the Barland pear, and intimates 'that the discovery of them was then but lately made, yet they had gotten a great reputation.' He adds, 'the soft crab and white or red horse pear excel them and all others known or spoken of in other counties.' Of the red horse pear of Felton or Longland, he says. 'that it has pleasant masculine rigour, especially in dry grounds, and has a peculiar property to overcome all blasts. Of the quality of the fruit he observes, 'such is the effect which the austerity has on the mouth on tasting the liquor, that the rustics declare it as if the roof of the mouth were filed away, and that neither man nor beast care to touch one of these pears, though ever so ripe.' Of the pear called rinny winter pear, which grows about Ross, in that county he observes, 'that it is of no use but for cider; and that if a thief steal it, he would incur a speedy vengeance, it being a furious purger; but being joined with well chosen crabs, and reserved to a due maturity, becomes richer than good French wine; but if drunk before the time, it stupifies the roof of the mouth, assaults the brain, and purges more violently than a Galenist."

"Of the quality of the liquor he says, 'according as it is managed, it proves strong Rhenish, Barrack, yea, pleasant Canary, sugared of itself, or as rough as the fiercest Greek wine, opening or binding, holding one, two, three, or more years, so that no mortal can say yet at what age it is past the best. This we can say, that we have kept it until it burn as quickly as sack, draws the flame like naptha, and fires the stomach like *aqua vitæ*.' Thus there appears a great difference between the opinions of these two men, who probably paid more attention to the subject than any others; and the question naturally arises, is the cider and perry of the country as good or better than it used to be, after greater attention has been paid to the orchards? I am decidedly of opinion that it is inferior; and it was this impression which caused me to venture to call your attention to the subject. If such be the case, it is a great object to ascertain what has caused the deterioration in the liquor. I believe it is for want of a due proportion of the peculiar acid which is found in the greatest quantity in the wild fruit; and beg to suggest whether it would not be worth while to try back, and mix a certain quantity of crabs with the fruit before it is crushed.

The best time of the year for making Cider.

"It has been before observed, that Mr. Knight recommends the fruit to be perfectly ripe, even mellow, before it is crushed, and this can only happen late in the autumn. As it is known to be more difficult to manage the fermentation of the liquor in warm weather, it is usual to defer making cider till November or December: if, however, the liquor can be put in a cold cellar after the first fermentation is over, I am of opinion that it might be commenced earlier. The juice of unripe fruits ferments more quickly than of that which is ripe, and contains more malic acid. Where there is the convenience of a good underground cellar, the difference of temperature between that and the outward air is greater in moderately warm weather than in November; so that if the liquor were fermented under sheds, as Mr. Knight recommends (and his instructions as to the management of the cider whilst fermenting are excellent,) and, as soon as fine, removed into the cold cellar, the change of temperature would be greater at the end of September than in November, and this would probably tend to prevent the liquor fermenting again. If the new cider cannot be removed, from the warmth of the atmosphere, there can be no question that is better to defer making till the weather becomes cool.

Fermentation of the Juice.

"The researches of scientific men, although very elaborate, have done very little in throwing light on the subject of fermentation; it appears to partake, in a measure, of the vital principle, of the phenomena attending which we know nothing. Many curious and interesting facts have been discovered during the investigation, but none of which appear to be of much use in the making of cider. There are three kinds of fermentation, or rather there are some products which pass regularly through three stages of fermentation, viz., the vinous, the acetous, and the putrescent. Other substances pass at onceto one or other of the latter stages; gum and water turning to vinegar without forming any spirit, and meat at once putrefying. It is not desirable that the vinous fermentation should be complete in the manufacture of cider, in which case all the sugar of the apple would be converted into spirit; this never does happen without a portion of vinegar being also formed, the acetous fermentation going on conjointly with the vinous, as when cider frets a great deal it may be very strong, but is comparatively of little value, having lost all its richness and become sour. The vinous fermentation stops naturally before it has run its course, and it is the object of the maker, to avail himself of this property in the liquor, and to endeavour to prevent any secondary fermentation taking place; the number of schemes which have been suggested to prevent which, showing that it is the most important point to be attended to in the manufacture of good cider. I am of opinion that the 100-gallon cask is much better than larger, and that the liquor is not only more easily managed, but more likely to be good; it may be that cider in large casks becomes stronger, but not so frequently rich as in single hogsheads. Although it may not be apparent, fermentation commences as soon as the juice is expressed from the fruit; and the sooner the cask is filled and allowed to remain quiet, the more regular and certain will be the process. What should we think of the brewer who, whilst his beer was working, brewed another quantity, and added the raw wort to the first? Yet this is constantly done in filling a large cask with cider; or even worse, for the apple juice is added cold, whereas the wort might be mixed with the beer whilst warm. It would be greatly better to keep the liquor in open tubs, till enough be obtained to fill the cask, and then to put it together at once.

"If I may be allowed to suggest an experiment, there is one use to which I should be very glad to see a large cask applied; that is, to fill it partly with *fresh* muss, and the remainder with boiling water—the probable result would be a very pleasant and useful liquor. Temperature has much to do with fermentation, and it would be an advantage to have two cellars, one much colder than the other. If the liquor, upon pitching fine, were racked in a clean cask and put into a cold cellar, there would be much less risk of its fermenting again. I should recommend no other liquor to be added to it; but, in order to prevent ullage, that it should be racked into a smaller cask;—the less air admitted the better, and if the cask be sound and iron-bound it may be better to close it at this time.

"The application of cold will check fermentation immediately. I have seen liquor in a state of froth boiling out of a large jar, suddenly reduced to a state of quiescence by pumping on the side of the jar. This fact induced me to cause an experiment to be tried at Gayton during a very bad season for the cider making the weather being very warm; a cask of juice was rolled into a brook of cold water, and sunk by stones attached to it; it remained in that position till nearly Christmas, and was so much better than any other made that year that Mr. Newman obtained double the price for that hogshead he did for any of the rest. Perfect stillness is very desirable, as motion is found to excite the acetous fermentation. A bottle of wine, attached to a sail of a windmill in motion was, after three days, converted into vinegar, although closely corked. When a second fermentation does take place in cider, there is very little hope of its being rich and good.

"In such case, I should recommend its being drawn out into tubs, exposed to the cold as much as possible; and after being thus flattened, put back into the cask, at the same time well stirring up the whites of fifteen or twenty eggs, previously mixed up with a portion of the liquor; if this succeeds in fining it, which probably it will, it may then be racked into a clean cask, and closed as much as possible from the air. It is probable that a great deal of mischief is caused by some principle of fermentation remaining in the case; this might be prevented by well scalding the casks before they are filled: or, what I think would be better, by washing out the casks with clear lime water. One large piece of lime put into a hogshead of water, and allowed to settle would answer the purpose. Some brimstone matches burned in the casks would have a tendency to prevent fermentation.

"I shall not say much upon the mode of crushing the apples and pressing out the juice, having had so little practical experience; but I have always thought that if the fruit were crushed between wooden rollers, and allowed to drain before being put under the stone, the process would be much expedited; as the apples sometimes roll before the stone a long time before they are broken.

"In Ireland they use a press formed by a lever, which might be made at less expense than with a screw, and be more quickly worked: it is impossible the pressure can be too light at first, and it should be increased gradually as the liquor runs from the muss. Two sets of bags, allowing one to drain some time without pressure, would be an undoubted advantage.

"E. P."

I need not, I think, add one word to the advice here given. I earnestly hope it will be followed, and sure I am that we shall all feel and acknowledge the value of it, in the improvement in quality, and increase in value, of our county beverage.

I have been asked by hundreds whether it is really the fact that during each visitation of that awful scourge, the Cholera, which has again appeared among us, not a single case has ever yet occured in Herefordshire: my reply has been *that it is so: I shall be glad to be corrected if I am wrong:* if I am right, the knowledge of this cannot be too widely circulated, nor can our thankfulness be too great to the Almighty Being who has so singularly and signally blessed and protected us.

Description of some New Kinds of Galvanic Batteries.

*Invented by Mr. Kukla, of Vienna.**

The combination used in one of these, is antimony, or some of its alloys, for a negative plate, with nitric acid of specific gravity 1·4, in contact with it, and unamalgamated zinc, for a positive plate, with a saturated solution of common salt in contact with it. A small quantity of finely powdered per-oxide of manganese is put into the nitric acid, which is said to increase the constancy of the battery. The alloys of antimony which Mr. Kukla has experimented with successfully are the following:—Phosphorus and antimony, chromium and antimony, arsenic and antimony, boron and antimony. These are in the order of their negative character, phosphorus and antimony being the most negative. Antimony itself is less negative than any of these alloys. The alloys are made in the proportions of the atomic weights of the substances. All these arrangements are said by Mr. Kukla to be more powerful than when platinum or carbon is substituted for antimony or its alloys. In this battery a gutta percha bell cover is used over the antimony, and resting on a flat ring floating on the top of the zinc solution,—this effectually prevents any smell, and keeps the per-oxide of nitrogen in contact with the nitric acid solution. When a battery of twenty-four cells was used, Mr. Kukla found that in the third and twenty-first cells pure ammonia in solution was the ultimate result of the action of the battery; but only water in all the others. This experiment was tried repeatedly, and always with the same result. A battery was put into action for twenty-four hours; at the end of that time the nitric acid had lost thirteen twentieths of an ounce of oxygen, and one quarter of an ounce of zinc was consumed.

Now as one-quarter of an ounce of zinc requires only 0.06 of an ounce of oxygen to form oxide of zinc, Mr. Kukla draws the conclusion, that the rest of the oxygen is converted directly into electricity; and this view, he says, is confirmed by the large amount of electricity given out by the battery in proportion to the zinc consumed in a given time. In the above battery each zinc plate had a surface of forty square inches. The addition of per-oxide of manganese does not increase the effect of the battery, but it makes it more lasting—the per-oxide of nitrogen, formed in the bell cover, taking one atom of oxygen from the per-oxide of manganese;—this is evident from only the oxide of manganese being found in the battery after a time: in the salt solution no other alteration takes place than what is caused by the oxide of zinc remaining in a partly dissolved state in the solution. For this battery Mr. Kukla much prefers porous cells, or diaphragms of biscuit ware, as less liable to break, and being more homogeneous in their material than any other kind. This battery is very cheap, antimony being only 5*d.* per lb., wholesale, and the zinc not requiring amalgamation.—The second arrangement tried by Mr. Kukla was antimony amalgamated zinc with only one exciting solution, viz. concentrated sulphuric acid:—this battery has great heating power, and the former great magnetizing power—it, however, rapidly decreases in power, and is not so practically useful as the double fluid battery, which will exert about the same power for fourteen days, when the

* Athenæum.

poles are only occasionally connected as in electric telegraphs. Certain peculiarites respecting the ratio of intensity to quantity when a series of cells is used, have been observed, which differ from those remarked in other batteries.—Mr. Kukla, on directing his attention to the best means of making a small portable battery for physiological purposes has found very small and flat Cruikshank batteries, excited by weak phosphoric acid (one of glacial phosphoric acid to twenty of water,) to be the best, phosphoric acid being very deliquescent, and forming with the zinc during the galvanic action, an acid phosphate of zinc. A battery of this description does not decrease in power very materially until it has been three hours in action.

Robert Stephenson, M.P.

(Continued from page 100.)

In company with Mr. G. P. Bidder, (now General Superintendent of the Grand Trunk Railway of Canada,) Mr. Robert Stephenson visited Norway in 1846, for the purpose of examining that country, with a view to the Construction of a Railway between Christiana and the Myosin Lake, a distance of about forty miles. To mark his appreciation of Mr. Stephenson's services on this work, the King of Norway and Sweden confered upon him the Grand Cross of the Order of St. Oliff. We are not in a position to describe the nature of the works on the forty miles of Railway, but either the Order of St Oliff must be of cheap acquirement:—or if honorary rewards are there distributed in the same ratio to merit as they are in England and America, the works on this Norwegian line must have been of tremendous difficulty.

In England, Mr. Stephenson took an active part in the "War of the Guages," which in 1845-6 created so much excitement in the Railway world, and determined the future connections and distances of the Railways of Great Britain. In this contest as to the relative merits of wide and narrow ways, Mr. Stephenson took the lead in supporting the interests of the narrow Guage. The Railway Guage of Canada has been settled, apparently to the satisfaction of every one, unless, the proprietors of the Great Western are an exception; and this once momentous question, has therefore, little interest here; it may not be amiss however, considering the prominent position occupied in the contest by the subject of this Notice, to examine briefly the arguments by which he supported his views of that question, and those of his principal opponent.

As will readily be surmised, the Gauge of 4 feet 8½ inches, the narrow Gauge of Europe and North America, was not originally adopted from any inherent advantages offered by that fractional measure, but like many other empirical proportions, owes its origin to some Cart-wheelwright in the neighbourhood of Newcastle upon Tyne, where Tram Roads had their birth, and at a time when half an inch more or less, possessed less value in the eyes of a Mechanic, than at the present moment; gradually Railways developed themselves in the same section of country, and their width was ruled not by the convenience of this age, but by the rolling stock of the old Tram Roads; hence, as Robert Stephenson says in his evidence, speaking of the 4 feet 8½ inches Gauge of the Manchester and Liverpool Railway;—"It was not proposed by my Father. it was the original Guage of the Railways about Newcastle, on Tyne, and *therefore* he adopted that Guage." And so of the Grand Junction Railway, and the Manchester and Leeds Railway, he says, "After the Liverpool and Manchester line had been established, it was quite apparent that all the lines in that neighbourhood must work into it, in order to get to the port of Liverpool, and it was considered imperative in fact, that the Guages should be all the same." Then of the North Midland, of which he himself was the Engineer and proposed the Guage, he says, "There was a part of the line common to both the Manchester and Leeds, and North Midland: and the Manchester and Leeds, having been fixed with a view of eventually working into the Manchester and Liverpool, of course, it became equally a matter of consequence, that the North Midland should be of the same Guage." Again, the Derby Junction line, being "in point of fact a continuation of the North Midland to Birmingham; it was made of necessity of the same Guage as the North Midland:" the London and Birmingham, with a view to connect with the Grand Junction, was next fixed with the same Guage, and "Uniformity was the principal reason for its adoption." For similar reasons, the narrow Guage was adopted as the Railway system was extended, and it daily became of more importance to proprietors that it should not be changed.

Thus, reasons originally of no value, gradually acquired force; until in 1846, they were almost irresistible, and though a period did arrive, when it became evident to Mr. Stephenson as an Engine Builder, that a few more inches of space between the wheels would have been of great value; yet he considers that "since that time, the improved arrangements in the Mechanism of the Locomotive Engine, have rendered that increase altogether unnecessary; at present with the inside cylinders; which is the class of engine requiring the most room between the rails; and the cranked axles with four eccentrics, we have ample space and even space to spare." These improvements he describes:—"in the arrangement of the Machinery, which is the main question, having reference to the width; the working gear has been much simplified, and the communications in the most recent engines, between the eccentric and the slide valve, have been made direct communications: whereas it was made formerly through the intervention of a series of Levers which occupied the width." * * "Then with reference to the increase of power, the size of the Boiler is in point of fact, the only limit to the power, and we have increased them in length on the narrow Guage, because we have always made the boiler as wide as the narrow Guage would admit of; but we have increased the power by increasing the length, both in the fire-box and in the tubes; we have obtained economy I conceive by lengthening the tubes, and we have obtained an increased power, by increasing the size of the fire-box; in fact the power of the engine, supposing the power to be absorbed, may be taken to be directly as the area of the fire-grate, or the quantity of fuel contained in the fire-box." * * I conceive the steadiness of the Engine to be very much increased by increasing the length, for the unevenness of the road is met by that, by increasing the length of the base, you increase thereby the steadiness," * * "as you increase the length, that is, the distance between the fore and hind axle, they are less liable to get off the rails in consequence of moving more steadily than the short engines on four wheels, where the base is the same width, by about 7, 8, and 9 feet, originally they were about 7, and 7 feet 6 inches, and 8 feet. The large weight hanging over the axle behind was exceedingly liable to make the engine oscillate with great violence, whenever it came to an inequality. I have known engines of that class actually lift the front wheels off the rail, one accident might be referred to that, though there may be a difference of opinion as to the actual cause of the accident, but in several cases I have attributed accidents to the engine, in the case of a slight imperfection of the road, being liable to such oscillation as to lift the front wheels, or at least to take the weight of them so as to render them useless as guides."

We have quoted this part of Mr. Stephenson's evidence as elucidating his improvements of the Locomotive, and as illustrating the fact that the great improvements on American built Engines have been based, if not directly on these opinions, certainly on similar ones, and that they embody these identical principles as fully as any engine manufactured under Mr. Stephenson's own eye. The American manufacturer has extended the base, and in so doing increased the stability, while the more frequent recurrence of short curves has driven him to the adoption of a contrivance which, while the length and base of the engine is increased, renders it much less liable to derangement on curves than the English engine. We refer to the truck frame, a feature characteristic of American engines, and without which many of the curves on our railways would be impracticable at high velocities.

Returning again to the width of guage we find Mr. Stephenson assigning as the reason for adopting the narrow guage on the London and Brighton Line, where a junction with no other Line was in contemplation, that he "felt that 4 feet 8½ inches were fully adequate for any purpose to which a railway could be applied; and believing also that the narrower the guage the less was the resistance. I conceived that that would prove safe and economical, and that there was no ground or reason for deviating from it." * * * "We believe the resistance in passing round curves to be materially affected by the width of the guage. We know that in the collieries about Newcastle, where the 4 feet 8½ inch guage prevails, wherever they come to any mining operations, where the power to be used is that of a horse or man, they immediately reduce the guage, because they want to go in or out amongst the mines with very sharp curves, and the wide guage would be quite impracticable amongst them. In fact the small carriages that are used in the mining operations are upon a guage of about 20 inches, and they go round curves under ground of about 10 or 12 feet radius, and they could only work such mines by such a guage. In the case of every guage when you come to a sharp curve, you see the outside and inside rails quite brightened by the sliding motion, because the one set of wheels has to slide forward to keep pace with the other, and the others have to slide backwards. In fact, when going round a curve both operations have to take place—the sliding backwards of the one set, and the sliding forwards of the other. Of course as you increase the width of guage the difference between the two becomes augmented, and I think the increase of resistance in a case of that kind would be found to be as the square of the guage, because the increased space that you have to slide over is as the width of guage, and you have to accomplish that in the same time as on the narrow guage: therefore it is in my opinion increased as the square."

As bearing more directly on the value of an uninterrupted guage over a considerable length of road, and as exhibiting his opinions of the value of a uniformity of guages on lines, worked in connection with each other, the reasons which influenced Mr. Stephenson to recommend the change of the Eastern Counties' Line, which had been laid down by Mr. Braithwaite, on a five feet guage, to the ordinary narrow guage of 4 feet 8½ inches will possess some interest, we therefore quote his evidence on that particular: "It became a question," he says, "after having decided upon the Northern and Eastern being altered, which was the only one leading up into the Counties already occupied by the narrow guage, whether we should alter the Eastern Counties' guage which was laid down for fifty miles to Colchester into a district of country where the junction of different guages would have been of less consequence, and indeed was little likely to take place, because the Eastern Counties is apart from any other Line almost in the Kingdom. * * * I was quite aware that there would be some difficulty in the first instance in trying to blend two guages together in the same Station; but I had no idea until we went into detail what those difficulties would amount to. Then there was another reason why we decided upon altering it, (the 5 feet guage) in fact we found that the two Lines would require two complete, separate, carrying establishments, we could never make use of the carriages of one Line upon the Line of the other, which we find to be really of vital consequence just now. * * * If they had had two carrying establishments, I consider that they would have spent far more money in the carrying establishment (that is £50,000) than they have spent in altering the guage, and when done the carrying establishment would not have been so effective."

These opinions are of course predicated with reference to the blending of two short Lines, and are irrespective of the consideration of how far railway stock can be run without thorough examination and repair; but on this Mr. Stephenson subsequently expresses his opinion that carriages might be run from Euston Square to Glasgow or Edinburgh without change or requiring repair. He says, "The carriages are now, from our experience, become so substantial and so secure and efficient in the arrangements that they run 400 or 500 miles very frequently, and in fact, I dare say, a great many carriages run a great many thousand miles without having any thing done to them except greasing."

Had Mr. Stephenson observed at any time a serious objection to the narrow guage of 4 feet 8½ inches, he would doubtless have changed it, when called upon to advise with reference to the construction of the Belgian Railways, where no considerations of future junctions with established Lines had any weight in determining the guage to be adopted; he says in reference to these Lines: "There of course there was a new field open to us, and it would have been competent to introduce a wider guage or a narrower one, just as our experience might dictate; but we had no reason whatever to urge upon them an alteration from that guage which has already been established in this country, and which seemed to answer every purpose without the least objection. The other Line that I was connected with was the Leghorn and Pisa. There of course again we were in a new country, and it was quite competent to alter the guage if it had been deemed necessary. * * * Perhaps if I had been called upon to do so it would be difficult to give a good reason for the adoption of an odd measure, 4 feet 8½ inches; but inasmuch as an inch or two more or less would have involved a different construction of engines on a new model or pattern, I followed it." Similar reasons doubtless prevailed with the engineers of the first Lines of Railway constructed in America, and thus we trace the influence of the old colliery tram roads as fixing the prevailing guage of the Railways of the world; and what is most singular the leading advocates of that guage have failed to offer to our notice any advantages possessed by it over other guages, and we doubt whether any machinist who might be called upon to design a locomotive of the power of our present first class engines, and entirely irrespective of any fixed guage or existing model, would approach within several inches of that particular measure. There is doubtless a limit to the width of guage that can be adopted with advantage, and we will now quote Stephenson's reasons for objecting to so wide a guage as that adopted by Mr. Brunel for the Great Western of England. With reference to which, he says, "I am not aware of any advantage whatever that it has. It has I think several disadvantages. The first of course is the additional expense of construction. It requires embankments and cuttings four feet wider, in consequence of the guage. * * * Their tunnels are of course necessarily increased beyond what is sufficient for the narrow guage. The narrow guage tunnels are twenty-four feet wide, that is six feet between the rails, and four feet between the rail and the wall of the tunnel; that makes twenty-four feet. Now of course to give the same space between the rails, and the same space between the outside rail and the wall, it requires the wide guage tunnel to be four feet wider. * * * *

(*To be continued.*)

Views on the Origin of Terrestrial Magnetism.*

The earliest view of terrestrial magnetism supposed the existence of a magnet at the earth's centre. As this does not accord with the observations on declination, inclination, and intensity, Tobias Meyer gave this fictitious magnet an eccentric position, placing it one-seventh part of the earth's radius from the centre. Hansteen imagined that there were two such magnets, different in position and intensity. Ampere set aside these unsatisfactory hypotheses by the view, derived from his discovery, that the earth itself is an electro-magnet, magnetised by an electric current, circulating about it from east to west, perpendicularly to the plane of the magnetic meridian; and that the same currents give direction to the magnetic meridian, and magnetise the ores of iron; the currents, being thermo-electric currents, excited by the action of the sun's heat successively on the different part of the earth's surface as it revolves towards the east.

A long time before the discovery of electro-magnetism, Biot was occupied with this subject, and regarded the terrestrial magnetism as the principal resultant of all the magnetic particles disseminated in the earth. M. Gauss adops this view, as an interpretation of the fact, without explaining it. An observation which I made some years since along with one of my brothers† has directed my attention to this subject. It related to the fall of a cylindrical meteor whose position was sensibly in the plane of the magnetic meridian. Many luminous meteors have been observed in this same position or near it, if I may judge from some of those described in the catalogue of Borguslawsky.‡

The special position of the meteor observed by my brother and myself was not fortuitous; it was determined by the magnetic action of the earth, an action which may be powerful in its influence on meteorites consisting essentially of the magnetic metals, iron, and nickel. In our view, the terrestrial magnet the earth, decomposed by its influence the normal fluid of the meteoric mass, and so gave the meteor thus polarized the direction of a compass-needle.

In generalising from this fact, and recalling the experiment of Arago on the magnetism developed when a magnet acts upon a turning disc, we ask whether the magnetic polarity of our planet may not be due to a like cause. Considering it, as proved, that the sun is polarized magnetically like the earth,§ the sun will then be the inductor magnet, the agent which decomposes the magnetic fluid of the terrestrial globe; it will be to the earth, what the earth was to the meteor. This explanation does not resolve the difficulty, as it does not say whence comes the magnetic polarity of the sun. It implies the intervention of a magnet whose intensity is superior to that of the sun, acting on this last by induction, and impressing a polarity which the sun transmits to other planets of the system. It is the hypothesis reversed of the central magnet, for it places in space the magnetic mass which some physicists have supposed to exist within the earth.

The real cause of the magnetic polarity of the planets, is in my view the same for all, and Arago's experiment conducts to it in a straight line. It results even from the condition of their existence. Each star turning around a central axis, and in determinate curves, is influenced by the mass of these stars and their velocity at the circumference; in a word, the agent decomposing into two fluids the normal magnetism of the earth and the other planets, is their rotation. A geometer examining this opinion, would find, we believe, that the declination, inclination and the perturbations of the magnetic needle, are explained on this hypothesis much better than on any other.

Since my researches on circular electro-magnets and in general on bodies in rotation, I have sought much for experimental demonstration of this theory, and have now the conviction that this is impossible, as it is not possible for us while upon the earth to remove ourselves from the action of its own magnetism. Whenever a development of magnetism under the influence of rotation is observed, it is common to attribute it to the inductive action of the earth, rendered so striking by the experiments of Arago and Mr. Barlow.

Alongside of the different sources of magnetism mentioned in Treatises on Physics,—friction, pressure, percussion, torsion,—we should add rotation, a mechanical action of equal title with the preceding, and whose effects, produced through a subdivision like that of magnetic polarity, are found grouped at the extremities of the axis in rotation; in the same manner as the poles develope at the extremities of a bar of iron when it is subjected to torsion.

Ingenious application of Science and its Results.

A very ingenious application of scientific principles to determine the point of fusion in a closed vessel, and a remarkable result from high pressure on fluids, were incidently mentioned by the President of the British Association in his inaugural address. Experiments were instituted by Mr. Hopkins, Mr. Fairburn, and Mr. Jowle, to determine the effects of increased pressure in raising the temperature of fusion. The substance operated on was inclosed in a very strong metal chamber, and the pressure was produced by water forced by a plunger acted on by a long lever down an iron tube, three quarters of an inch thick. Wax was the substance employed; and it was of course essential to ascertain the exact moment that it became fluid when heat was applied. As all the apparatus must necessarily be opaque, the melting point could not be seen. The difficulty was ingeniously surmounted in the following manner: a small magnet was enclosed on the top of the wax, whilst outside the metallic chamber containing it, and on the same level, a nicely-balanced

* Silliman's Journal, correspondence of J. Nickles.

†Poggendorff's Annalen, vi. 1.

‡ See Proceedings, Brit. Assoc., 1853, Sept. 7, Report of Col. Sabine.

§ Sur la chute d'ume bolide par M. N. Nickles and J. Nickles, Compt. Rend. de l'Acad, xix. 1035.

magnetic needle was placed. The enclosed magnet acted on the needle and deflected it, at a certain angle, from its natural position; but the instant that the wax melted, the magnet fell to the bottom, and the vibration of the needle indicated the fact. It was thus ascertained that under a pressure of thirteen thousand pounds on the square inch, wax requires thirty degrees additional heat to melt it; about one-fifth of the whole temperature at which it melts under the pressure of the atmosphere.

During the experiment, it was observed that the plunger gradually descended in the tube, and on examination it was discovered that the water had, under the influence of the enormous pressure, been forced through the pores of the iron, though three quarters of an inch thick. On afterwards examining the tube closely with a lens, not the least opening could be seen by which the water could have escaped. This result far exceeds that of the celebrated Florentine experiment, by which the incompressibility of water was supposed to be proved by its forcing a passage through the pores of a globe of silver, very thin in comparison with the three-quarter inch iron tube. It was not ascertained whether any of the melted wax had been forced into the pores of its containing vessel.

CANADIAN INSTITUTE ESTABLISHED 1849

INCORPORATED BY ROYAL CHARTER.

Fourth Ordinary Meeting, January 14th, 1854.

The following Donations to the Museum and Library of the Institute were announced :

1.—A number of Minerals and Fossils from Ireland and Canada, by Thomas Herrick.

2.—Indian Relics by Dr. Richardson.

3.—Hay's Book of British Birds by Mr. Hope.

The thanks of the Institute were ordered to be presented to Mr. Thomas Herrick, Dr. Richardson and Mr. Hope, for their valuable donations.

The names of the following Candidates for Membership were read:

Leslie Battersby, (Jun. Mem.)	Toronto.
Hon. S. B. Harrison,	"
D. Macdonell	"
Rice Lewis	"
A. M. McKenzie, C.E.	Guelph.
Hon. J. H. Cameron, Q.C.	Toronto.
George Netting	"

The following Gentlemen were elected Members:

F. A. Whitney	Toronto.
J. W. G. Whitney	"
C. H. Jarvis	"
Rev. E. St. John Parry	"
J. Small, M.D.	"
Capt. C. R. Scholefield	"
J. E. Small	"

A Paper was read by A. Brunel, C.E. on "The Comparative advantages of Single and Double Track Railways."

Fifth Ordinary Meeting, January 21st, 1854.

A Donation from Capt. Lefroy, R.A. F.R.S. of "A Map of the British Provinces in North America, drawn in 1776," was announced.

The names of the following Candidates for Membership were read:

P. M. Vankoughnet, Q.C. (Life Member)	Toronto.
Joseph Workman, M.D.	"
William Hallowell, M.D.	"
Hewson Murray (Jun. Mem.)	"

The following Gentlemen were elected Members:

Leslie Battersby	Toronto.
Hon. S. B. Harrison	"
D. Macdonell	"
Rice Lewis	"
A. M. McKenzie, C.E.	Guelph.
Hon. J. H. Cameron, Q.C.	Toronto.
George Netting	"

A Paper was read by Mr. G. H. Dartnell, on "The Duration and Expectation of Life in Canada."

Sixth Ordinary Meeting, January 28th, 1854.

The names of the following Candidates for Membership were read:

James Edwin Ellis	Toronto.
Agustus J. Thibodo, B.M.	Kingston.
G. P. Ure	Toronto.

Notice was given by Mr. D. Crawford, that at the second General Meeting from the present, he would move for an alteration in the Bye-Law relating to the Balloting for Members.

The following gentlemen were elected Members:

P. M. Vankoughnet, Q.C.	Toronto.
Joseph Workman, M.D.	"
William Hallowell, M.D.	"
Hewson Murray, (Jun. Mem.)	"

A Paper, communicated by W. E. Logan, F.R.S. & G.S. Provincial Geologist, "On the Physical Structure of the Western District of Upper Canada," was read by Professor Croft.

The Paper was illustrated by a geological map of a portion of Upper Canada, and with a section of the country between Lakes Huron and Erie. It is the intention of the Council to publish Mr. Logan's valuable Paper, together with the accompanying Map and Section.

The thanks of the Institute were ordered to be presented to Mr. Logan for his important Paper, and the valuable Maps which accompanied it.

The Royal Society and the Canadian Institute.

We have much pleasure in calling the attention of the members of the Canadian Institute to the following Minutes of the Council of the Royal Society. The advantage and importance of receiving early impressions of the proceedings of the most distinguished Scientific Society in the British Empire, and perhaps in the world, cannot be too highly estimated.

Read the following letter from Captain Lefroy, addressed to the Secretary;

"Woolwich, October 27, 1853.

"Sir,—I have the honour to request that you will lay before the Council of the Royal Society, an application which I am authorised to make on behalf of the Canadian Institute of Toronto, U.C. for the privilege of receiving the Philosophical Transactions and Proceedings of the Royal Society.

"I beg to state that the Canadian Institute is a regularly incorporated Scientific Society, having a Royal Charter. A monthly publication called the *Canadian Journal* emanates from it, and although of very modest pretensions and still in its infancy, the Society has met with very encouraging success. It numbers over 300 members, distributed over every part of Upper and Lower Canada It would greatly gratify its members, and add to their claims to the public support, were it to be honoured with this proof of the sympathy and encouragement of the Royal Society. Perhaps I may be permitted to remark, that while five copies are distributed in the United States, no Institution in British America appears, by the printed list, to be so honoured ; and I have reason to believe that only one Public Library (that of the Legislature at Quebec) contains the work.

"In thus applying on behalf of a Society in which I am personally interested, I am desirous at the same time of submitting for consideration a larger question ; namely, whether it may not be made a rule to supply single copies of the Philosophical Transactions, at a cost only covering paper, presswork, and binding, to all regularly incorporated Scientific or Literary Societies in the British Colonies that may conform to certain necessary conditions. Having passed the last thirteen years principally in the Colonies, I may be permitted to state, that in my humble opinion, everything which can strengthen their moral ties to the mother country is worthy the attention of all who value that connection. A measure of this comprehensive favour and liberality would be received with a grateful feeling by the most educated and enlightened classes of Colonial Society ; while its probable effect, if adopted generally by the great Societies, would be invaluable. The number of copies that might be claimed under such a rule would not, I think, exceed twenty at present, and I cannot but submit the measure, with much respect, as one it would be worthy of the Royal Society to adopt.

"I have the honour to be, Sir,

"Your most obedient Servant,

"J. H. LEFROY,

"*Captain R.A. F.R.S.*"

"*The Secretary, &c. &c. &c.,*
Royal Society."

Resolved,—That Captain Lefroy be referred to the Officers of the Society to report on to the Council.

REPORT.

With reference to the Minutes of Council of the 24th November, containing a letter from Captain Lefroy, the Officers recommend that the Canadian Institute of Toronto should be placed upon the List of Institutions to which the Proceedings of the Royal Society should be presented. and that the Sheets of the Proceedings as they are printed be sent by post to an Agent in London, who may be appointed by the Canadian Institute to receive them.

If, further, the Canadian Institute be desirous to be supplied with the Philosophical Transactions at a low rate of purchase, the Officers recommend that advantage be taken of the privilege possessed by the Fellows of the Society of purchasing the volumes five years after their publication for one third of the cost price.

Resolved,—That the above recommendation be adopted.

The Canadian Journal.

The present number of *The Canadian Journal* is published by Thomas Maclear & Co., the successors to the Book and Stationery business of the late Hugh Scobie, Esq. We are assured that whatever defects may be observed in the typographical execution of this number, they will be remedied as soon as a fresh supply of type arrives from the manufacturers. The unavoidable derangement in the establishment of the late Publisher, during the long illness which preceded his decease, and the subsequent changes which occurred in the various departments of business over which he presided, will, we believe, satisfactorily account for, and excuse, the defects occasionally evident in the mechanical execution of some late numbers. Arrangements are now being made to publish the Journal on the 1st instead of the 15th of the month, as heretofore.

Want of space prevents the insertion of descriptions of the Great Western, and the Buffalo, Brantford and Goderich Railways, which are now in operation; the former throughout its entire length from the Niagara River to Detroit: the latter from the Niagara River to Brantford. The same cause excludes for the present, the Prize List of the Canadian department at the New York Exhibition of the Industry of all Nations. These omissions will be supplied in the March number.

Notices of Books.

Elementary Chemistry, by G. Fownes, F.R.S. Edited by R. Bridges, M.D. Lea & Blanchard, Philadelphia.

There has scarcely ever appeared a Manual of any Science, that has acquired so high a reputation as "Fowne's Chemistry for Students." Appearing after the later editions of Turner's Elements, and the earlier ones of Graham & Kane, Mr. Fowne's work, the third edition of which was finished only a few days before his decease, has pretty universally taken the place of those works in England, and considering the very moderate price of the present American edition, it is sure to do so in this country.

The work particularly recommends itself by its accurate although necessarily very concise descriptions, the clearness of its explanations, and the simplicity of its arrangements, and is exceedingly well adapted for the use of students, serving as an introduction to the more comprehensive works of Gregory, Graham and Gmelin.

The last edition was published in 1849, and consequently the remarkable progress of chemistry during the last few years, especially as regards the history of the compound ammonias and vegetable alkaloids, as well as in many other departments, has rendered the publication of an amended edition a great desideratum among teachers. The fact of the present edition having been superintended by Bence Jones & Hoffman, will be a sufficient guarantee for the completeness of the work, and the notes of the talented American editor, Dr. Bridges, will be found of very considerable value, as bringing the work still more nearly up to the present period.

Having used the former edition, as text book for our Students for several years past, we can most cordially recommend the present one as giving a very excellent digest of the present state of chemical science, and as especially adapted to the wants of the Student.

Correspondence.

To the Editor of the Canadian Journal.

Sir,—In the summer of 1851, I took a beautiful species of bat, about 11 A. M., in the forest north of this city. It was suspended by the claws or fore feet, from a twig of a young maple tree. Knowing the animal to be rare in this locality, I took great care in preserving and stuffing it. On the 3rd instant, I sent it to Professor L. Agassiz of Cambridge, Mass., for the purpose of ascertaining whether it was a new species. From the learned Zoölogist, I received the following answer:—"The bat is a species not uncommon in the middle States, but I had supposed its farthest northernmost limit to be Massachusetts, which your specimen proves to be a mistake. It is *Vespertilio Noceboracensis*—you will find a description and figure of it in 'DeKay's Natural History of New York.' I am very much obliged for the specimen, which is beautifully preserved, and very interesting to me, as indicating the Geographical range of the animal." Linnæus in his "Systema Naturæ," says that the same animal inhabits New Zealand. There are reckoned upwards of thirty genera of this strange animal, and more than three hundred species. Eight indigenous species has been taken by myself. I have been told that a bat with a white body was seen last summer, flying about willow trees near the bay.

WM. COUPER.

Toronto, January, 1854.

Scientific Intelligence.

An Improved Material applicable for many purposes for which Papier Mache and Gutta Percha have been or may be used.

*Patented by Peter Warren. October, 12, 1852.**

This invention consists in manufacturing a new material or composition of a character analogous to papier maché, which is capable of being employed either as a substitute for papier maché or gutta percha, and its compounds, in forming or manufacturing various articles for which these substances are now used, such as panels and mouldings for railway carriages, trays, picture and other frames, door knobs, buttons, &c, by treating the straw of any fibrous vegetable material in the manner hereby described. In order to carry out this invention, straw of any fibrous vegetable substances, such as wheat, barley, oats, rye, and other similar straws are cut into short lengths, by means of any suitable cutting machine When those straws have any knots, it is necessary to open out and divide the same, which is effected by passing the straw through a pair of millstones, or between crushing rollers; or they may be submitted to the action of any other equivalent apparatus, so that the knots and fibres may be thoroughly and effectually separated and divided. In some cases, either hot or cold water or other liquid is applied to the materials under operation, in order to facilitate the process. The cut and divided straw is then boiled in a strong alkaline ley, or solution of caustic alkali, such as soda, potash, &c., until a pulpy mass is produced,—which effect will, however, greatly depend on the nature of straw operated on, and the strength of the alkaline ley, or solution which is employed. The mass is then transferred to the machine known in the paper making trade as the rag engine, where it is reduced to pulp in the manner usually practised when operating on rags, &c., in the manufacture of paper. The pulp is then partially dried; in which state it may be pressed or rolled into sheets, or moulded into other forms. These sheets or moulded articles are then dipped into oleaginous or glutinous matter, or oil, and are afterwards baked in an oven similar to that employed when manufacturing sheets or moulded articles of papier maché. The sheets or moulded articles, thus formed or manufactured, may be ornamented in any desired manner, either by japaning, or painting and varnishing, or by inlaying the surface with shell, or other analogous material, as is commonly practised in the ornamenting of articles composed of papier maché and gutta percha. When the sheets or moulded articles are required to be colored pigments or coloring matter might be introduced in the pulp while in the rag engine; the subsequent processes of drying, rolling, pressing, or moulding, being performed as previously described.

The patentee claims the manufacture of a material which may be used as a substitute for papier maché, and for many purposes to which papier maché and gutta percha have been or may be employed, from straw pulp submitted to pressure and then oiled and baked as hereinbefore described.

* From the London Repertory of Patent Inventions, Sept. 1853.

Rolled Sheets of Bitumen.

MM. Aumeteyer believe that they have made a valuable improvement in the use of bitumens, by submitting them to rolling. The bitumens, say they, have been proved as to their qualities and endurance; their water-repelling properties and impermeability cause them to be more and more sought for every day: but up to the present time, no one had thought of rolling them out, and reducing them to thin sheets, easily to be laid when cold, like zinc and lead. This new mode of treatment does away, in the first place, with the inconveniences of melting on the spot, which is so disagreeable: and it gives to the bitumens, besides, a density and solidity which they have not yet attained; it assures them an indefinite durability.

Thus prepared, bitumen will very advantageously replace slate, zinc, thatch, &c., as coverings for terraces, buildings, &c. It melts, but does not inflame; and would rather extinguish than nourish combustion. They are incomparably lighter even than slates, and are non-conductors both of heat and electricity; they cost less even than thatch, require no attention, and are in no way affected by atmospheric influences; they are impermeable to water, &c., &c. They will be of great service in rendering damp places healthy; they are applied without difficulty to walls, and adhere strongly; a cellar whose walls were covered with rolled bitumen or asphalte, would be as healthy and as habitable as the upper story, provided light finds access, and the air is sufficiently renewed. In water conduits, reservoirs, basins, baths, washing establishments, and silos for the preservation of grains and vegetables, these sheets of bitumen, so thin, yet as unalterable as metals, will be of immense service. Easily painted, they may be employed either for wall-hanging or for floors.—*Journal Franklin Institute.*

ADDITIONAL EXPERIMENTS ON THE INTERNAL DISPERSION OF LIGHT.—In a lecture delivered before the Royal Institution in London, Prof. Stokes has communicated some new observations on internal dispersion, which are of much interest. In accordance with an observation of Faraday, Stokes has found that the blue flame of sulphur burning in oxygen is a source of rays which exhibit the phenomena extremely well. Letters written upon white paper with a solution of chinin, immediately become visible when illuminated with this light, particularly when it has passed through a blue glass, although they are invisible in gas light. The letters remain visible when observed through a glass containing a thin layer of a solution of chromate of potash, but they instantly vanish when this glass is interpolated between the flame and the paper, the solution being impervious to the rays which occasion the color. The author points out in the next place the advantages which prisms and lenses of rock-crystal possess over those of glass, in experiments of this kind, inasmuch as they readily transmit the invisible rays. By employing the light of the powerful galvanic battery of the royal institution, and lenses and prisms of quartz, the author obtained a spectrum six to eight times as long as the ordinary visible spectrum, and crossed from one end to the other with bright bands. The interposition of a plate of glass shortened the spectrum to a small fraction of its original length, the highly refrangible portion being entirely absorbed. The discharge of a Leyden jar gave a spectrum which was at least as long, but which was not perfectly similar to the others, as it consisted only of insulated bright bands. Stokes remarks finally that in winter, even in bright sunshine, he could obtain no such extended spectrum; as the spring advanced, the light constantly improved: he could not, however, see so far into the spectrum as at the end of last August. The Earth's atmosphere was evidently not transparent for the very highly refrangible rays of the suns light.—*Pogg. Ann.*, lxxxix, 627.

Telegraphic Inventions.—The *Official Venice Gazette* states in a special article, that the Olympic Academy of Vicenza, having carefully examined the discovery made by their fellow-citizen Tremeschini of electric telegraphy by secret transmission, has publicly declared it to be a successful invention. The commission appointed to test its efficacy was composed of the councillor-delegate, of the Podesta, the superior commissary, and the Academic council. The first experiment consisted in sending and receiving a despatch in the common way, without secresy. In the second experiment a despatch was sent secretly, and the answer received in the same manner, by the aid of the new apparatus. In the third a despatch was sent openly, and the answer received secretly, to show that the secret apparatus might be used or suspended at will. The results of the inquiry are said to show—first, that the apparatus of Tremeschini may be applied to Morse's telegraph; secondly, that when the despatch is sent secretly it can only be received so, any fraud in that respect being subject to immediate detection; thirdly, that secresy may be suspended or applied at pleasure.

The Royal Observatory at Brussels has just been placed in electric communication with the Royal Observatory, Greenwich, for the purpose of facilitating the determination in a direct manner of the difference of longitude between the two establishments. This operation is one of extreme delicacy, as well as of great importance to geodesy. The electric communication is made in such a manner that every oscillation of the pendulum at Brussels will be represented with accuracy at Greenwich, and *vice versa*. The observations are to commence this week.

Public Health—Lead, Copper or Zinc Pipes.—The Minister of Commerce, Agriculture, and Public Works in France, has just issued a circular to all Préfects calling upon them to put a stop to the use of lead pipes in Breweries. The Minister in his circular states that "Experience proves that beer, by simple contact with lead, takes up an appreciable quantity of the metal, and thus acquires poisonous properties. Leaden pipes are not only used in breweries; but a custom has arisen in taverns, and in houses where wine is sold, of using a small pump, which communicates with the barrels in the cellar by means of a leaden pipe. The use of the pipe in this instance is peculiarly objectionable, inasmuch as the action of the pump is at intervals only. A whole family was poisoned by using for some time a pump of this kind for drawing up their odinary consumption of wine. The Préfet of the North, who had already taken the initiative in adopting measures necessary for putting a stop to the methods used in his department for the refining of beer, has, following the advice of the Council of Public Health, just prescribed the use of lead, copper, or zinc pipes for the drawing or transmission of this liquid."

Preparation of Valerianic Acid from Fusel Oil.—Gruneberg recommends the following proportions as the most advantageous, 2¾ lbs. of bichromate of potash are to be introduced into a retort, and 4½ lbs. of hot water poured upon the salt. A cooled mixture of 1 lb. of fusel oil and 4 lbs. of sulphuric acid diluted with 2 lbs. of water is to be allowed to flow very slowly and in a thin stream into the liquid in the retort, and the whole is then to be distilled. The distillation goes on quietly, and 9 ounces of oily valerianic acid are obtained.—*Journal sur prakt. Chemie*, lx, 169.

Photography on Textile Fabrics.—Messrs. Wulff, of Paris, have placed before the French Institute some specimens of photography on linen, oil cloth, chintz., &c. This discovery will be of great importance for architectural ornamentation and other useful purposes. Such pictures can be cleaned by wiping, nay, they can be washed, and a portrait on linen or long-cloth can be forwarded in a letter. As moreover, these photographs can be obtained at a cheaper rate than those on metal or paper, the art will become more popularized. Messrs, Wulff keep their procedure yet secret, but it is thought that they operate on a preparation of idodized collodion.—*Builder*,

Preparation of Ferrocyanhydric Acid.—Liebig gives the following simple method of preparing this acid. When a saturated solution of ferrocyanate of pottash is mixed with its own volume of fuming muriatic acid added in small portions at a time, a snow-white precipitate of pure ferrocyanhydric acid is thrown down. These are to be washed with muriatic acid, dried upon a brick, and dissolved in alcohol; from the alcoholic solution the acid may be obtained in beautiful crystals.—*Ann. der Chimie und Pharmacie*, lxxxvii. 127.

A New Comet.—On the morning of the 2nd December, a comet was discovered by Mr. Klinkerfues, of the Gottingen Observatory, on the border of the Constellation Perseus, near the foot of Andromeda. At four o'clock. a. m., on the 3rd, its right ascension was in 1h. 37m. 20s. and its declination 51 deg. 37 sec. north. The diurnal motion in right ascension was 2m. towards the west, and in declination of 1½ deg. towards the south. Mr. Klinkerfues was the discover of the third comet of the present year, which became so conspicious at the end of August in the north-western heavens.

Separation of Nickel from Cobalt.—Liebeg has found that when a current of chlorine is passed into a cold solution of the double cyanades of cobalt and potassium and of nickel and potassium, the liquid being kept alkaline by the addition of caustic soda or potash, the nickel is completely converted into sesquioxid and precipitated, while the cobalt remains in solution as unaltered double cyanid. The sesquioxyd of nickel may be washed and the nickel weighed in the form of protoxyd; it is perfectly free from cobalt. The solution after passing the chlorine must still be alkaline. The smallest trace of Nickel gives an inky black color when dissolved in cyanid of potassium, and treated with chlorine. This method of separating cobalt and nickel has perhaps some advantages over Liebig's second method which it will be remembered, consists in boiling the mixed double cyanids with oxyd of mercury, which precipitates the nickel but not the cobalt.

Fossil Human Skulls—Wonderful if True.—The German Association for the Advancement of Science, lately held at Tubingen, appears to have been a most successful gathering. In the course of the proceedings, Prof. Karnat announced that Germany had coal enough to supply herself, and all the rest of the world, for the next 500 years. This is important if true; but the great fact elicited at the meeting was the clearing up of the mystery of the fossil human teeth exhibited at the preceeding year's meeting, which were found, it will be recollected, in the Swabian Alps, in strata of the mammoth period, and doubts expressed as to their being human teeth, as a man was not believed to have existed in the time of the mammoth. Since the meeting in 1852, however, a number of perfect human skulls have been found in the same locality with the teeth in them, which discovery if correctly reported, would naturally lead to the conclusion that a race of human beings was in existence contemporaneously with the mastodon, and other of the larger antediluvian animals.—*Mining Journal.*

The Nova Zembla Bottles.—Colonel Sabine on the part of the Committee of the Royal Society appointed to inquire into the probable origin of some bottles recently found on the shores of Nova Zembla, reported :—

"That the Committee had availed itself of the assistance of the Committee for managing the affairs of Lloyds, and had received from Captain Halsted a report, which is subjoined: and that the Committee have further requested that the Agents for Lloyds on the coast of Norway may be directed to obtain specimens of the bottles stated to be employed by the Norwegian fishermen, to compare with the bottles received from the Admiralty. The evidence relating to the bottle exhibited in the Vestibule of Lloyds, appeared to prove conclusively that it was of Norwegian make and similar to those used by the Norwegian fishermen for the past five years as floats for fishing nets.

Miscellaneous Intelligence.

King's College, London.—The following appointments have been made by the Council of King's College, London, consequent on the vacancy in the List of Professors created by the removal of the Rev. F. D. Maurice. The Rev. Dr. M'Caul is elected into the Chair of Ecclesiastical History,—in addition to that of History and the Old

Testament hitherto held by him. A lecturer is to be appointed to relieve Dr. M'Caul by instructing the junior classes in Hebrew. The Chair of English Literature and Modern History is filled by the nomination of Mr. G. W. Dasent, of Magdalen Hall, Oxford, Doctor of Civil Law.

Academy of Sciences, Paris.—M. Elie de Beaumont has been elected Secretary of the Paris Academy of Sciences, in the room of the late M. Arago. M. Dupin contested the place with M. de Beaumount. The number of votes were—M. Beaumont, 29; M. Dupin, 17. It is understood that M. Leverrier is to be appointed Keeper of the Observatory.

The Greatest Ancient and Modern Ships.—At the Institution of Civil Engineers a paper was read on ocean steamers, in which was the following statement :—

	Tonnage,	External bulk.
Ptolomasus Philopater's ship....	6,445 tons.	830,700 cubic ft.
Noah's Ark.....	11,705 "	1,580,000 "

Contrasting with these a few modern ships, it was found that

Great Western........................	1,242 tons,......	161,100 cubic ft.
Great Britain	3,445 "	446,570 "
Arctic (American packet).........	2,745 "	356,333 "
Himalaya..............................	3,528 "	457,332 "

and, calculating by the same rules, taking the dimensions given in the prospectus of the Eastern Steam navigation Company, their

Proposed iron ship ....22,942 tons ...2,973,598 cubic ft.

Thus the new ship is just double the size of Noah's Ark.

The *Persia*, to be built by Mr. Robert Napier, of Glasgow, for the Cunard Company, to ply between Liverpool and New York, will be about 45 ft. broad in the beam, and extend in length to 360 ft. ; and the tonnage will be 3060. The engines will be 100-in. cylinders, with a 10 ft. stroke. Although no part of this immense vessel has yet been set up, the framework is in rapid progress ; and it is believed that she will be ready in twelve months hence;

A Real Gold Mine in England.—At last the mining world of London has been electrified by the astounding news that the copper mine in Cornwall, called by the name of Tremollett Down, is nothing less than a *veritable mine of gold*, the mundic, of which the supply is said to be inexhaustible, having yielded to two separate tests the enormous result of *eight ounces of pure gold* per ton, thus placing this now celebrated mine deservedly at the head of all the mines in Europe in point of profit ! It is understood that the fortunate shareholders are to have a meeting immediately, to subscribe for two of Berdan's machines, with four basins each, and a steam engine, capable of raising and reducing 100 tons per month, which, at 8 ozs. per ton of gold, makes the Tremollet mundic worth 30*l*. per ton, or, at 1000 tons per month, 30,000*l*.; whilst the cost of raising and reducing this auriferous pyrites will not exceed, royalty included, 5000*l*., leaving a nett profit of 25,000*l*. per month, or 300,000*l*. per annum, which would make each share worth 400*l*.

Forster's Wrought Iron Plates.—The *Gateshead Observer* has the following remarks on these extraordinary plates :—" Wonders never cease. We have on several occasions noticed the extraordinary productions of the Derwent Iron Works, at Consett—to wit, a rail which quite eclipsed the sea serpent, and plates of a ton weight, of vast breadth and length, for which a prize medal was awarded by the Commissioners of the Great Exhibition, and other things equally extraordinary. But now Mr. Forster the Manager at these works, has outshone himself, and produced what really seems incredible—four wrought-iron plates, 1¼ in. thick, 5 ft. broad, and no less than 17 ft. 3 in. long! Think of such plates, as long as a good comfortable room, and weighing no less than 1 to 14 cwts. each ! How men can lift such things at all, to say nothing of doing so when they are at an intense white heat, is what we cannot comprehend. And how they are sheared, too. Think of a pair of neat scissors quietly clipping the edges of such plates, 1¼ in. thick ! If this does not " whip creation " we do not know what does. These large monsters have gone to Glasgow, to astonish the natives there, and are to be used as engine-beams, being much lighter and stronger than cast-iron ones.

Consumption of Atmospheric Air.—The total produce of pig-iron for the year 1850, was estimated at 2,380,000 tons. In order to produce this quantity there were consumed 9,500,000 tons of coal 2,500,000 tons of ironstone, and the ores operated upon could not have been less than 7,000,000 tons. But the most remarkable fact in connection with the iron trade is the immense weight of atmospheric air required in the various blast furnaces, and which although generally considered as so light in its nature, has yet considerably exceeded in weight that of all other materials consumed. One of the large furnaces of South Wales consumes 12,608 cubic feet of air each minute in supplying the oxygen necessary to the combustion of the fuel, To supply the air consumed on an average in each furnace requires an engine of 25-horse power. Engines of nearly 12,000 horse power are constantly employed to drive the " breath of life " into the glowing masses within the furnaces of the United Kingdom. Each furnace on an average sucks in 17,000 gallons of air per minute, or five tons weight per hour. The number of furnaces in blast in 1850 was 459; the aggregate weight of air, therefore, required during that period to keep life in these fiery monsters was not less than 55,080 tons daily, or 20,049,000 tons during the year—a quantity exceeding in weight the totals of the coals, ore, and limestone consumed in the process of smelting.

Mileage of Railways.—The mileage of railways in England is 5238 miles 5 furlongs 211 yards; and in Wales 348 miles 5 furlongs 203 yards. Mileage of the railways in the United States 14,064.25.

Novel Application of Glass.—The Prussians have put glass to a novel use. A column, consisting entirely of glass, placed on a pedestal of Carrara marble and surmounted by a statute of Peace six feet high, by the celebrated sculptor Rauch, is about to be erected in the garden of the palace of Potsdam. The shaft will be ornamented with spiral lines of blue and white.

Institut Canadien.

The ninth Annual Meeting of the *Institute canadien* was held last week, and gathered the *elite* of the French Canadians of Montreal. We see with pleasure by this report that this society is constantly progressing and promises to be one of the most useful and important institutions of our country. Our readers will be ready to endorse our opinion when they hear that during the year 43 meetings were held, 17 questions discussed and 6 lectures delivered; that its library had an increase 730 volumes, making the present number 2,701 ; that 66 newspapers were received in the reading room ; that its membership has increased to 499; that its receipts have exceeded by £54 11s. 6d. its expenses. A society exhibiting such signs of life and prosperity cannot fail of exerting a powerful and beneficial influence upon the community.

We will only add that the *Institut Canadien* has been incorporated, and it is proposed to adopt measures to secure a building lot and erect a suitable edifice for its use.—*Le Semeur Canadien.*

Canadian Canals.

November Traffic.

	1852.			1853.		
Welland Canal..............................	7,579	1	6	8,237	7	4
St. Lawrence................................	3,172	13	5	2,954	7	10
Chambly	197	9	4	137	19	8
St. Ann's Lock..............................	117	1	0	131	8	8
Burlington Bay Canal....................	819	0	6	906	11	1
	11,885	5	9	12,367	14	7
Previously this year.......................	70,954	2	2	81,496	15	5
Total	72,839	7	11	93,864	10	0

Grand Total of Tonnage of Vessels passing through all the Canals.

	1852.	1853.
Nov.	270,544	255,811
Previously this year......................	1,746,937	1940,265
	2,017,481	2,196,076

Grand Total of Merchandize passing through all the Canals.

	1852.	1853.
Nov.	203,354	210,706
Previously this year......................	1.246,221¾	1,497,484½
Total...	1,449,575¾	1,708,190½

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—December, 1853.

Latitude, 43 deg. 39.4 min. North. Longitude, 79 deg. 21. min. West. Elevation above Lake Ontario, 108 feet.

Magnet.	Day.	Barom. at tem. of 32 deg.				Tem. of the Air.				Tension of Vapour.				Humidity of Air.				Wind.			Mean Vel'y in Miles	Rain in Inch.	Snow in Inch.
		6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M. °	2 P.M. °	10 P.M. °	M'N. °	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.			
a	1	29.760	29.741	29.683	29.729	30.5	29-3	29.4	29.33	0.155	0.113	0.127	0.128	91	70	78	75	N b E	N N E	NE b N	6.57	...	Inap.
b	2	.624	.593	.634	.616	26.0	28.5	29.8	28.02	.122	.122	.122	.124	86	77	78	80	N E	NE b N	N b W	5.49	...	...
b	3	.581	.768	.902	.767	31.8	29.5	22.0	26.97	.148	.113	-096	.117	82	70	79	77	NW b N	N W	N b W	8.96	...	...
c	4	.945	.909	—	—	19.0	28.4	—	—	.095	.134	—	—	89	84	—	—	NW b W	W S W	—	1.65	...	2.3
c	5	.762	.752	.738	.744	26.8	34.8	32.5	29.88	.125	.169	.168	.146	86	84	92	87	Calm	Calm	W b N	0-99	0.450	...
c	6	.424	.826	.697	.480	35.9	40.6	33.8	36.67	.180	.208	.153	.178	85	81	78	82	S b E	W b S	N W	9.80	0.015	Inap.
a	7	.880	.952	.984	.944	27.4	25.1	20.0	23.65	.140	.110	.094	.108	93	79	84	82	N b W	N b W	Calm	4.97	...	...
a	8	.938	.817	.744	.827	23.0	33.0	29.1	28.53	.109	.131	.141	.128	85	70	88	81	Calm	S W	SW b W	3.94	...	...
b	9	.737	.650	.664	.685	20.2	39.5	30.9	29.82	.095	.190	.130	.135	85	79	75	78	Calm	SW b W	Calm	2.08	...	...
a	10	.650	.612	.537	.633	25.5	41.6	32.8	32.95	.116	.183	.144	.149	81	70	79	79	Calm	S W	Calm	1.80	...	...
a	11	.650	.669	—	—	27.1	42.2	—	—	.123	.153	—	—	82	57	—	—	S W	S S W	—	1.98	...	...
af	12	.766	.708	.766	.750	34.8	39.5	37.2	37.00	.176	.206	.196	.192	88	86	89	88	NE b E	Calm	N b E	1.88	...	...
b	13	.862	.864	.877	.868	35.9	39.1	28.7	34.03	:169	.194	.137	.164	81	82	87	83	N E	N N E	Calm	0,95	...	...
b	14	.800	.749	.762	.769	32.3	35.9	34 5	34.13	.162	.164	.171	.166	89	78	86	84	Calm	W b S	Calm	1.30	...	...
c	15	.721	.669	.614	.667	34.3	35.3	33.8	34.38	.170	.170	.166	.170	87	83	86	86	Calm	W b N	Calm	1.42	Inap.	...
c	16	.533	.454	.384	.434	36.8	38.3	33.4	36.13	.200	.198	.174	.192	92	86	92	90	Calm	W b S	Calm	0.72	0.050	0.3
b	17	.800	.137	28.969	.126	33.2	34.6	21.9	29.25	.180	.171	.091	.145	95	86	75	87	Calm	NE b N	N	11.01	...	0.3
c	18	.096	.288	—	—	15.8	16.3	—	—	.078	.065	—	—	83	68	—	—	N N W	N N W	—	9.13	...	0.1
—	19	.531	.583	29.701	.617	9.0	15.4	4.9	9.73	.064	.069	.045	.060	93	75	77	83	N E	N b E	N b E	2.93	...	0.3
c	20	.777	.838	.943	.866	10.8	21.9	19.0	16.70	.051	.078	.081	.070	67	65	76	71	N b E	W b N	W b S	3.92	...	...
d	21	.937	.833	.696	.801	19.4	21.3	24.1	21.72	.087	.090	.115	.099	80	76	86	81	W	Calm	SW b S	2,35	...	0.4
c	22	.618	,616	.461	.549	28.7	33.2	33.2	31.83	.129	.135	.173	.148	80	71	92	82	W S W	SW b W	S S E	2.64	0.110	0.1
c	23	.083	.154	.508	.265	33.8	27.1	17.6	25.20	.180	.104	.080	.114	94	69	79	79	W b S	W b N	NW b W	13.32	...	Inap.
b	24	.608	.447	.453	.504	17.2	23.6	14.2	17.97	,081	.097	.076	.084	81	74	86	81	W S W	W S W	W b S	8.54	...	...
b	25	.501	.474	.—	—	30.2	32.5	—	—	.150	.141	—	—	89	77	—	—	W	W S W	—	6.82	...	2.8
a	26	28.973	29.061	—	—	29.8	30.6	—	—	.154	.147	—	—	94	86	—	—	S S E	N N W	—	7.64	...	Inap.
a	27	29,520	.506	.485	.503	19.4	22.3	25.8	22.22	.092	.106	.118	.100	84	86	83	80	N b E	N N E	N E	6.07	...	3.0
d	28	.459	.498	.500	.483	14.4	10.6	7.1	8.68	.074	.057	.051	056	83	77	77	80	N E	NE b N	N N E	8.99	...	0.5
b	29	.529	.496	.411	.474	-3.9	7.1	2.9	2.43	.024	.044	.048	.036	62	66	70	61	N	N b W	NW b N	4.83	...	2.3
b	30	.293	,084	.100	.159	8.0	18.0	14.4	13.47	.053	.088	.078	.074	79	85	89	85	N E	E N E	N [illegible] b N	8.43	...	6.5
b	31	.201	.238	.424	.298	5.7	27.3	16.5	17.72	.042	.136	.087	.093	70	90	90	84	N N E	Calm	W	4.32	...	3.4
—	M	29.611	29.580	29.605	29.5984	23.71	28.94	24.19	25.32	0.120	0.132	0.118	0.122	84	78	82	81	3.84	6.10	4.50	4.98	0.625	22.3

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1876.38.	1690.09.	460.62.	585.70.

Mean direction of Wind N W b N.

Mean velocity of the Wind... 4.98 miles per hour.

Maximum velocity .... 25.0 miles per hour, from 9 to 10 p.m. on 17th.

Most windy day...... 23rd; Mean velocity... 13.32 miles per hour.

Least windy day ..... 16th; Mean velocity... 0.72 ditto.

Raining on 4 days. Raining 11.0 hours.

Snowing on 13 days. Snowing 60.8 hours.

Toronto Bay frozen over on the morning of the 19th.

First Sleighing in Toronto on the 16th.

Toronto Bay crossed on foot on the 21st, going and returning from Toronto to the Peninsula.

Highest Barometer...... 29.984, at 10 p.m. on 7th } Monthly range:
Lowest Barometer ...... 28.952, at midnight, 17th } 1.032 inches.

Highest temperature.... 46.4, at p.m. on 11th } Monthly range:
Lowest temperature ... --8°.4. at a.m. on 29th } 54°.8.

Mean Maximum Thermometer ...... 31.32 } Mean daily range, 14.14.
Mean Minimum Thermometer ..... 17.18 }

Greatest daily range .... 24.9, from p.m. 27th to a.m. of 28th.

Warmest day...... 12th. Mean temperature ...... 37.00 } Difference
Coldest day.......... 29th. Mean temperature ...... 2.43 } 34°.57.

Aurora observed on 5 nights. Possible to see Aurora on 8 nights. Impossible to see Aurora, 18 nights.

Comparative Table for December.

Year.	Temperature. Mean.	Max. obs'vd.	Min. obs'vd.	Range.	Rain. D's.	Inch.	Snow. D'ys	Inch.	Wind Mean Vel'y.	
	°	°	°	°						
1840	24.3	41.0	—4.4	45.4	3	0.000	18	Not Record'd.	Not Record'd.	
1841	28.7	45.5	+2.4	43.1	7	6.600	5			
1842	24.7	40.3	+3.8	36.5	3	0.880	17			
1843	30.0	41.1	+2.7	38.4	6	1.040	8	8.1	0.53	lb.
1844	28.2	48.9	—0.8	49.7	6	imp.	6	4.2	0.40	lb.
1845	21.1	37.6	—2.7	40.3	2	0.000	12	4.7	0.70	lb.
1846	27,5	49.2	+3.7	45.5	5	1,215	9	6.0	0.57	lb.
1847	30.1	50.0	+6.6	43.4	7	1,185	8	6.8	4.55	Miles.
1848	29.1	49.1	+0.6	48.5	7	2.750	7	16.5	5.44	Miles.
1849	26.5	41.3	—5.2	46.5	5	0.840	12	9.6	6.23	Miles.
1850	21.7	48.3	—9.7	58.0	2	0.190	18	29.5	7.40	Miles.
1851	21.5	43.8	—10.5	54.3	6	1.075	15	10.7	7.37	Miles.
1852	31.9	41.0	+13.9	27.1	7	3.995	10	20.1	6.54	Miles.
1853	25.3	42.2	—5.2	47.4	4	0.625	13	22.3	4.98	Miles.
									0.55	lb.
M'n.	26.47	44.24	—0.34	44.58	5'0	1.569	11.3	12.59	6.07	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——December, 1853.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6. A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 P.M.	2 P.M.	10. A.M.	Humidity of Air. 6 P.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity in Miles per Hour. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	19 P.M.
1	29.654	29.582	29.597	21.2	26.0	19.0	.086	.108	.080	.64	.64	.64	N E	N E	N E	9.58	8.52	3.62			Clear.	Clear.	Clear.
2	.601	.532	.536	15.0	23.0	20.0	072	082	064	63	57	56	N E	N E	N E b E	10.11	6.03	5.15			Do.	Do.	Overcast.
3	.490	.887	.565	30.1	23.1	17.0	125	106	069	67	73	60	N E b E	N N E	N W	7.08	5.80	6.50		0.92	Overcast.	Slight Snow.	Clear. [lis.
4	.740	.710	.754	3.0	11.8	2.5	044	063	033	77	67	57	W N W	W N W	W b S	10.66	7.78	4.27			Clear.	Clear.	Do. A. Borea-
5	.750	.687	.696	0.0	12.5	14.5	025	070	066	50	73	61	N E b N	N E b E	N E b E	0.50	4.00	5.42			Cir. Str. 10.	Cir. Str. 9.	Cir. Str. 10.
6	.442	.098	.236	22.0	32.5	27.5	079	160	112	63	80	67	N E b E	E S E	W N W	5.60	5.02	7.72		1.00	Cir. Str. 10.	Snowwith hail	Clear.
7	.590	.642	.712	18.5	19.6	16.5	082	178	074	68	60	64	W N W	W b N	W b N	1.90	9.30	7.49			Str. 2.	Str. 10.	Str. 10.
8	.668	.596	.541	13.5	28.8	28.0	064	129	119	63	72	68	W	W S W	S W b W	9.00	6.87	8.12			Do. 10.	Cum. Str. 10.	Do. 10.
9	.517	.495	.461	30.0	41.0	30.0	138	253	145	74	72	78	W S W	S W	S W	8.00	6.42	5.00			Cir. Str. 10.	Do. 2.	Clear.
10	.492	.455	.506	22-5	34.0	26.0	096	170	118	68	79	73	S W	W N W	N W b N	3.40	0.37	0.80			Do. do 10.	Clear.	Fog.
11	,513	.497	.568	28.0	32.2	29.5	153	182	152	88	91	85	W N W	W	W N W	0.08	0.94	3.03			Fog.	Str. 5.	Hazy.
12	.606	.511	.538	31.0	36.0	31.0	171	192	141	89	83	72	W N W	E	N W b W	0.62	0.02	2,52			Str. 10.	Do. 10.	Str. 10.
13	.621	.628	.692	29.0	39.3	23.0	157	214	099	76	84	69	W N W	E b N	E b N	1.75	3.44	1.75			Clear.	Clear.	Clear.
14	.651	.534	.516	11 5	33.0	30.5	067	197	168	67	95	90	N E b E	N b E	S W	0.23	0.09	0.52			Do.	Do.	Str.10.
15	.531	.497	.456	25.0	37.0	32.9	135	218	197	86	91	95	W	W S W	W S W	0.32	0.16	0.16			Do.	Str. 10.	Do. 10.
16	.389	.333	.238	33.5	36.0	34.0	199	210	204	95	91	95	S S W	S W b S	S	1.80	3.30	3.95			Str. 10.	Do. 10.	Do. Rain at 10
17	.167	28.994	.011	33.2	36.0	24.1	197	220	135	95	94	90	S	S	N E b E	0.11	1.24	13.32	0.316		Slight Rain.	Do. 10.	Sleet. [40p.m.
18	28.843	28.847	.164	22.0	14.0	4.2	123	075	056	88	72	95	N W	W N W	W	18.00	10.73	7.97		6.50	Snow.	Cir. Str. 5.	Str. 10.
19	29.400	29.468	.585	−7.8	2.6	−10.2	033	046	019	91	84	60	W b N	W b N	W b N	14.51	0.75	0.16			Str. 10.	Clear.	Clear. [lis.
20	.641	.719	.754	−21.5	2.1	−12.5	013	042	019	63	76	63	W b N	W b N	W N W	Calm	Calm	0.16			Clear.	Ditto.	Do. A. Borea-
21	.793	.739	.700	−0.5	7.5	5.7	027	055	062	68	80	82	N N E	N E b E	N E b E	0.22	0.03	Calm			Str. 10.	Str. 10.	Str. 10.
22	.599	.548	.545	−7.2	16.5	18.0	054	086	094	79	85	85	N E b E	N E b E	N E	5.00	0.21	Calm		Inapp	Do. 10.	Slight Snow.	Do. 10.
23	.147	28.851	28.950	26.0	35.0	26.0	132	203	135	88	91	83	E b S	S	W N W	3.32	12.13	6.22		3.40	Do. 10.	Str. 8.	Clear.
24	.150	29.221	29.422	25-0	6.3	8.5	123	043	058	79	63	80	W N W	W b N	W b N	22.00	26.25	19.59			Do. 10.	Cir. Str. 5.	Str. 10.
25	.265	.260	.258	10.0	19.5	17.2	065	097	096	72	77	83	W b N	W b N	W S W	17.63	2.05	2.97			Do. 10.	Str. 10.	Clear.
26	.105	.100	.101	16.1	21.0	19.0	105	111	097	94	83	77	N E b E	N E b E	N E b E	2.30	12.14	14.47		0.60	Do. 10.	Snow.	Snow.
27	.279	.280	.282	14.1	13.5	0.0	080	088	044	78	87	83	N W	W N W	W b N	26.51	12.20	10,05		0.11	Do. 10.	Str. 8.	Clear. [lis.
28	.286	.329	.335	−8.0	3.0	−0.9	026	036	015	79	59	38	W b S	W	W	8.13	1.15	0.0[illegible]			Do. 8.	Clear.	Do. A. Borea-
29	.108	.251	.100	−13.1	−0.2	−3.9	019	036	032	63	84	70	N	N W	W N W	Calm	Calm	8.51			Do. 10.	Do.	Do.
30	.166	.277	.266	−12.1	0.4	1.5	017	051	044	57	85	84	W S W	W SW	N E b E	4.54	6.47	Calm			Clear.	Str. 8.	Snow.
31	.234	.270	.351	2.1	13.0	4.9	043	088	047	77	87	78	N E b E	N E b E	N E b E	5.24	1.12	6 50		0.60	Str. 10.	Do. 10.	Clear.

Barometer:
- Highest, the 21st day 29.793
- Lowest, the 18th day 28.843
- Monthly Mean 29.456
- „ Range 0.950

Thermometer:
- Highest, the 9th day .... 41°.0
- Lowest, the 20th day .... -21°.5
- Monthly Mean .... 16°.56
- „ Range .... 62°.5

Greatest Intensity of the Sun's Rays .... 131°.0

Mean Humidity .... .759

Rain fell in 1 day amounting to 0.316 inches.
Snow fell on 7 days amounting to 13.13 inches.
Winter fairly set in 18th December.
Most prevalent Wind N E b E.
Least do. do. E.
Most Windy Day, the 24th day; Mean miles per hour, 22 61.
Least Windy Day, the 20th day; Mean miles per hour, 0.05.
The Electrical State of the Atmosphere has been marked *generally* by a Moderate Intensity of Positive Electricity; and during the Snow Storms of the 3rd and 6th days indicated a High Tension of a *positive* character.

Monthly Meteorological Register, Quebec, Canada East.—December, 1853.

BY LIEUT. A. NOBLE, R.A.

Latitude, 46 deg. 49.2 min.; Longitude, 71 deg. 16 min. Elevation above the level of the Sea, — Feet.

Date.	Barometer corrected and reduced to 32 degree, Fahr.				Temperature of Air.				Elasticity of Air.				Humidity of Air.				Direction of Wind.			Velocity of Air.			Rain in inch.	Snow in inch.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	6 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		
					°	°	°	°																
1	29.950	29.914	29.910	29.926	23.0	23.2	24.0	23.4	.111	.093	.129	.111	.87	.73	.95	.85	N E	E N E	E N E	15.2	11.4	8.	...	...
2	.963	.919	.863	.895	20.5	20.0	19.0	19.8	096	090	092	093	85	80	87	84	N E	N E	E N E	13.9	13.4	14.3	...	...
3	.767	.702	.740	.736	20.0	23.4	18.0	20.4	082	120	092	098	90	93	81	88	E b N	E N E	E	11.4	10.9	6.2	...	3.0
4	.879	.914	30.040	.954	4.4	9.0	2.5	5.3	017	051	010	046	81	73	75	76	N N W	N W	N W	10.9	8.8	8.	...	...
5	30.054	30.057	.055	30.055	3.3	12.0	13.0	9.4	011	053	064	053	76	66	76	73	N W	Calm	Calm	8.	...	...	...	1.0
6	29.920	29.603	29.349	29.627	20.4	21.5	26.0	23.6	092	119	136	116	81	88	96	88	E	E b S	E b S	10.1	11.4	10.1	...	5.0
7	.474	.814	.805	29.698	21.5	25.1	17.0	21.2	112	106	075	098	94	77	77	83	Calm	N N W	N N W	...	8.8	8.	...	...
8	.930	.868	.849	.882	16.8	23.5	21.6	21.0	089	108	117	105	91	83	97	90	N N W	N N W	Calm	6.2	3.8	...	...	2.5
9	.734	.789	.748	.757	27.0	35.0	1.5	31.1	125	156	153	145	84	77	87	83	W	W b S	W b S	5.2	3.8	3.8	...	...
10	.755	.766	.766	.762	32.5	37.5	33.3	34.4	166	180	175	174	91	80	93	88	N N W	W N W	W N W	3.8	3.8	3.8	...	...
11	.703	.805	.862	.820	30.8	32.8	29.6	31.1	159	163	141	155	93	88	88	90	N W	N W	Calm	3.8	3.8	...	...	...
12	.874	.853	.857	.861	26.5	35.6	31.7	31.3	140	162	158	153	96	78	89	88	Calm	Calm	E	...	...	8.	...	...
13	.855	.974	30.016	.958	30.2	32.0	17.0	26.4	162	171	091	141	96	95	92	94	Calm	E b N	Calm	...	5.2	...	...	...
14	30.006	.850	29.762	.873	10.3	21.8	24.3	19.8	051	116	113	093	69	85	84	79	Calm	N W	N W	...	5.2	8.	...	...
15	29.760	.817	.770	.782	25.5	33.0	30.2	29.6	121	156	146	141	84	83	88	85	N N W	N N W	W N W	6.2	5.2	3.8	...	...
16	.703	.648	.673	.641	30.5	35.2	36.3	34.0	135	178	155	156	79	87	73	80	Calm	W b N	W b N	...	3.8	3.8	...	1.5
17	.494	.422	.341	.419	33.3	38.5	29.0	33.6	183	198	144	175	97	85	90	91	Calm	E b N	E b N	...	6.2	19.	...	3.5
18	28.893	28.844	.127	28.934	27.5	24.2	11.5	21.1	137	112	058	102	90	84	75	83	E N E	Var.	N W	19.7	11.4	13.9	...	0.5
19	29.451	29.689	.650	29.597	-2.5	0.4	-6.5	-2.9	029	044	027	033	67	90	76	78	N W	N W	N W	8.0	8.	3.8	...	...
20	.857	.991	30.048	.965	-17.8	-4.8	-8.0	-10.2	012	031	027	023	59	86	84	76	N W	N W	N W	3.8	3.8	3.8	...	...
21	30.078	30.095	30.056	30.077	-3.0	7.8	5.0	3.2	026	053	047	042	63	79	79	74	N N W	N N W	N N W	5.2	5.2	3.8	...	...
22	29.994	29.917	29.882	29.931	10.3	15.8	18.0	14.7	059	082	089	077	80	87	87	85	E	E	E b N	5.2	13.4	8.	...	1.5
23	.648	.266	.102	.339	20.8	22.9	27.5	23.7	114	119	132	122	97	94	87	93	E N E	E N E	E N E	10.1	11.4	6.2	...	9.5
24	.044	.104	.106	.084	24.6	13.5	3.5	13.8	109	071	041	074	81	82	74	79	N N W	N W	N N W	9.3	8.	8.	...	...
25	.284	.404	.498	.395	4.3	15.8	15.5	12.2	018	087	088	074	83	93	95	90	N W	N W	N W	9.3	7.2	8.	...	...
26	.451	.355	.369	.393	10.5	20.5	21.0	17.3	095	096	103	098	68	85	88	80	E N E	E N E	E N E	9.3	11.4	10.9	...	1.5
27	.421	.386	.346	.384	22.5	23.1	11.5	19.0	108	122	063	098	96	96	79	90	N b W	N b W	N N W	9.3	8.8	13.9	...	1.8
28	.331	.624	.611	.488	4.5	6.2	-2.5	2.4	045	058	021	041	77	95	48	73	W N W	N N W	N N W	13.9	10.9	7.2	...	...
29	.522	.322	.082	.309	-8.0	3.2	2.0	-0.9	029	017	010	039	88	84	77	83	Calm	N N W	N N W	...	8.8	10.9	...	3.0
30	.197	.449	.580	.408	-3.5	6.0	1.0	1.2	029	013	015	039	71	70	90	77	N W	N W	N W	10.1	8.	6.2	...	1.0
31	.492	.530	.735	.585	9.8	14.2	13.5	12.5	062	085	068	072	85	96	79	87	N W	E S E	E S E	6.2	6.2	6.2	...	2.0
	29.660	29.665	29.660	29.662	15.3	20.1	16.8	17.4	091	105	093	096	83	81	83	81				6.9	7.3	6.9	0.0	37.3

REMARKS

1st. At about 11½ a.m. light cirrus clouds at a great elevation; at Ls. to the meridian. Aurora visible.

2nd. A very faint Aurora.

3rd. Snowing from 12½ to 7½ p.m. Aurora visible.

4th. A good Aurora appeared at 6, still visible at 11.

6th. Snowed 1½ p.m. to 10½ p.m.

7th. A very faint Aurora.

8th. Snowed from 5½ a.m. to 2 p.m.

12th. Aurora visible at 6 a.m., not visible previously.

13th. cirrus clouds Ls. to meridian at 2 p.m.

14th. Lunar halo 60° in diameter at 6 o'clock p.m.

15th. At 1 p.m. cirrus clouds at Ls. to meridian.

22nd. Sky covered with clouds, but in the north a dark arch, and a glow above it; thought it might be Aurora. Observed this about 9 p.m.

26th. Lower stratum of clouds moving; with the wind E.N.E. Upper stratum S.S.E.

Highest Barometer, at 2 p.m. on the 21st............... 30.059 } Monthly Range, 1.251 in.
Lowest Barometer, at 2 p.m. on the 18th............... 28.811 }

Maximum Thermometer, on the 17th .... 38.5 } Monthly Range, 56°.5.
Minimum Thermometer, on the 20th .... -18.0 }

Mean Maximum, Thermometer, ... 22.4 } Mean Daily Range, 12°.3.
Mean Minimum, Thermometer, ... 10.1 }

Greatest Daily Range .... 30°.0 on the 18th.
Least Daily Range .... 3°.5 on the 2d.

Warmest Day, the 10th .... 34°.4 } Climatic Difference, 44°.2.
Coldest Day, the 29th .... -10.2 }

Possible to see Aurora on 11 nights.
Aurora actually visible on 9 nights.