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THE

CANADIAN JOURNAL:

A REPERTORY OF

INDUSTRY, SCIENCE, AND ART;

AND A RECORD OF THE

PROCEEDINGS OF THE CANADIAN INSTITUTE.

EDITED BY

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ASSISTED BY

THE PUBLISHING COMMITTEE OF THE CANADIAN INSTITUTE.

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FOR THE

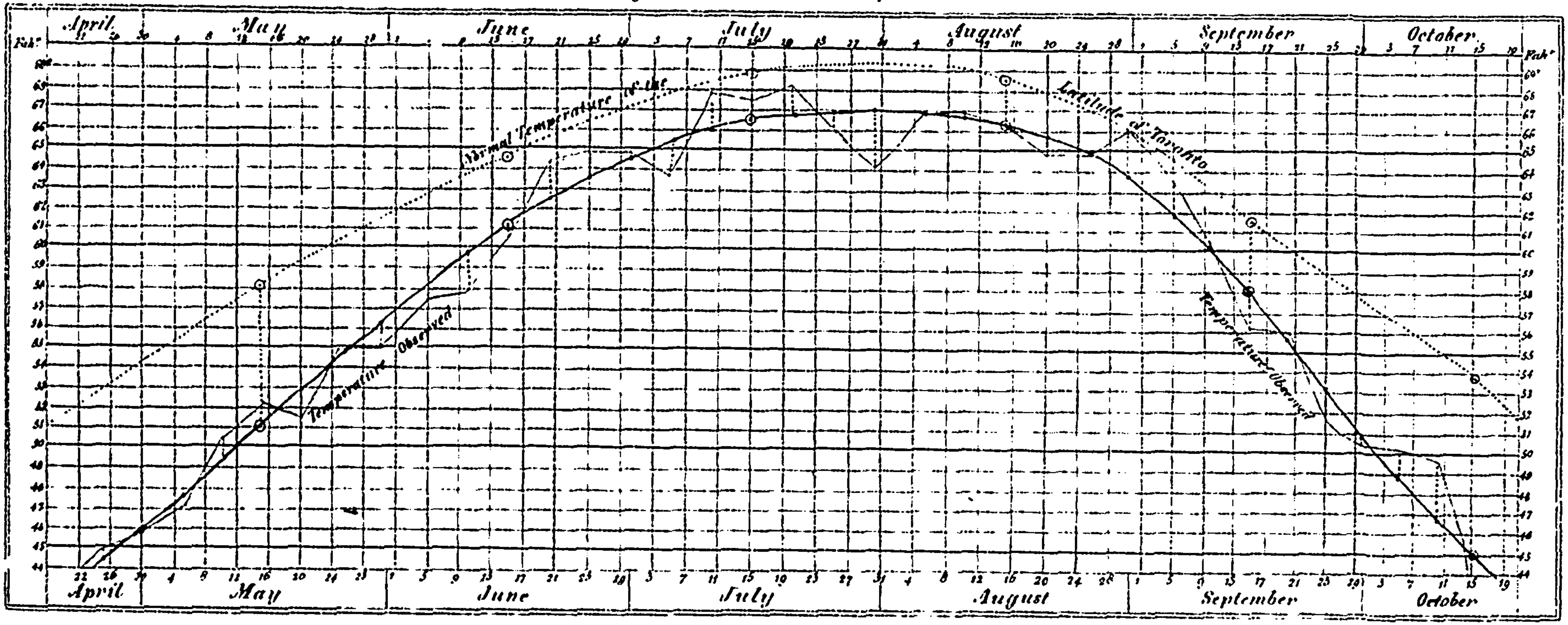
COUNCIL OF THE CANADIAN INSTITUTE.

TORONTO, 1854.

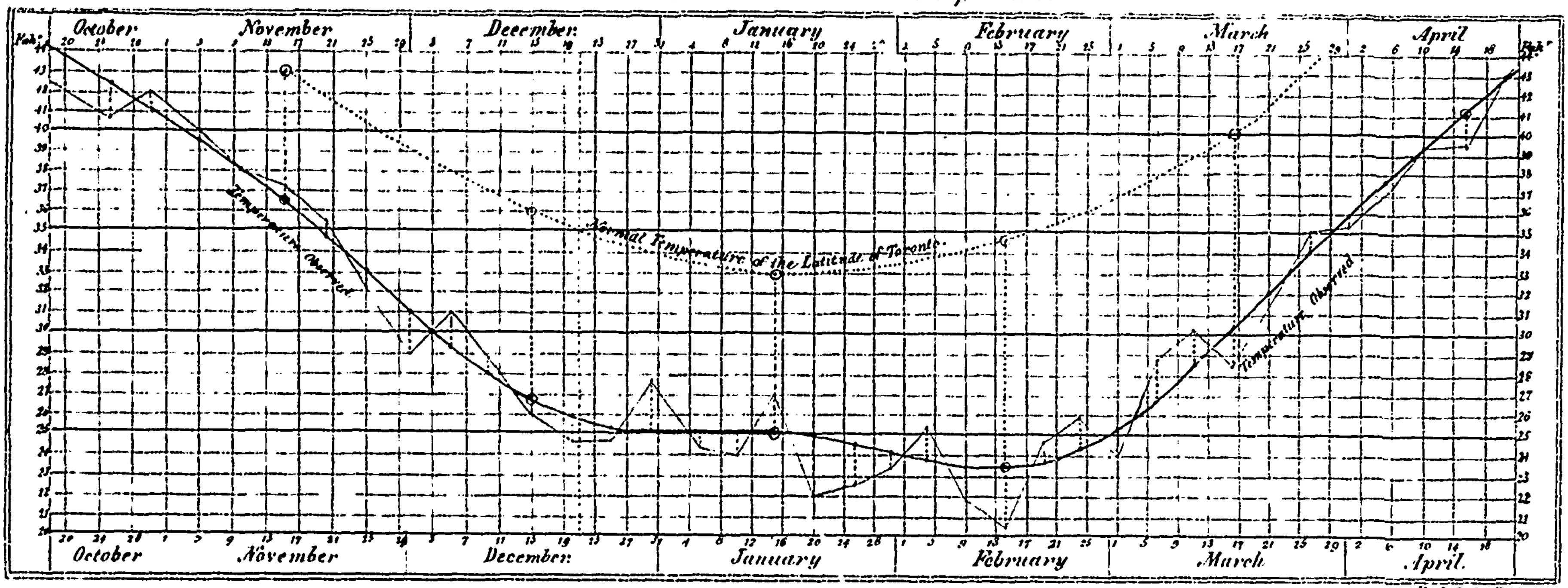
INDEX.

Five-day Means of the Temperature at Toronto from 12 years of Observation.

1° Between the highest and the mean Temperature.



2° Between the lowest and the mean Temperature.



Hugh Scobie Lith.

The Canadian Journal.

TORONTO, AUGUST, 1853.

The commencement of another volume of the *Canadian Journal* offers a suitable opportunity for reviewing the progress which has been made during the past year, by the only scientific Society in Western Canada, which has hitherto been bold enough to publish a record of its transactions. So numerous and yet so fruitless had former efforts been to sustain in full activity a Society devoted to scientific and industrial pursuits, that when it was proposed—not much more than two years ago—to place the Canadian Institute upon a broad basis, and to publish its transactions, few, but those who laboured unremittingly for the accomplishment of that object, imagined more encouraging results than those which had been already attained by some of its predecessors. The experiment, for such it undoubtedly was, has been eminently successful, and the monthly records of the past Session of the Institute afford the strongest assurance that its general design was wisely conceived, and the efforts to sustain it spirited and generous.

Although much has been already accomplished, and the first impulse given to the representation of the interests of Science and the Industrial Arts in this Province, we are fully aware that the Society will not yet admit of any relaxation in the support and co-operation of its promoters. It will require the continuance of active exertion for several years in order to combine that intellectual strength which matured and well-directed associations almost invariably command. That the Canadian Institute will grow with the growth and strengthen with the strength of the country it represents, we do not for a moment question; but, in order to arrive rapidly at the age of entire self-reliance, when it will draw to itself that literary support which it has hitherto solicited, the undiminished exertions of its present members are still in request. On the score of pecuniary resources, there is happily neither difficulty or doubt. The Provincial Government, with a liberality which cannot fail to secure the gratitude of all who can appreciate its value, has extended its powerful arm to lift into active and vigorous life the youngest of Canadian Societies. It will be a source of lasting benefit to its present and future members, to be able to recognize some of the fruits of that timely aid in the form of well-filled library shelves and a growing museum of Industry and Art.

Embracing now nearly three hundred members, scattered over every part of the Province, the Institute is rapidly becoming the acknowledged centre of practical and theoretical Science, as well as of Literature, in Western Canada,—a country whose sudden increase in wealth and population, whose astounding progress in railway enterprise and commercial activity, are unmistakeable announcements of her social and political progress,—and significant indications of her future destiny. May we not also see in the sudden spring of the Canadian Institute, from the weakness of infancy to the vigour of youth, an equally encouraging sign of advancing appreciations of the claims of Literature and Science. It would be unreasonable to suppose that there could already be found among the transactions of the Society, *or in the contributions* to this Journal, any positive additions to knowledge such as illumine the records of kindred associations in older countries. And yet a search would not be altogether in vain. Ethnologists will be thankful for the glimpse which is given of the condition and numbers af the race now passing away from the prairies and forests of the British Possessions in America. "The time may not be far remote when posterity may be counting its last remnants, and wishing that we in our day had been more alive to the facts, and more industrious in setting up marks by which we might measure the ebbing tide, and comprehend the destiny about to be consummated."* Meteorologists will acknowledge the worth of the elaborate monthly tables of temperature, magnetic disturbances, barometric fluctuations, rainfall, &c., which emanate from the Provincial Magnetical Observatory, and from the private Observatory of Dr. Smallwood, in Lower Canada. The hourly corrections of the Thermometer in Canada, derived from seven years of hourly observations at Toronto, will convey information to future observers of the most valuable description, which would, probably, have never seen the light but for the Canadian Institute.† Our readers will recognize with pleasure the local direction taken by many of the authors of the papers read before the Society at its weekly meetings. We venture to say that there is no surer way of awakening an interest in the study of Natural Science, than by selecting those departments for discussion which will permit of illustrations being brought from our forests, rivers, fields or rocks. Among the contributions to the Society's transactions, having a local or Canadian interest, we may mention:—"The Mineral Springs of Canada;" "The Provincial Currency;" "The Valley of the Nottawasaga;" "The Poisonous Plants in the neighbourhood of Toronto;" "The Rocks of Toronto," and "The Land Birds wintering near Toronto."

The subjects brought under the notice of the Institute during the last Session, will naturally attract the attention of those who interest themselves so far in its proceedings, as to endeavour to discover the tendencies of the Society from its transactions. Out of seventeen papers communicated during the Session of 1850-'1 and 1851-'2, no less than ten treated on topics relating to the Engineering and Surveying professions; whereas, out of fourteen papers read before the Society during the Session of 1852-'3, very few allusions were made by members to subjects bearing directly upon those professions. We give below a classification of the papers submitted to the Society during the last three years:—

1850, 1 and 2.

Engineering and Surveying	10
Geology and Physical Geography	6
Meteorology	1

* On the probable numbers of the native Indian population of British America, Capt. J. H. Lefroy, R. A., read before the Canadian Institute, May 1, 1852. See Can. Jour. Vol. 1, p. 193.

† See Can. Jour., vol. 1, p. 77.

1852-'3.

Engineering and Surveying	0
Geology and Physical Geography	3
Meteorology	1
Physical Science	1
Political Economy	2
Natural History	3
General Literature	3
Ethnography	1

It is very far from our intention to question the exertions of the professional gentlemen who first gave existence to the Canadian Institute, and from whose enlightened efforts in many directions it has hitherto drawn such a large measure of its influence and strength, but we would warmly urge the claims of the various Departments of Practical Science upon their numerous and accomplished representatives among the members of the Institute. Canada fills now so large a space in the world's eye, that the condition and progress of its means of internal communication,—its stupendous Railway system, its magnificent Canals,—its vast and navigable Rivers,—are become such prominent objects of interest abroad, as well as of vital importance to ourselves, that no reasonable means should be spared to afford the public authentic information respecting their construction, improvement and management. That a fair measure of support is given to the Institute through the pages of its Journal, we are glad to acknowledge, and we have every reason to believe that the extension of that support in the way of original contributions in all home matters relating to engineering and surveying operations, would be both interesting and advantageous to the public here and abroad. We have alluded thus pointedly to the absence of that general professional co-operation which was so liberally promised a year or so ago, in consequence of its having already attracted attention without the walls of the Institute, and led to the supposition that the Society, originally founded by the Engineers and Architects of the Province, is gradually being transformed into one of a purely Scientific character. Such, however, is very far from being the case. The Council, thoroughly impressed with the importance of sustaining in full vigour and efficiency, the practical character of the Society over which it presides, divided the sum set apart from the Government Grant of last year, for the purchase of books and Maps, into two equal portions, one half being placed at the disposal of the Committee representing the professions of the Engineer, the Architect, and the Surveyor, for the purchase of standard works on the subjects of these professions; the other half being disbursed by another Committee in procuring works of a more general description. We have every reason to believe that a similar distribution of the library funds will be made this year. The arrangements which have been already completed, or are yet in progress, will, most probably, secure to the present volume very comprehensive facilities for illustrating the magnificent public works of the Province, well known by their annually increasing revenue, but still without a place in the pages of any periodical or print.

Fourteen months ago, a document was issued by the Council of the Institute, soliciting promises of literary aid for the weekly meetings during the Sessions, and for the pages of the then contemplated Journal. The signatures of many gentlemen, admirably qualified to render the required assistance, were received. The Lecture room of the Institute as well as the pages of the first volume of its Transactions, bear witness to the industry with which that promise was fulfilled by many who contributed their much valued exertions to promote the objects of the Society. We are, however, still enabled to recognize on the list which now lies before us, the names of several gentlemen upon whom the burthen rests of recording their zeal for the progress of Science and Art, by works in addition to words.

It has been our misfortune to listen to the complaints of members of the Institute that the profession, manufacture or trade, in which *they* are engaged, has not attracted the attention of the Society or been fairly represented in the pages of the Journal. We have recently had the opportunity of perusing the report of the Proceedings of the Second Annual Conference between the Representatives of the Institutions in Union, and the Council of the Society of Arts. We find in the speech of the Chairman, at the opening of proceedings, a few trite observations, which apply with the same force to Individuals as to Institutions. In transcribing and commending these remarks to the attention of members who think themselves aggrieved, we venture to remind them of the peculiar position of the Canadian Institute, and of the claims which it has in its youth to the active and generous co-operation of *all* its members.

"The Council has felt that in the whole management of this Union, the principle enunciated at the last Conference must be borne in mind; namely, that it is the duty of each Institution to do its own work, and for the Society of Arts to do that amount of work which the Institutes cannot do of themselves, and which can only be done by means of combined action; and therefore I shall ask you to bear in mind that if there is any thing you think ought to be done which has not been done, you will reflect for an instant and consider whether it does not come under that class of duties which Institutes ought to have done for themselves, and which, in fact, no central authority whatever could do for them. Another point I will thank you to bear in mind is, that any thing in this world that is to be done, cannot be done in an instant. Works worthy of being done, do not grow up like mushrooms; if you wish to have an oak tree, you must begin by planting an acorn, and wait patiently for some time for it to develop itself. A number of impossible discussions have been proposed to the Council during the year: for instance, gentlemen living far North, have suggested that we should send down first-rate lecturers—men like Faraday—some 300 or 400 miles, and that the whole expense should come within a pound. Now I confess that no central power which I can conceive would be able to accomplish that feat; and it will be for you to judge how far such a thing is possible. Another point of difficulty I would mention has been the question of the Journal. The Council thought the establishment of a Journal, for every Institute to pour its suggestions into, and to record its advice, its feelings, and its wishes, would be very useful. They accordingly established a Journal at a very considerable drag upon their funds; in fact it involved the expenditure of the funds of the Society to an extent nearly equivalent to the subscriptions of all the Institutes. If that Journal is not what I think it ought to be, and if the Institutes have not corresponded with it, to tell their grievances and their wants, of course it cannot be said to be the fault of the Council."

The proceedings of the Institutions in Union with the Society of Arts at the Second Annual Conference, were distinguished by discussions on various subjects which tend to throw much light upon the numerous difficulties with which Literary and Scientific Institutions in England are fettered, many of which are happily unknown to the people of Western Canada. It will scarcely be accounted a digression if, in closing these remarks we extract the pith of the discussions, for the sake of information and encouragement.

The Chairman classed the subjects to be discussed under several heads. First, Parliamentary Papers; second, The Provision of Books and Maps; third, News-Rooms and Reading-Rooms; fourth, Lectures; fifth, Classes, &c.; sixth, Statistics and Trade Museums.

1st. Parliamentary Papers. No resolutions were adopted in relation to their distribution; the Report of the Committee not having been received. The opinion was unanimous that the greatest utility would result from a distribution of selected Parliamentary Papers among the Institutes. No difficulty, we apprehend, will for the future, be found to exist in this country if timely application be made in the proper quarter. We regret to say, however, that there is at present extreme difficulty experienced in obtaining some Parliamentary papers. They appear to have been distributed so indiscriminately immediately after their issue that at this period no complete copies are to be obtained of many important documents. The Canadian Institute has not yet succeeded in obtaining one perfect copy of the Provincial Geologist's Reports.

2nd. Books, Maps, Apparatus, &c.

The Rev. T. S. Howson. M. A., (Liverpool,) thought it might be of the greatest possible advantage to the whole country, if a permanent exhibition of educational apparatus could be established in London. He had learned more on the preceding evening by looking at the apparatus exhibited at the Mansion-house, than he could have done by reading a dozen catalogues.

Dr. Booth said, it was in contemplation by the Society of Arts to get up an Exhibition of Educational Apparatus not limited to the models produced in this country, but comprising those, many of them much superior, made on the continent, and especially in France and Germany. In fact what the Great Exhibition had done for manufactures they wished now to do for education; they would get the best models from different countries, and then gentlemen interested in the subject would be able to visit the Exhibition, and select such apparatus as they found best fitted for the purposes of instruction.

Mr. Pond (Southampton) said, in reference to the question of interfering with trade, the booksellers at Southampton had, unasked, made a reduction to the Polytechnic Institution there; and provided they were properly secured from private individuals getting books at the reduced rate, he felt sure that booksellers generally would readily agree to the arrangement.

Mr. Redgrave said that the Committee intended to take precautions that private persons should not be able to avail themselves of the advantage of the reduction, and booksellers would in point of fact be benefited by books getting noticed in quarters which they did not before reach.

The following Resolution was then moved, and carried unanimously:—

"That this meeting approve the steps already taken by the Institutes' Committee of the Society of Arts, respecting the cheapening of books, maps, diagrams, and apparatus; and request them to continue their labours."

With respect to books, maps and apparatus for educational purposes, the Canadian Institute has nothing to do, the duties of that department being most efficiently executed by the Education Office. In this particular, indeed, Canada is already far in advance of all probable results arising from the exertions of the Society of Arts. In 1851, the Chief Superintendent of Schools, in his Address to the Governor General upon the occasion of the opening of the new Normal and Model Schools, remarked that "the facilities for furnishing all our schools with the necessary books, maps and apparatus, will soon be in advance of those of any other country." The spirit of the resolution above quoted, is well worth the careful consideration of all literary and scientific bodies in Canada. It has already been carried into very successful and active operation by the Chief Superintendent of Schools for the formation of school libraries. Why should it not be adopted by self-sustaining schools 'of larger growth'?

3rd. News rooms and reading-rooms. Fiscal regulations retarding the spread of knowledge, scarcely exist in Canada. The following resolution has, therefore, no application in this country, except in relation to foreign books:—

"That this meeting is of opinion that the fiscal restrictions on paper, advertisements, news, and foreign books, have an injurious effect on the Institutions in Union with the Society of Arts, and that the Council be requested to proceed with their investigation on the subject, with a view to the abolition of all such restrictions."

One indignant speaker said that—

"It gave him a sense of shame at times when he saw the advertisements of professors of other countries announcing instruction at such low rates as 6d. per lesson, to think that for each of those announcements these gentlemen must pay 1s. 6d. to the English Government. He thought this was a question therefore on which the Chancellor of the Exchequer ought to know their opinion."

The following resolutions on the subject of lectures and class instruction, were carried unanimously:—

"That this Conference do express its confidence that the Society of Arts will make the best possible arrangements for facilitating the supply of Lecturers to the Institutions in Union; and does not deem it expedient to attempt to define the modes by which such arrangements should be made,"

"That the infusion of science and art into elementary instruction is required by the people generally, and is desirable for the ultimate success of Mechanics' Institutions, which could then advance science and art more efficiently by systematic class instruction."

"That it is desirable that the training-schools of this country should introduce into their courses of study a more thorough knowledge of the natural and physical sciences, and a system of instruction in art; and that the Council of the Society of Arts be requested to forward this Resolution to the President of the Council of Education, and to the various training Institutions."

The legal position of the Institutions in England is peculiar, and all discussion on that subject possesses, consequently, a local interest only. It is worthy of remark that one of the members stated that "he thought the experience of by far the greater number of Institutions, not only in London, but throughout the country, would show, that unless those who were now subject to taxation had some hope of immediate relief, the disruption and close of many of them would take place."

"The Chairman, in concluding the proceedings, said the Conference had been sitting five hours and a half; 106 speeches had been made, and each had occupied on an average three minutes and a half. He thought that was a statistic worth recording."

On the Physical Constitution of the Sun.

Abstract of a paper submitted to the French Academy, by M. Arago.

After briefly reviewing the phenomena of the solar spots and the peculiar radiance, less luminous than the rest of the orb, with which they are surrounded,—the penumbra,—M. Arago says:—This penumbra, first noticed by Gallileo, and carefully observed by hi stronomical successors in all the changes which it undergoes has led to a supposition, concerning the physical constitution of the sun, which at first must appear altogether astonishing. According to this view the orb would be regarded as a dark body, surrounded at a certain distance by an atmosphere, which might be compared to that enveloping the earth, when composed of a continuous bed of opaque and reflecting clouds. To this first atmosphere would succeed a second, luminous in itself, and which has been called the *photosphere*. This photosphere, more or less removed from the interior cloudy atmosphere, would determine by its circumference the visible limits of the orb.—According to this hypothesis, spots upon the sun would appear as often as there were found in the concentric atmospheres corresponding vacant portions, which would permit us to see exposed the dark central body. Those who have studied with powerful instruments, professional astronomers, and competent judges, acknowledge that this hypothesis concerning the physical constitution of the sun, supplies a very satisfactory account of the facts. Nevertheless, it is not generally adopted; recent authoritative works describe the spots as scoriæ floating on the liquid surface of the orb, and issuing from solar volcanoes, of which terrestial volcanoes are but a feeble type.

It was desirable then to determine, by direct observation, the nature of the incandescent matter of the sun, but when we consider that a distance of 95,000,000 of miles separates us from this orb and that the only means of communication with its visible surface are luminous rays issuing therefrom, even to propose this problem seems an act of unjustifiable temerity. The recent progress in the science of optics, has however, furnished the means for completely solving the problem.

None are now ignorant that natural philosophers have succeeded in distinguishing two kinds of light, viz., natural and polarized. A ray of the former of these lights exhibits, on all points of its surface, the same properties; whilst, with regard to the polarized light, the properties exhibited on the different sides of its rays are different. These discrepancies, manifest themselves in a multitude of phenomena which need not here be noticed. Before going further, let us remark, that there is something wonderful in the experiments which have led natural philosphers legitimately to talk of the different sides of a ray of light. The word "wonderful" which I have just used, will certainly appear natural to those who are aware that millions and millions of these rays can simultaneously pass through the eye of a needle, without interfering one with the other. Polarized light has enabled astronomers to augment the means of investigation by the aid of some curious instruments, from which great benefit has accrued already—among others, the paralizing telescope, or polariscope, merits attention. In looking directly at the sun with one of these telescopes, two white images of the same intensity, and the same shade will be seen. Let us suppose the reflected image of this orb to be seen in water, or a glass mirror. In the act of reflection the rays become polarized, the lens no longer presenting two white and similar images; on the contrary they are tinged with brilliant colors, their shape having experienced no alteration. If the one be red, the other will be green; if the former be yellow, the latter will present a violet shade, and so on; the two colors being always what are called complementary, or susceptible by their mixture, of forming white. By whatever means this polarized light has been produced, the colors will displays themselves in the two images of the polarizing telescope, as when the rays have been reflected by water or glass. The polarizing telescope, thus furnishes a very simple means of distinguishing *natural* from polarized light.

It has been long believed, that light emanating from incandescent bodies, reaches the eye in the state of natural light, when it has not been partially reflected, or strongly refracted, in its passage. The exactitude of this proposition failed, however, in certain points. A member of the Academy has discovered that light emanating under a sufficiently small angle, from the surface of a solid or liquid incandescent body, even when unpolished, presents evident marks of polarization; so that in passing through the polarizing telescope it is decomposed into two colored pencils. The light emanating from an inflamed gaseous substance, such as is used in street illumination, on the contrary, is always in its natural state, whatever may have been its angle of emission. The means used to decide whether the substance which renders the sun visible is solid, liquid or gaseous, will be nothing more than a very simple application of the foregoing observations, in spite of the difficulties which appeared to arise from the immense distance of the orb.

The rays which indicate the margin of the disc, have evidently issued from the incandescent surface under a very small angle. The question here occurs,—The margin of the two images, which the polarizing telescope furnishes, do they, when viewed directly, appear colored?—then the light of these margins proceeds from a liquid body; for any supposition which would make the exterior of the sun a solid body is definitely removed by the observations of the rapid changing of the form of the spots. Have the margins maintained their natural whiteness in the glass? then they are necessarily gaseous. The incandescent bodies which have been studied by a polariscope, the light being emitted under angles, are the following:—of solids, forged iron and platinum; of liquids, fused iron and glass. From these experiments it may be said, you have a right to affirm, that the sun is neither fused iron nor glass; but what authority have you further to generalize? My response is this; following the two explanations that have been given of the abnormal polarization which presents rays emitted under acute angles, all ought to be the same, with the exception of the quantity, whatever be the liquid, provided that the surface of emergence has a sensible reflecting power. There would remain only the case, in which the incandescent body would, as to its density, be analogous to a gas; as for example, the liquid of an almost ideal rarity, which many geometricians have been led to place hypothetically, at the extreme limit of our atmosphere where the phenomena of polarization and colorization may perhaps disappear. I shall however, anticipate a difficulty which may suggest itself. It ought to be observed, that the lights proceeding from two liquid substances, may, according to the special nature of these substances, not be identical in reference to the number and position of the black bands of Frauenhofer, and which these prismatic hues offer to the eye of the philosopher. These discrepances are of a nature to be considerably augmented by the differently constituted atmospheres through which the rays have to travel before reaching the observer.

Observations made any day of the year, looking directly at the sun, with the aid of powerfully polarizing telescopes, exhibit no trace of colorization. The inflamed substances then, which defines the circumference of the sun, is gaseous. We can generalize this conclusion, since, through the agency of rotation, the different points of the surface of the sun come in succession to form the circumference. This experiment removes out of the domain of simple hypothesis the theory we have previously indicated concerning the constitution of the solar photosphere. These results, let it be loudly proclaimed, are entirely due to the united efforts of the observers of the 17th and 18th centuries, and also in a certain measure to those of our contemporary astronomers. And, here, let me make a remark, which, when *endeavouring to determine the physical constitution of the stars*, we shall have occasion to apply. If the material of the solar photosphere were liquid, if the rays emitted from its margin were polarized, the two images furnished by the polarizing telescope would not only be colored, but they would be different in different parts of the circumference. Is the highest point of one of these images red, the point diametrically opposite will be red also. But the two extremities of the horizontal diameter will each exhibit a green tint and so on. If then, one succeeds in concentrating to a single point, the rays emitted from all parts of the sun's limb, even after their decomposition in the polarizing telescope, the mixture will be white.

The constitution of the sun, as I have just established it, may equally serve to explain how, on the surface of the orb, there exist some spots not black but luminous. These have been called faculæ, others of much smaller dimensions, and generally round have been called lucules. These latter cause the surface of the sun to appear spotted. It is a singular fact; but I may trace the origin of the discovery of the faculæ and lucules to an administrative visit to a shop of novelties, on the Boulevards. "I have to complain," said the master of the establishment, "of the Gas Company; it ought to direct on my goods the broad side of the bat wing burner, whilst, by the carelessness of their servants, it is often the edge which is directed on them." "Are you certain," said one of the assistants, "that in that position the flame gives less light than in the other?" The idea, appearing ill-founded, and I would say, absurd, it was submitted to accurate experiment; it was determined that flame sheds upon any object as much light when it illuminates by its edge as when its broad surface was presented to it. Thence resulted the conclusion, that a gaseous incandescent surface of a determined extent is more luminous when seen obliquely than under a perpendicular incidence. Consequently, if like our atmosphere, when dappled with clouds, the solar surface presents undulations, the parts of these undulations which are presented perpendicularly to the observer, must appear comparatively dim, and the inclined portion must appear more brilliant; and hence every conic cavity must appear a lucule. It is no longer necessary in accounting for these appearances, to suppose that there exists on the sun millions of fires more incandescent than the rest of the disc, or millions of points distinguishing themselves from the neighboring regions by a greater accumulation of luminous matter.

After having proved that the sun is composed of a dark central body, of a cloudy-reflecting atmosphere, and of a photosphere we should naturally ask if there is nothing besides. If the photosphere terminate abruptly and without being surrounded by a gaseous atmosphere, less luminous in itself, or feebly refracting? Generally, this third atmosphere would disappear in the ocean of light, with which the sun always appears surrounded, and which proceeds from the reflection of its own rays upon the particles of which the terrestial atmosphere is composed. A means of removing this doubt presented itself; it was selecting the moment, when, *during a total eclipse, the moon completely obscures the* sun. Almost at the moment when the last rays emanating from the margin of the radiant orb, disappeared under the opaque screen formed by the moon, the atmosphere in the region, which is projected between the moon, the earth, and the neighbouring parts, ceased to be illuminated. In all our researches upon solar eclipses, innumerable unexpected appearances invariably present themselves; the observers were not a little surprised, when, after the disappearance of the last direct rays of the sun behind the the margin of the moon, and after the light reflected by the surrounding terrestrial atmosphere had also disappeared, to see rose-shaped prominences from two to three minutes in height, dart, as were, from the circumference of our satellite. Each astronomer, *following the usual bent of his ideas, arrived at an independent* opinion regarding the causes of these appearances. Some attributed them to the mountains of the moon; but this hypothesis would not bear a moment's examination. Others wished to discover in them certain effects of diffraction, or of refraction.—But the touch-stone of all theories is calculation; and uncertainty the most indefinite must follow, in reference to their application to the remarkable phenomena specified, those, namely, of which we have just been speaking. Explanations, giving neither an exact account of the height, the form, the color, nor the fixity of a phenomenon, ought to have no place in science. Let us come to the idea, much extolled for a short time, that the protuberances were solar mountains, whose summits extend beyond the photosphere covered by the moon at the moment of observation. Following the most moderate computations, the elevation above the solar disc of one of these summits, would have been 19,000 leagues. I am well aware that no argument because based on the vastness of this height, should lead to the rejection of the hypothesis, but it may be much shaken by remarking that these pretended mountains exhibit considerable portions beyond the perpendicular, which consequently in virtue of the solar attraction must have fallen down.

Let us now take a rapid glance of the hypothesis, according to which the protuberances would be assimilated to solar clouds floating in a gaseous atmosphere. Here we find no principle of natural philosophy to prevent our admitting the existence of cloudy masses from 70,000 to 90,000 miles in length, with their outlines serrated, and assuming the most distorted forms, only in further pursuing this hypothesis, one could not fail to be astonished that no solar cloud had ever been seen entirely separate from the circumference of the moon. It is towards this determination, the subject otherwise eluding us, that researches of astronomers should be directed. A mountain being incapable of sustaining itself without a base, the fortuitous observation of a prominence, separated in appearance from the margin of the moon, and consequently, from the real margin of the solar photosphere, should be sufficient utterly to overthrow the hypothesis of solar mountains. Such an observation has really been made. M. Kutochi who observed the eclipse of July 8th, 1850, writes: "the slender and redish striated appearance which was found near the northern prominence seemed to be completely detached from the margin of the moon." In the eclipse of the 28th of July, 1851, Messrs. Mauvais and Soujon, of Dantzic, and the celebrated foreign astronomers who had repaired to the different parts of Norway and the north of Germany, saw in all the selected stations without exception, a spot uniformly red, and separated from the limb of the moon. These observations put a definite termination to the explanations of the protuberances, founded on the supposition that there existed in the sun, mountains whose summits would reach considerably above the photosphere. When it shall be clearly demonstrated that these luminous phenomena cannot be the effect of the inflexions which the solar rays might experience in passing near the rough parts which *fringe the circumference of the moon; when it shall be demon*strated that these rosy tints cannot be assimulated to simple optical appearances, and have, in truth, a real existence, that they are not real solar clouds, it will then be necessary to add a new atmosphere to the two of which we have spoken; for these clouds cannot be sustained *in vaccuo*. The existence of a third atmosphere is moreover established by phenomena of quite another nature, namely, by the comparative intensity of the border and the centre of the sun, and also in some respects by the zodiacal light, so perceptible in our climate during the equinoxes.

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Archelaus, who lived in the year 448, B. C., was the last philosopher of the Ionian Sect; he said, regarding the sun,—"It is a star, only it surpasses in size all other stars." The conjecture for what is not based upon any measurement, or any observation, deserves no other name, was certainly very bold and very beautiful. Let us pass over an interval of more than two thousand years, and we shall find the relation of the sun and the stars established by the labors of the moderns, upon a basis which defies all criticism. During nearly a century and a half, astronomers endeavoured to determine the distance between the stars and the earth; the repeated failures with which their researches were attended, seemed to prove that the problem was insolvable. But what obstacles will not genius, united to perseverance, overcome? We have discovered within a very few years the distance which separates us from the nearest stars. This distance is about 206,000 times the distance of the sun from the earth, more than 206,000 times 95,000,000 of miles. The product of 206,000 by 95,000,000 would be too much above the numbers we are in the habit of considering, to warrant its annunciation. This product will still more strike the imagination, when I refer to the rapidity with which light travels. Alpha, in the constellation of the Centaur, is the star nearest to the earth, if it be allowable to apply the word near to such distances as those of which I am about to speak. The light of Alpha, of the Centaur, takes more than three years to reach us, so that were the star annihilated, we should still see it for three years after its destruction. Recall to your recollection that light travels at the rate of 192,000 miles in a second; that the day is composed of 86,400 seconds, and the year of 365 days, and you will feel as thunderstruck before the immensity of these numbers. Furnished with these data, let us transport the sun to the place of this, the nearest star, and the vast circular disc, which in the evening occupies a considerable time in descending entirely below the same line, would have dimensions almost imperceptible, even with the aid of the most powerful telescopes, and its brilliancy would range among the stars of the third magnitude, you will thus see what has become of the conjecture of Archelaus. One may perhaps feel humiliated by a result which reduces so far our position in the material world; but consider that man has succeeded in extracting everything from his own resources, whereby he is elevated to the highest rank in the world of thought.

We would remark that in the recent works of complete astral catalogues, we shall find that the number of stars visible to the naked eye in a single hemisphere, namely, the northern, is less than three thousand. A certain result, and one, which, notwithstanding will strike with astonishment, on account of its smallness, those who have only vaguely examined the sky on a beautiful winter night. The character of this astonishment will change if we proceed to the telescopic stars. Carrying the enumeration to the stars of the fourteenth magnitude, the last are seen by our powerful telescopes, we shall find by an estimate which will furnish us the minor limit, a number superior to 40,000,000, (40,000,000 of suns!!) and the distance from the farthest of them is such that the light would take from three to four thousand years to traverse it. We are then, fully authorized to say, that the luminous rays,—those rapid couriers,—bring us, if I may so express it, the very ancient history of these distant worlds. A photometric experiment, of which the first indications exist in the Cosmotheoros of Huygens, an experiment resumed by Wollaston a short time before his death, teaches us that 20,000 of stars the same size as Sirius, the most brilliant of the firmament, would need to be agglomerated to shed upon our globe a light equal to that of the sun. On reflecting upon the well known fact, that some of the double stars, are of very different and dissimilar colours, our thoughts naturally turn to the inhabitants of the obscure and revolving planetary bodies which apparently circulate around these suns; and we would remark, not without real anxiety for the works, the paintings, of the artists of these distant worlds, that a day lightened by a red light, succeeds not a night but a day, equally brilliant, but illuminated only by a green light.

But abandoning these speculations, however worthy they may be of admiration, we shall come back to the chief question, which I have proposed to treat in this account, to try, if possible, to establish a connection between the physical nature of the sun and of the stars. We have succeeded by the help of the polarizing telescope, in determining the nature of the substance which composes the solar photosphere, because by reason of the great apparent diameter of the orb, we have been able to observe separately the different points of its circumference. If the sun were removed from us to a distance where its diameter would appear as small to us as that of the stars, this method would be inapplicable, the colored rays proceeding from the different points of the circumference would then be intimately mixed, and, we have said already, their mixture would be white. It appears, then, that e must not apply to stars of imperceptible dimensions, the process which so satisfactorily conducted us to the result in regard to the sun. There, are, however, some of these stars, which supply us with the means of investigation. I allude to the changing stars. Astronomers have remarked some stars whose brilliancy varies considerably; there are even some which, in a very few hours, pass from the second to the fourth magnitude; and there are others in which the changes in intensity are much more decided. These stars, quite visible at certain epochs, totally disappear, to reappear in periods longer, or shorter, and subject to slight irregularities. Two explanations of these curious phenomena present themselves to the mind; the one consists in supposing that the star is not equally luminous on all parts of its surface, and that it experiences a rotatory movement upon itself; thus it is brilliant when the luminous part is turned towards us, and dark when the obscure portion arrives at the same point. According to the other hypothesis, an opaque, and, in itself non-luminous satellite, circulates round the star, and eclipses it periodically. In accordance with one or the other of these suppositions, the light which is exhibited some time before the disappearance, or before the reappearance of the star has not issued from all points of the circumference. Hence, there can be no doubt of the complete neutralization of the tints of which we have just spoken.

If a changing star, when examined by a polarizing telescope remains perfectly white in all its phases, we may rest assured that its light emanates from a substance similar to our clouds, or our inflamed gas. Now, such is the result of the few observations that have been hitherto made, and which will be highly useful to complete. This means of investigation demands more care, but succeeds equally well, when applied to those stars which experience only a partial variation in their brilliancy. The conclusion to which these observations conduct us, and which we may, I think, without scruple generalize, may be announced in these terms; our sun is a star, and its physical constitution is identical with that of the millions of stars with which the firmament is strewed.—*American Annual of Scientific Discovery.*

Mode of Constructing Telegraphs in India.

From Calcutta to Rajmoole, the conductor is laid under ground, in a cement of melted resin and sand. From that village through the remaining distance to Kedgeree it is carried over ground on bamboo poles, 15 feet high, coated with coal-tar and pitch, and strengthened at various distances by posts of saul wood, teak, and iron wood from America. The bamboo posts are found to resist the storms which have uprooted trees, the growth of centuries. Though the bamboo soon decays, its amazing cheapness makes the use of it more economical than that of more durable and more costly materials. The branch road from Bishlopore to Moyapore passes through a swamp; the conductor runs on the foot paths between the island villages, and for some miles crosses rice swamps, and creeks on which no road or embankment exists.

The most difficult and objectionable line was selected to test the practicability of carrying the conductors through swampy ground, and it has been perfectly successful. The Huldee River crosses the Kedgeree line half way, and varies in breadth from 4,200 to 5,800 feet. A gutta percha wire, secured in the angles of a chain cable, is laid across and under the river, and thechain is found to afford perfect protection from the grapnels of the heavy native boats which are constantly passing up and down.

The overground lines differ totally from those in use in any other country in this important respect. No wire is used. Instead of wire a thick iron rod, ⅜ of an inch diameter, weighing one ton to a mile, is adapted—the heaviest wire elsewhere used being only one cwt. to the mile. The advantages of these substantial rods are these: they possess a complete immunity from gusts of wind or ordinary mechanical violence; if accidentally thrown down they are not injured, though passengers and animals may trample on them; owing to the mass of metal, they give so free a passage to the electric currents that no insulation is necessary; they are attached from bamboo to bamboo without any protection, and they work without interruption through the hardest rains; the thickness of the rods allows of their being placed on the posts without any occasion for the straining and winding apparatus, whereas the tension of wire exposes them to fracture, occasions expense in construction and much difficulty in repairs; the thick rods also admit of rusting to take place without danger to an extent which would be fatal to a wire; and lastly, the rods are no more costly than thin wire, and the welding occasions no difficulty.

The importance of this discovery of the superiority of rods over wire will be fully appreciated in a country like India, where the line must often run through a howling wilderness, tenanted by savage beasts or more savage men. The lines must therefore, protect themselves, and this is secured by the use of thick rods.

The entire expenditure on this line was about 450 rupees a mile, and it is estimated that the future overground lines will be at the rate of 350 rupees a mile for a double line, river crossings and erection of offices being a separate charge. The pecuniary returns from the Calcutta and Kedgeree line were originally calculated at about 200 rupees a month, but they have been more than three times that amount. A rupee is about 56 cents U. S. currency.

Treatment of Foreign Wines.

At a recent evening meeting of the Royal Institution, Mr. Brockedon, F.R.S., gave the following interesting particulars relative to the Treatment of Foreign Wines.

"The wine when pressed is not vatted in large quantities, but placed in casks which have been sulphured, to check fermentation and preserve its sweetness as far as possible. During the winter following the vintage, it is racked two or three times, and in the following spring, about March, the bottling commences.

"In order to obtain the wine with perfect brightness, into each bottle is put a wine glass full of *liqueur*, which is prepared by dissolving fine candied sugar in wine till it becomes a rich syrup. If the wine is to be made pink, a red wine is used; if pale, white wine. This liquor produces a fresh fermentation in the bottle, by converting the sugar into alcohol and carbonic acid gas. Every bottle on being filled and corked is laid on its side on a frame having holes made through it, into which the neck of the bottle is inserted. As the fermentation advances, every bottle in succession is dexterously shaken gently on its axis every day, to prevent any adhesive deposit on the side of the bottle; and each day it is lifted more and more upright in the frame until the foul portion rests only in the downward neck of the bottle. It is then ready for *degorgement*, a process by which the foul deposit is removed. The bottle is carfully held in such a position,that when the string which holds the cork is cut, the deposit is blown out by the force of the gas within. The foul matter only is allowed to escape by the skilful use of the fore-finger of the operator, which stops the flow until the effervescence subsides under its pressure. He then quickly and dexterously fills up the bottle from the contents of another already purified. It is then passed with great rapidity under a machine, by which a large cork is forced into the bottle, and is then as rapidly tied. It is afterwards wired and stacked away in vast and cool caves, some of which, thousands of yards in extent, have been excavated in the solid chalk of the hill side. These stacks of bottled Champagne are so ingeniously made, that though they may each contain from 1,000 to 10,000 bottles, any one of them can be withdrawn for examination. In a warm spring the extent of bursting in these bottles is a cause of great loss. In April, 1843, Madame Cliquot, of Rheims, lost 400,000 out of her stock for that season of 1,600,000 bottles. Further destruction was checked by obtaining from Paris ten or twelve waggon loads of ice, which strewn in the caves lowers their temperature.

"When the wine is thus stacked, the merchants visit the caves to buy, and it is scarcely recommended to their notice, unless the breakage can be shown to be not less then ten per cent. It is this loss, and the cost of labour in preparing, that enhances so much the value of the wine of Champagne.

"The condition of the wine in the bottle can be easily ascertained by a simple means. A fine hollow needle can be thurst through the cork, and a taste obtained from the pressure within, through the tube. On withdrawing the circular needle, the elasicity of the cork closes the puncture."—*Jour. Soc. Arts.*

Mean Results of Meteorological Observations,

Made at St. Martin, Isle Jesus, Canada East, (nine miles west of Montreal,) for 1852; by CHAS. SMALLWOOD, M. D.*

Barometric Pressure.—The readings of the barometer are all corrected for capillarity, and reduced to 32° F. The means are obtained from three daily observations, taken at 6 A.M. 2 P.M. and 10 P.M.

The mean height of the barometer in January, was 29·607 inches, in February 29·902, in March 29·952, in April 29·470, in May, 29,539, in June 29·489, in July 29,555, in August, 29·668, in September 29·645, in October 29·689, in November 29·615, and in December, 30,011 inches. The highest reading was in December, and indicated 30·329 inches, the lowest was in

* The geographical co-ordinates of the place are 45° 32′ N lat. and 73° 36′ W. long.; height above the level of the sea 118 feet.

June, and indicated 28·727 inches; the *yearly mean* was 29·686 inches, the *yearly range* was equal to 1·602 inches. The atmospheric wave of November was marked by its usual fluctuations, the final trough terminated on the 30th day.

Thermometer.—The mean temperature of the air in January, was 12°·65, in February 21°·90, in March 20°·7, in April 38°·38, in May 52°·27, in June 66° 12, in July 72° 33, in August 68°.02, in September 59°·15, in October 45°·69, in November 33°·0, in December 24°·64 F.

The highest reading of the maximum thermometer was in July, and marked 100°·5; the lowest reading of the minimum thermometer was in January, and was –28°·0. The mean temperature of the quarterly periods was, winter 16°45, spring 37°·11, summer, 68°·82, autumn 45°.94. The *yearly mean* was 42°·86, and the *yearly range* 128°·5. The greatest intensity of the Sun's rays was in July, and indicated 122° 5, the least intensity was in November, and was 62° 4.

The *mean humidity* of the atmosphere in winter was ·781, in spring ·806, in summer ·810, and in autumn ·895. The *yearly mean* of humidity was ·823.

Rain fell on 88 days, amounting to 47·131 inches and was accompanied by thunder and lightning on 17 days. *Snow* fell on 48 days amounting to 84·61 inches *on the surface*. The equivalent of 1 to 10 as used by the Smithsonian Institute at Washington, for the comparison of melted snow to rain does not hold good in this climate; it varies from 1 to 5 to 1 to 8. I have undertaken a series of experiments on this point, which I have not at present brought to a close.

The whole amount of snow which fell in the winter 1851–2, amounted to 95·920 inches; the first snow fell on the 25th of October, 1851, and the last on the 16th of April, 1852.

The amount of evaporation was regularly measured and recorded during that period of the year, when the thermometer stood above the freezing point, and owing to frosty nights, and frost also during some days, no accurate measure could be taken. The amount of evaporation in May was 3·720 inches, in June 3·450, in July 4·150, in August 2·620, in September 2·020, and in October 1·220: this period includes what I consider could be taken with anything approaching to accuracy.

The most prevalent wind during the year was the west, the next in frequency was the E. N. E., the least prevalent wind was the N. by W. The mean of the maximum velocity (as measured by an anemometer similar in construction to Dr. Robinson's) was 17·632 miles per hour; the mean minimum velocity was equal to 0·463 miles per hour.

The Aurora Borealis was visible on thirty-six nights, at the following hours, and its appearance was generally followed by rain in summer and snow in winter.

January 19th, 10 P.M. Faint auroral arch—sky clear; *26th*, 10 P. M. Do., dark clouds in the horizon.

February 15th, 4 A. M. Bright aurora in the north, streamers shooting to the zenith; sky clear. *19th*, at 6·30 P. M., the heavens presented a curtain or canopy of auroral light; streamers of yellow, green and crimson were sent up in rapid succession from the horizon to the zenith, where they formed a cupola or corona near *a Aurigæ;* at the horizon, the arch extended from E. to N. W. Stars of the 4th and 5th magnitude were visible through these magnificent curtains of auroral light. These appearances lasted about 30 minutes, and then gradually faded away, as if to seek a rest, and to shine forth with still greater splendour; for at 10 P. M., the northern horizon presented a low auroral arch of a yellow colour, while in the southern horizon, stretching from E. to W., a most splendid display of streamers rose to an apex, about 60° above the horizon; the streamers were of the same colour as in the former part of the evening; these appearances lasted 20 minutes; the northern arch remained still visible. Volta's No. 1 electrometer marked 0·76 positive electricity; there was no change indicated during or after the phenomenon. *20th*, 10 P. M. Low auroral arch in the north very faint; sky clear.

March 7th, 7 P. M. Faint aurora, occasional streamers; sky clear. *19th*, 10 P. M. Low auroral arch, bright; sky clear. *20th*, 9 P. M. Faint auroral arch; sky clear.

April. No aurora observed this month.

May 5th, 10 P. M. Faint auroral patches; sky clear. *6th*, 10 P. M. Faint auroral arch; sky clear. *18th*, 10 P. M. Faint auroral arch; horizon clouded.

June 11th 8·45 P. M., the heavens presented an auroral arch 3° broad, of great magnificence; the arch commenced in the E. at the horizon, stretching to the zenith, and descending nearly due west to the horizon; the colour was crimson, at other times pale green; the borders or edges were well defined. Stars of the 4th and 5th magnitudes were distinctly visible through it; a few *light cirri* were discernible in the eastern horizon, but otherwise the sky was clear; a faint auroral light was visible in the north. The arch vanished at 9·20 P. M. The electrometer marked 0; wind west, velocity 1·10 miles per hour. *15th*. Low auroral arch from E. to W.N.W., bright yellow colour; occasional streamers to the zenith, from 9.40 to 11·10 P.M. *23rd*, 11·40 P.M.. faint auroral light; sky clear.

July 5th, 10 P.M. Auroral bow stretching from E to W.N,W., 2° wide and bright; sky clear. Wind south, velocity 0·12 miles. *6th*, 10 P. M. Auroral light in the north, moderate brightness; streamers; sky clear. *7th*, 10 P. M. Patches of auroral light, or clouds from E. N. E. to W. S. W., which vanished, leaving a broad auroral arch; sky clear. *10th*, 10 P. M. Auroral streamers, bright. *Cumul. Strat.* 4. *20th*, 9 P. M. An arch of light auroral clouds, 1° in width, passing through the constellations Cygnus, Lyra and Hercules to the horizon, lasted 20 minutes, sky clear, wind S.W., velocity 6·26 miles. *29th*, 8 P.M. Auroral arch bright. *Cumul. Strat.* 4. Heat lightning very vivid.

August 5th, 10 P. M. Very faint auroral light. *Cirr. Cumul.* 4. *6th*, 10 P.M., do. *Cumul. Strat.* 4. *10th*, P. M. Bright auroral arch broad; dark segment underneath; sky clear. 11th, 10 P. M. Faint auroral clouds in the north; sky clear.

September 3rd, 10 P. M. Faint auroral light; sky clear. *4th*, 10 P. M. Bright auroral arch, extended and sending up occasional streamers; sky clear. *17th*, 10 P. M. Faint auroral arch, low, sky clear; *18th*, 10 P. M., do. *29th*, 10 P. M. Floating auroral clouds, varying in brightness; sky clear.

October 6th, 10 P. M. Masses of auroral clouds in the north of moderate brightness. *Cirr. Cumul.* 4. *19th*, 10 P. M. Auroral arch faint and low. *Stratus* 2. *20th*, 9 P. M. Faint auroral arch, with dark segment underneath, at 9·20, a fine display of streamers; sky clear.

November 11th, 10 P. M. Bright auroral streamers, not very extended; sky clear.

December 1st, 3 A. M. Auroral light in the north, bright and extended; sky clear. *29th*, 10 P. M. Low auroral arch; sky clear.

Lunar halos visible on six nights. A *lunar rainbow* was also visible on the 29th February. *Fogs* were observed on six mornings. *Shooting stars* were seen on the 18th of July, and 9th and 10th of August. A slight shock of an *earthquake* was felt on the 11th of February at 5·40 A. M., barometer 29·067, thermometer 38·5, wind E. by N., velocity 6·00 miles per hour; the *wave* came from the W. N. W. The barometer continued to fall until 11 A. M., it was then 28.892 accompanied by slight rain (0·50 inch;) the wind veered about noon by the N. to the W. S. W., and increased to a velocity maximum 30·57 miles per hour, which continued during the day following; wind W. N. W.

Electrical state of the atmosphere.—The atmosphere has afforded indications of electricity, varying in intensity on every day or nearly so, during the year, and was *generally* of a *positive* or *vitreous* character. Two remarkable *electrical storms* occurred on the 23rd and 31st of December, indicating an intensity of 450 ° in terms of Volta's electrometer, No. 1: sparks of of $\frac{1}{30}$th of an inch were constantly passing from the *conductor* to the *discharger* for several hours each day: it was of a *positive* character, with frequent and quick changes to negative electricity. An increase of intensity is always observed during the snow storms of our winter; this increase generally possesses the character of positive electricity, although frequent signs of negative electricity have been observed here; this change from positive to negative electricity appears to be connected with change in the form of crystals of snow. The crystals of snow in this climate during the very severe weather, are generally those described by Scoresby, and figured from 16 to 20 in Kaemtz's Meteorology, also fig. 3; and plain hexagonal prisms have likewise been observed.

St. Martin, Feb. 1, 1853.

The Mississippi and Ohio Rivers.

From the Report by Charles Ellet, Jr., C. E.

THE MISSISSIPPI.—To be able to form a just conception of the present physical constitution of the delta, and the causes of its overflow, we must imagine a great plane sloping uniformly from the mouth of the Ohio, in a direction deviating but little from a due southerly course, to the Gulf of Mexico. The length of this plane, from the mouth of this river to the waters of the gulf, is 500 miles. Its northern extremity is elevated 275 feet above the surface of the sea, and is there and every where nearly level with low water in the Mississippi River. Its total descent, following the highest surface of the soil, is about 320 feet, or at the rate of 8 inches per mile.

The breadth of this plane, near the mouth of the Ohio, in an east and west direction, is from thirty to forty miles; and at the Gulf of Mexico it spreads out to the width of about one hundred and fifty miles.

It is inclosed on the east and west by a line of bluffs of irregular height and extremely irregular direction.

This plane, containing about 40,000 square miles, has been formed in the course of ages from the material brought down from the uplands by the Mississippi and its tributaries. The river has therefore raised from the sea the soil which constitutes its own bed. It flows down this plane of its own creation, in a serpentine course, frequently crowding on the hills to the left, and once passing to the opposite side and washing the base of the bluff which makes its appearance on the west at the town of Helena.

The actual distance from the mouth of the Ohio to the coast of the gulf is, in round numbers, as stated, 500 miles. The computed length of the Mississippi River, from its confluence with the Ohio to the mouth of the South-west Pass, is 1,178 miles; and the average descent at high water $\frac{27}{100}$ths of a foot, $3\frac{1}{4}$ inches per mile.

The course of the river is therefore lengthened out nearly seven hundred miles, or is more than doubled by the remarkable flexures of its channel; and the rate of its descent is reduced by these flexures to less than one-half the inclination of the plane down which it flows.

In the summer and autumn, when the river is low and water is scantily supplied by its tributaries, the surface of the Mississippi is depressed at the head of the delta about forty feet, and as we approach New Orleans, twenty feet below the top of its banks. It then flows along sluggishly, in a trench about 3,000 feet wide, 75 feet deep at the head, and 120 feet at the foot, and inclosed by alluvial and often caving banks, which rise, as stated, from 20 to 40 feet above the water.

But when the autumnal rains set in, the river usually rises until the month of May, when it fills up its channel, overflows its banks, and spreads many miles over the low lands to the right and left of its trace. This leads to another important feature in the characteristics of this great stream.

The Mississippi bears along at all times, but especially in the periods of flood, a vast amount of earthy matter suspended in its waters, which the current is able to carry forward so long as the river is confined to its channel. But when the water overflows the banks, its velocity is checked, and it immediately deposits the heaviest particles which it transports, and leaves them upon its borders; and as the water continues to spread further from the banks, it continues to let down more and more of this suspended material—the heaviest particles being deposited on the banks, and the finest clay conveyed to the positions most remote from the banks. The consequence is, that the borders of the river, which received the first and heaviest deposits, are raised higher above the general level of the plane than the soil which is more remote; and that, while the plane of the delta dips towards the sea at the rate of eight inches per mile, the soil adjacent to the banks slopes off at right angles to the course of the river, into the interior, for five or six miles, at the rate of three or four feet per mile.

THE OHIO.—This noble tributary rises on the borders of Lake Erie, at an average elevation of 1,300 feet above the surface of the sea, and nearly 700 feet above the level of the lake. The plane along which this river flows is connected with no mountain range at its northern extremity, but continues its rise with great uniformity, from the mouth of the Ohio to the brim of the basin which incloses Lake Erie. The sources of the tributary streams are generally diminutive ponds, distributed along the edge of the basin of Lake Erie, but far above its surface, and so slightly separated from it, that they may all be drained with little labour down the steep slopes into that inland sea.

From these remote sources, a boat may start with sufficient water, within seven miles of Lake Erie, in sight, sometimes, of the sails which whiten the approach of the harbor of Buffalo, and float securely down the Connewango, or Cassadaga, to the Alleghany, down the Alleghany to the Ohio, and thence uninterruptedly to the Gulf of Mexico. In all this distance of 2,400 miles, the descent is so uniform and gentle—so little accelerated by rapids—that when there is sufficient water to float the vessel, and sufficient power to govern it, the downward voyage may be performed without difficulty or danger in the channels as they were formed by nature; and the return trip might be made with equal security and success with very little aid from art."

Rain, a Source of the Nitrogen in Vegetation.

M. BARRAL, from some analyses of rain-water collected at two distinct spots in the grounds of the Observatory at Paris, during the last five and six months of the past year, has shown us that, the rain-water is there charged with nitric acid, ammonia, chlorine, lime and magnesia, to an extent scarcely to be credited, were it not the actual result of experiment. Taking the average of these analyses, and reducing the French weights to our own standard of 7,000 grains to the pound, it will be seen, in these six months, the rain which fell on a space of ground at the Observatory at Paris, equal in area to an English acre, contained, as nearly as possible, 7.75 pounds of ammonia; 36.50 pounds of nitric acid; 5.56 pounds of chlorine; 12.60 pounds of lime; 4.81 pounds of magnesia.

From July to December is usually the drier half of the year, as well as that in which the less fuel is consumed, so that we may safely double these quantities, in estimating the annual supply per acre of nitrogeneous compounds, gradually distributed over the country by the rain. For the sake of illustration, we have calculated the amount of the solid constituents of the rain falling on an area equal in extent to Great Britain, and balancing the various causes likely to lessen or to increase the quantity of these matters, which would so fall on this island, we may venture to set one against the other, and apply the above statement to our own country, as the basis of an estimate, which singularly manifests the "power of littles," as well as the grand scale on which even the minutest of natural phenomena proceed. Thus, on the Parisian data, the weights of these fertilizing materials annually supplied to the soil of this island by the rain, amount to about 400,000 tons of ammonia; 1,850,000 tons of nitric acid; 279,000 tons of chlorine; 640,000 tons of lime; 244,000 tons of magnesia.

Making every allowance for errors of experiment, which, however, would rather increase than diminish these quantities, excepting, it may be, the amounts of the two last on the list, these researches of M. Barral prove to us that, the amount of fertilizing matter conveyed to the soil by the rain, must exercise a constant and most important influence on the vegetation of a country. These facts also tend to throw still further doubt upon the peculiar efficiency of the salts of ammonia, and of the acid of the nitrates as manures; for we find in rain-water a constant supply of these nitrogeneous matters, not applied once, or at most twice, in the year, as is the case with the various artificial manures, such as the nitrates of potash and of soda, Peruvian, and those guanos which contain a large proportion of soluble ammoniacal salts, and the various ammoniacal composts, made and sold in this country. the utility of which must chiefly depend on the concurrence of several favorable conditions of the plants, the soil and the weather; for we find that the nitrogen required for the growth of the plant is supplied in the fittest state for assimilation (viz., that of great dilution,) and at all stages of its growth, by every shower that falls. The later opinions entertained by Liebig, of the superior value of the alkaline and earthly constituents of manures, *i. e.*, the potash, soda, lime, magnesia, and the phosphates and sulphates of these bases, to that of their nitrogeneous compounds, derive much weight from these experiments of M. Barral, which show that a vast amount of nitrogeneous fertilizing matter is distributed by the rain but none of the fixed alkalies, or of the salts of phosphoric and other acids, equally important to the due growth of vegetables, and which, unless naturally existing in sufficient amount in the soil, must be supplied by the application of manure, or the plant will either dwindle, or yield an imperfect produce, owing to an insufficient supply of one portion of its requisite constituents, however much it may be stimulated by an abundant application of ammoniacal fertilizers. The prevailing use of these manures, which are so highly charged with the salts of ammonia, readily account for the increasing "steeliness" which is observable in English wheat, arising in great measure, as remarked by Liebig, from a superfluous and unnecessary supply of the ammoniacal stimulants, and a deficiency in the more important constituents of the cereals, viz., the earthy phosphates and alkaline salts, which are not brought to the growing corn in the rain, like the nitrogeneous constituents.—*London Critic.*

On Oxygen, by Professor Faraday.

Royal Institution, June 22nd.

The object of the speaker was to bring before the members, in the first place, M. Boussingault's endeavors to procure pure oxygen from the atmosphere in large quantities; so that being stored up in gasometers it might afterwards be applied to the many practical and useful purposes which suggest themselves at once, or which may hereafter be developed. The principle of the process is to heat baryta in close vessels and peroxidize it by the passage of a current of air; and afterwards by the application of the same heat, and a current of steam (with the same vessels), to evolve the extra portion of oxygen, and receive it in fitly adjusted gasometers: then the hydrated baryta so produced is dehydrated by a current of air passed over it at a somewhat higher temperature, and finally oxidized to excess by the continuance of the current at a lower temperature: and thus the process recurs again and again. The causes of failure in the progress of the investigation were described as detailed by M. Boussingault; the peculiar action of water illustrated; the reason why a mixture of baryta and lime, rather than pure baryta, should be used, was given; and the various other points in the *Memoire* of M. Boussingault were noticed in turn. That philosopher now prepares the oxygen for his laborotory use by the baryta process. The next subject consisted of the recent researches of MM. Fremy and E. Becquerel "On the Influence of the Electric Spark in converting pure dry Oxygen into ozone." The electric discharge from different sources produces this effect, but the high intensity spark of the electric machine is that best fitted for the purpose. When the spark contains the same electricity, its effect is proportionate to its length; for at two places of discharge in the same circuit, but with intervals of 1 and 2, the effect in producing ozone is as 1 and 2 also. A spark can act by *induction;* for, when it passes on the *outside* of a glass tube containing within dry oxygen, and hermetically sealed, the oxygen is partly converted into ozone. Using tubes of oxygen which either stood over a solution of iodide of potassium or, being hermetically sealed, contained the metal silver, the oxygen converted into ozone was absorbed; and the conversion of the *whole* of a given quantity of oxygen into ozone could be thus established. The effect for each spark is but small; 500,000 discharges were required to convert the oxygen in a tube about 7 inches long and 0.2 in diameter into ozone. For the details of this research, see the "*Annales de Chimie,*" 1852, xxxv. 62.—Mr. Faraday, then referred briefly to the recent views of Schonbein respecting the probable existence of part of the oxygen in oxy-compounds in the ozone state. Thus of the peroxide of iron, the third oxygen is considered by him as existing in the state of ozone; and of the oxygen in pernitrous acid, half, or the two latter proportions added when the red gas if formed from oxygen and nitrous gas, are supposed to be in the same state. Hence the peculiar chemical action of those bodies; which seems not to be accounted for by the idea of a bare adhesion of the last oxygen, inasmuch as a red heat cannot separate the third oxygen from the peroxide of iron; and hence also, according to M. Schonbein, certain effects of change of colour by heat, and certain other actions connected with magnetism, &c.

Mode of Manufacturing Artificial Essences.

Prof. Fehling, in the Wurtemberg *Journal of Industry,* gives the following abstract of what is at present generally known respecting the composition and production of some of the artificial extracts of fruit. He says:

Amongst the chemical preparations exposed at the London

Exhibition, the artificial extracts of fruits were particularly deserving of attention. Although some of these extracts, as for instance, butyric ether, have already found applications, their use has been hitherto only on a very limited scale. It is now, however, no longer to be doubted but that the majority of our artificial organic compositions will, ere long, be extensively applied, and their practical applications cannot but have a very stimulating effect on the study of organic chemistry, which will again most probably lead to the discovery of technical applications for the new organic compositions, which the investigations of our modern chemists have furnished us with. Among the extracts of fruit exhibited by a London manufacturer, those which more particularly attracted attention were pine apple oil, bergamot pear oil, apple oil, grape oil, cognac oil, &c. Several of these oils have been analyzed by M. Faiszt, of Stuttgardt. We give here a succinct description of some of these extracts, and of their manufacture.

Pine Apple Oil.—This product consists of a solution of 1 part of butyric acid ether, in 8 to 10 parts of spirits of wine. For preparing butyric acid ether, pure butyric acid is required, and this is obtained most readily and in greatest quantity, by the fermentation of sugar, or of St. John's bread, (*siliqua dulcis.*) For preparing butyric acid from sugar, M. Bentch takes a solution of 6 pounds of sugar, and half an ounce of tartaric acid in 26 pounds of water, which is left to stand for some days; at the same time about a quarter of a pound of old decayed cheese is diffused in 8 pounds of sour milk, from which the cream has been removed; and after this has also stood for some days, it is mixed with the first solution, and the whole is kept from four to six weeks at a temperature of about 24° to 28° Reaumer, water being added from time to time to replace that which is lost by evaporation. After the evolution of gas has entirely ceased, the liquid is dissolved with its own bulk of water, and finally 8 pounds of crystalized soda, dissolved in 12 pounds to 16 pounds of water are added to it. The liquid is then filtered and evaporated till it weighs only 10 pounds, when a quantity of 5½ pounds of sulphuric acid, (*nordhausen*, or fuming sulphuric acid,) diluted with 5½ pounds of water, is carefully mixed with it by small portions at a time. The butyric acid, in the state of an oily substance, will now appear on the surface of the liquid, from which it may be skimmed off; but as the remaining liquid still contains some butyric acid, it is submitted to distillation, by which means another portion of diluted butyric acid is obtained, which may be be concentrated by means of melted chloride of calcium, or by saturating it with carbonate of soda, evaporating and decomposing by sulphuric acid. By this method 1¾ pounds of pure butyric acid are obtained from 6 pounds of sugar.

M. Marsson says that the same product may be obtained from St. John's bread (*siliqua dulcis,*) by taking 4 pounds of mashed St. John's bread, and mixing it with 10 pounds of water and 1 pound of chalk; the liquid matter must be maintained from three to four weeks at a temperature of from 25° to 35° Reaumer, and be often and well stirred, and from time to time the water that has evaporated must be replaced. After fermentation has ceased, a quantity of water equal to the bulk of the liquid is added and afterwards a concentrated solution of 2½ pounds or 2¾ pounds of carbonate of soda, when it is finally evaporated. To the concentrated liquid is then added 1½ pounds to 2 pounds of sulphuric acid, diluted with 2 pounds of water; and the remainder of the process is performed as already described. By this method a little more than half a pound of coloured butyric acid will be obtained. The acid, however, retains a peculiar smell from the St. John's bread, which continues even in the ether prepared from the same, whereas that prepared from sugar gives an ether of a very pure smell. It will be found advantageous to agitate the oily butyric acid with chloride of calcium, in order to deprive it entirely of its moisture.

For preparing butyric acid ether, (butyrate of oxyde of ethyle,) from butyric acid, 1 pound of butyric acid is dissolved in 1 pound of rectified alcohol, (95° Tralles,) and is mixed with one-half to one-fourth of an ounce of concentrated sulphuric acid; the compound is heated for some minutes, when the butyric acid ether will form a thin layer on the top. The whole is then mixed with half of its bulk of water, and the upper layer taken off; the remaining liquid being submitted to distillation, yields another quantity of butyric acid ether, which is mixed with that obtained in the first instance, and the whole well agitated with a very diluted solution of soda, in order to deprive it of all the acid; which operation should be repeated several times if a very pure ether is desired to be obtained. Care should be taken to use but small quantities of the diluted soda solution at a time, so as not to loze too much ether, this latter being in some measure soluble in water. When large quantities are to be acted upon, the washing water (*eau de lavage,*) is collected, mixed with an equal volume of spirits of wine, and distilled, by which means a solution of pure butyric acid ether in spirits of wine is obtained.

Butyric acid ether may be also obtained immediately from butyrate of soda, by dissolving 1 part of this salt in 1 part of rectified alcohol, adding 1 part of sulphuric acid, and heating some minutes. The ether collects on the top of the liquid, and is purified by washing with water and with diluted soda solution.

For preparing pine apple oil, 1 pound of butyric acid ether is dissolved in 8 pounds to 10 pounds of spirits of wine, which should have been previously deprived of its empyreumatic or fusel oil. Pure French spirits of wine will be found best suited for this purpose. According to the purpose for which the pine apple oil is to be applied, either rectified alcohol of 80° to 90° Tralles, or brandy of 40° to 50°, should be used for dissolving the ether. 20 drops to 25 drops of such an extract will suffice for giving a strong pine apple odour to 1 pound of sugar solution, to which some acid, such as tartaric or citric acid, is generally added.

Bergamot Pear Oil.—What is called pear oil is an alcoholic solution of acetate of oxyde of amyle, and acetate of oxyde of ethyle, prepared from potato fusel oil, (the hydrate of oxyde of amyle.) The potato fusel oil, or oil of potato spirits (in German, *fuseloel,*) is the compound distilled over towards the end of the first distillation of spirits made from potatoes, and is an oily liquid of a very strong and nauseous odor. This oil, in the state in which it is obtained from large potato brandy distilleries, is never pure; but it may be purified by agitating it with a diluted soda solution, when the pure fusel oil collects as an oily layer on the top of the liquid; this oily substance is then submitted to distillation, and that part which distils over at 100° to 112° Reaumer, is collected, and forms the pure fusel oil.

For preparing acetate of oxyde of amyle from this fusel oil, 1 pound of pure ice vinegar is mixed with an equal quantity of fusel oil, to which is added half a pound of sulphuric acid; the liquid is digested for some hours at about 100°, when the acetate of oxyde of amyle separates, particularly on being mixed with a small quantity of water. The remaining liquid, when mixed with more water, yields, on being submitted to distillation, a further quantity of acetate of oxyde of amyle. The entire mass of oxyde of amyle thus obtained is now agitated several times with water and a little soda solution, in order to deprive it of all free acid.

The acetate of oxyde of amyle may also be obtained by taking 1 part of fusel oil to 1½ part of dry acetate of soda, or 2 parts of dry acetate of potash, with 1 to 1½ parts of sulphuric acid. The liquid having been kept for some time at a gentle heat, the acetate of oxyde of amyle is separated by adding water, and proceeding as above explained. 15 parts of acetate of oxyde of amyle are mixed with 1½ part of vinegar ether (vinegar naptha, acetate of oxyde of ethyle,) and dissolved in 100 to 120 parts of spirits of wine, as in the case of pine apple extract; an acid, for instance, tartaric or citric, should be added to the sugar solution, on making use of the pear extract, which addition makes the flavour of the bergamot pear better distinguishable, and the taste acquires at the same time more of the refreshing qualities of fruit.

Apple Oil.—What is called apple oil, is a solution of valerianate of oxyde of amyle in spirits of wine, which may be obtained as a secondary product when fusel oil is distilled with chromate of potash and sulphuric acid for the preparation of valerianic acid. The light solution which collects in the tops of the distilled liquid contains valerianate of oxyde of amyle, together with other liquids, such as adehyde, which gives to the product a less agreeable taste and smell. It is therefore to be preferred for preparing pure valerianate of oxyde of amyle.

For preparing valerianic acid, 1 part of fusel oil is mixed by small portions with 3 parts of sulphuric acid, and afterwards 2 parts of water are added. At the same time, a solution of 2½ parts of bichromate of potash in 4½ parts of water, is heated in a tubular retort; the first liquid is then permitted to flow very slowly into the liquid of the retort in such manner that the boiling continues but very slowly. The liquid which is distilled over is saturated with carbonate of soda, and is evaporated either to dryness for obtaining valerianate of soda, or to the consistency of syrup, when sulphuric acid is added, (say 2 parts of concentrated acid diluted with the same quantity of water, for every three parts of crystalline carbonate of soda.) The valerianic acid forms an oily layer on the upper part of the liquid: which latter will still yield some valerianic acid, on being submitted to distillation. For preparing valerianate of oxyde of amyle, 1 part by weight of pure fusel oil is mixed carefully with an equal quantity by weight of common English sulphuric acid; the resulting solution is added to 1¼ parts of oily valerianic acid, or to 1½ parts of dry valerianate of soda, and is treated by a water bath, and then mixed with water, by which means the impure valerianate of the oxyde of amyle will be separated; this is washed several times with water, afterwards with a solution of carbonate of soda, and finally again with water. In preparing this compound, it is essential that the mixture of sulphuric acid and fusel oil, with valerianic acid, should not be heated to a too high degree, or too long, as the product would thereby acquire an insufferably pungent smell when required for use. 1 part of valerianate of oxyde of amyle is dissolved in 6 or 8 parts of spirits of wine, and acid is added in the same manner, as has been before explained in the preparation of other extracts.

Artificial Oil of Bitter Almonds.—When Mitscherlich, in 1834, discovered nitro-benzole, he little thought, after twenty years to find this body in an industrial exhibition. He certainly, at that time, pointed out the remarkable resemblance which the odor of nitro-benzole had to that of bitter almonds; but the only sources for obtaining benzole at that time, viz., the oil of compressed gas, and the distillation of benzoic acid, were much too expensive, and put an end to the idea of substituting the use of nitro-benzole for oil of bitter almonds. Mansfield, however, in 1849, showed by careful investigation, that benzole may be produced easily and in large quantities from oil of coal tar, and this discovery has not been lost sight of in the arts. Among the articles of French perfumery in the Great Exhibition, with the title *of artificial oil of bitter almonds*, and the fanciful name of *essence of Mirbane*, there were several specimens of oils, which consisted of more or less pure nitro-benzole. The apparatus used in the preparation of this substance is that proposed by Mr. Mansfield. It consists of a large glass worm, the upper end of which branches into two tubes, which are provided with funnels. A stream of concentrated nitric acid flows slowly through one of these funnels, whilst the other is for the benzole, (which for this purpose need not be absolutely pure.) At the point at which the tubes of the funnels are united, the two bodies come in contact, the chemical compound formed becomes sufficiently cooled in passing through the worm, and only requires to be washed with water, and finally with some weak solution of carbonate of soda, to be ready for use. Although the nitro-benzole closely resembles oil of bitter almonds, in physical properties, it possesses, however, a somewhat different odor, readily recognized by a practised person. However, it answers well for scenting soap, and would be extensively applicable for confectionary and for other culinary purposes. For the latter purpose it has the special advantage over oil of bitter almonds, that it contains no prussic acid.

The application of organic chemistry to perfumery is still in its infancy; and we may expect that a careful survey of those ethers and etherial compounds with which we are at present acquainted will lead to further results. The interesting caprylic ethers which M. Blouis has lately discovered are remarkable for their extremely aromatic odor, (thus the acetate of caprylic oxide possesses an odor as strong as it is agreeable,) and promises, if they can be obtained in larger quantities, to yield materials for perfumery.—*Hoffman's letter to Liebig.*

The subject of the composition and artificial production of the various extracts of fruit and other similar perfumes and essences, strikingly illustrates the wonderful progress which has been made in organic chemistry within the last few years. A position has been taken by some chemists who have carefully investigated this subject, which cann . at present be controverted, that the extracts or perfumes of the various fruits which can be artificially prepared in our laboratories from the basic organic radicals, are identical and the same with those which nature carefully elaborates in the apple, the pear, the pine apple, banana, and the like. The whole subject has been investigated more carefully, and has been applied to more practical purposes than the public is generally aware of. Take for instance the well-known perfumes known as "Lublin's Extracts," extract of geranium, millefleurs, new-mown hay, and many others; all of these are said to be prepared from two or three of the common and cheap essential oils, and from the organic radicals. In addition to perfumes the most agreeable, odors of the most disgusting and nauseous character can also be produced by like means; as for instance, the odor of the bed-bug, squash-bug, and of many of the common weeds and plants. As an odor or perfume of a different character can be produced by the action of each different acid on the different oxydes of the organic radicals, the number of bodies of this character capable of being produced is almost innumerable, and may possibly embrace every known odor or perfume which is now recognized in the animal, vegetable or mineral kingdom.

The various artificial extracts of fruit have been applied to the flavouring of an agreeable species of confectionary known as the "acidulated fruit drops." These have been denounced as poisonous by some persons, on the ground that fusel oil is known to produce deleterious effects; and as a natural consequence the confectionary referred to has been discarded. There is, however, no foundation for such statements or belief, and if the confectionary flavoured with these extracts has in any case produced injurious effects, it is undoubtedly to be referred to an injudicious consumption of it, and not to any inherent deleterious property.—*American Annual of Scientific Discovery.*

Report on J. L. Gatchell's Hydraulic Ram.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "an Improvement in Hydraulic Rams," invented by Mr. J. L. Gatchell, of Elkton, Maryland—REPORT:

That the improvements submitted for examination consist, first, in the use of a chamber between the body of the ram and the air vessel, in which chamber is placed a flexible diaphragm, depressed by a spring, but capable of elevation by the recoil, thus communicating the momentum of the water passing through the body of the instrument to that contained in the air vessel. The principal advantage of this mode of construction is, the making the ram "double acting," as it is called, that is, keeping the water in the air vessel separate from that driving the instrument; so that in this way the water of any flowing stream, although unfit for domestic or manufacturing use, may be made available for raising the whole supply of a good spring. The Committee are aware that this effect has been before more or less perfectly produced, both by sliding pistons and by interposed columns of air; but the use of the flexible diaphragm, by its tendency to produce *a vacuum in the chamber above it when depressed* by its spring, enables the water to be lifted into this chamber by atmospheric pressure or friction, and this feature the Committee regard as a novelty. It moreover appears probable that the mechanical action of this diaphragm will react upon the discharge valve, and thus have a tendency to prevent the stoppages which have so often been a cause of annoyance in the use of hydraulic rams.

The second improvement presented is a method of further preventing these stoppages by placing a spring upon the head of the ram, so that it shall be slightly lifted at every rise of the valve, and then by its reaction force the valve down again and re-open the passage for the water, to be again stopped when the water has acquired the requisite velocity. The Committee satisfied themselves that when this spring is in action the ram cannot be stopped by holding the valve shut for a short time, which can be done in other rams; so that if while in action any fortuitous circumstance prevents the instant falling of the valve, the action of an ordinary ram ceases, while the one under consideration will recommence by the action of the spring.

The third improvement is in the method of regulating the discharge of the water from the head valve. It is allowed to pass through a series of orifices around the circumference of a disk, which orifices may be more or less closed by a second moveable disk which slides over the first. This method is simple and delicate, but might be so arranged as to allow the readjustment to be made without taking off the valve, which could not be done in the one seen by the Committee.

Finally, the patentee claims the method of putting together his ram by keys instead of screws, which arrangement renders it much more easy to take the instrument apart and re-set it, and avoids the difficulties arising from the rusting of the screws generally used.

The Committee having examined the model exhibited, and seen it in operation, report that, in their opinion, the peculiar features which Mr. Gatchell claims to have introduced into hydraulic rams, are very decided improvements, and recommend them to the attention of persons about to use these convenient and advantageous instruments.

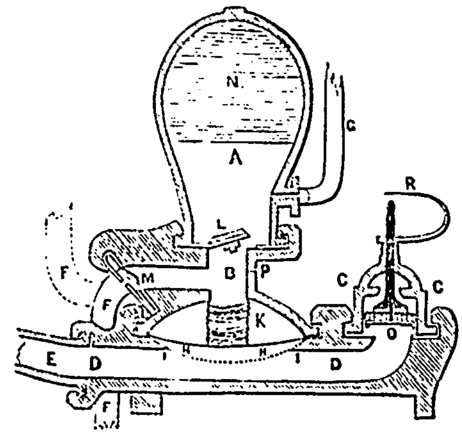
By order of the Committee,

WM. HAMILTON, *Actuary.*

Philadelphia, May 12, 1853.

DESCRIPTION BY THE INVENTOR.

A, the air vessel; B, the diaphragm or piston chamber; C C, the impetus or stop valve; D D, the body of the ram; E, a small section of the feeding pipe; F F F, the pipe supplying the diaphragm chamber with spring or well water; G, the pipe through which the water is carried to the desired elevation; H H, a flexible diaphragm separating the two kinds of water; K, a weight or



spring attached to the diaphragm; M, the spring or well valve; N, the compressed air in the air vessel; O, the sliding plate on the bottom of the impetus valve, and L, the snifling valve, to admit air into the air chamber. R, a spring screwed to the impetus valve C C, which effectually prevents the ram from stopping, from dirt, sand, &c.

Now, it is thought any ordinary person can readily understand the operation of this ram. When the water in the feeding pipe E, is put in motion, its momentum soon closes the impetus valve C C, and exerts an influence on the diaphragm H H, (in the position of the dotted lines I I,) driving it into the position H H, at the same time the spring well valve L is forced open, driving a portion of water into the air vessel A, the compressed air in which gradually forces the water up the rising pipe G, to the desired point. It will be very easily perceived that by using a suitable weight or spring K, on the diapragm H H, at the time of the reaction of the water in the body of the ram D D, the falling of the *diaphragm into the position of the dotted lines* I I, *will* produce a vacuum in the diaphragm chamber B, admitting a portion of water up the pipe F F, through the valve M, from a well, spring, or reservoir below the level of the ram. And by introducing the spring water into the diaphragm chamber through the pipe represented bp the dotted lines F, or by its natural flow or gravity, it will supersede the necessity of the weight or spring K, being at all used.

By means of the sliding plate O, on the underside of impetus or stop valve C C, it can be very easily regulated to suit the quantity of water afforded by the spring or stream. It is also so constructed that the water passing through it has a tendency to give it a partial revolution, by which means it will assume a new position on its seat at every stroke, and will be made to wear equally and always to bed itself correctly.

Experience has shown that the use of screw bolts in putting the rams together, is attended with a great inconvenience on account of the threads of the screws becoming corroded, and generally in less than a year, it is with considerable difficulty that the rams can be taken apart even with a wrench of the best kind; but the above rams are fastened together by means of small keys, which any farmer or common mechanic can with an ordinary hammer take all apart in a few minutes, and put them together in the same space of time.

There will be several sizes of these rams, from No. 1 up to No. 5; capable of throwing from 1 pint to 8 or 10 gallons per minute.

On the Variations of Temperature at Toronto.

To the Editor of the Canadian Journal.

PROVINCIAL MAGNETIC OBSERVATORY,
Toronto, August 2, 1853.

SIR,—

Having lately received through the kindness of Col. Sabine, a paper read by him before the Royal Society, (Feb. 10, 1853.) it has appeared to me of so much importance and interest, to Canadians especially, that I venture to lay before you the following account of it with a few accompanying comments. The title of this paper is

"*On the periodic and non-periodic variations of the Temperature at Toronto, in Canada, from* 1841 *to* 1852, *inclusive. By Col. Edward Sabine, Treas. and V.P.R.S.*

It may be regarded as an anticipation of the 2nd Volume of Observations at the Toronto Observatory, which has been prepared for publication by Col. Sabine, and is now forthcoming in a few weeks.

The terms *periodic* and *non-periodic*, though familiar enough to scientific ears, may require a little explanation for the general reader. The *temperature* at any place is understood to be that of the air as indicated by a thermometer placed at a certain elevation above the ground, usually four or five feet, at the observer's station: the thermometer must be screened from the Sun's rays, and distant from any object capable of reflecting or radiating heat; it should also be exposed to a free current of air on all sides, and must moreover be sheltered from the rain, snow, and in short as much as possible from all extraneous causes, which might mix up their effects on the temperature with that of the air. Strictly speaking, the instruments should also be protected from the heat radiated by the earth, but this is not the usual practice, and it is preferred to make separate observations of this element; no error can arise from this cause, the custom being universal. It is evident that the fulfilment of all these conditions is extremely difficult, and no plan of exposing thermometers has yet been discovered which is free from objection. The thermometers at the Toronto Observatory, are situated on the North end of the building, and sheltered by a double shed of Venetian blinds, with many precautionary details which need not be entered into, but after all, the position cannot be deemed perfectly satisfactory; in the daytime they are read by a telescope through a window, but at night the observer is compelled to approach them with a light and read with the naked eye: this plan, which is very objectionable, it is intended to alter, the effect of it has undoubtedly been to make the night-temperatures higher than they should be, the thermometers being so sensitive that the heat of the observer's person during even the short period necessary for reading them, causes the mercury to rise sensibly. With regard to the difficulties which arose in an early stage of the observations, from the mechanical imperfections of the instruments, I would refer to an excellent article by Captain Lefroy, in the 2nd and 3rd numbers of the Canadian Journal: until very lately, those made by English makers were in general altogether untrustworthy, and in fact until the establishment of the Kew Observatory, where standard thermometers can now be obtained at the low rate of $5 each, there could not be said to exist any English standard. I would here reiterate Capt. Lefroy's warning to all who may be inclined to make meteorological observations, to put no confidence in thermometers where the graduation is not cut on the glass stem itself, and to remember that for the purposes of scientific investigation, the common cheap thermometers are worse than useless.

It should also be remarked that the day in all the following remarks is reckoned from 6 A. M. to 6 A. M.: the reason of this is to be sought for in the original plan of the Colonial observatories. Their especial object was to procure magnetic values in different parts of the world, at the same instant of absolute time, and the astronomical day at Göttingen from noon to noon was chosen as the day of reference for all the stations. As a connection between the magnetic and meteorological changes at the different stations was anticipated, the latter were made simultaneous with the former, and the noon of Göttingen happening to coincide very nearly with 6 A. M. at Toronto, our day is made to commence with that hour.

Coming now to the general question of variations of temperature, some of them are so obvious and familiar, as to require no pointing out, such as the increase in the morning and decrease towards night: by watching, however, a sensitive thermometer continuously for a short time, the column of mercury is seen to be almost constantly in a state of fluctuation, ascending and descending rapidly and repeatedly under the observer's eye, still on the whole, after the lapse of some minutes, sensibly altering its mean position in the tube, so that we may consider it to be always in a state of oscillation about a mean value which is itself in a state of ascent or descent, exactly resembling the small waves of the sea which alternately advance and retire while the great tide wave is steadily progressing. It is evident therefore, that noting the indication of the thermometer at one instant of time, will not give accurately the general temperature that pervades a sensible period including that instant; by actually watching the thermometer unceasingly, and recording all the changes that occur, we should evidently be able to eliminate the small and irregular variations, and deduce with certainty the *mean* temperature of the period, or that temperature which sustained uniformly throughout that period would be equivalent to the amount of heat which has been expended in producing the irregular changes actually occurring during the period. Such a mode of observation would not however be practicable, nor luckily is it necessary. By noting the temperature at certain equidistant periods of time, and with a frequency which experience has shown to be sufficient we may be certain that the effects of the irregular variations will sensibly counterbalance each other and leave us a mean result freed from their influence. Thus, experience has shewn that observations made every hour, or every two hours, will give with accuracy the mean temperature for the day; and the mean of all the daily means thus obtained in a year, will give with accuracy the mean temperature of that year, and the mean of a few years will give the mean annual temperature of the place. So also the mean of these annual temperatures at a considerable number of places on the same parallel of latitude gives the annual temperature for that latitude, and by extending the same process over all the parallels, we obtain finally the mean annual temperature of the whole surface of the earth, and can watch the changes that occur in it from year to year. When, however, we descend to the changes at the same place during the year, and compare them with those occurring at other places, the above process is no longer applicable. For this purpose the mean daily temperatures observed for a considerable number of years, are collected into monthly averages, and the intermediate temperatures are interpolated between these by Bessel's formula, so as to obtain the mean or normal annual march of the temperature. Again when the daily observations are taken at fewer times than hourly or two-hourly, a mean of the observations will not give the true daily mean, and certain corrections must be applied to the individual observations, deduced from the known diurnal march of the temperature on that day: to effect this the observations at each hour for a series of years are separately collected into monthly averages, and the means thus obtained are used to furnish by interpolation the normal diurnal march on each day. In this way the normal diurnal curves being constructed for a sufficient number of places on each parallel of latitude, the mean curve for that latitude is found by graphical interpolation, and from the curves of all the latitudes, that for the whole surface of the earth is determined. It is thus that Professor Dove has been enabled to construct his well known isothermal maps, and to announce those striking results which have astonished and delighted all engaged in the pursuit of meteorology: I may refer the reader for information to Humboldt's *Cosmos*, to *Views of Nature*, and to Dove's *Verbreitung der Wärme*, and *Brit. Ass. Reports* for 1847-8.

This principle then of separating the changes of value of the meteorological elements into two classes—periodic—or those which recur in a determinate order,—and non-periodic—or those which may be considered accidental at the period of occurrence, and whose effect is to be eliminated from the mean result—so fertile in results and powerful in analysis, was first brought prominently into notice by Bessel and Gaüss, and has since been applied with eminent success by those distinguished philosophers, Dove and Col. Sabine. . . The non-periodic variations are those to which the attention of meteorologists will in future be mainly directed in connection with the whole subject of the windrose, which Dove has shewn to be the key of the great problem of climatology.

To proceed now to the paper which is the subject of this letter.

The first table given by Colonel Sabine, contains the temperature of each hour of the day, arranged in monthly means on the average of six years, from 1842 to 1848, and from this by Bessel's formula, he has calculated another table giving the corrections to be applied to the observed temperature at each hour of the day, for every five days throughout the year in order to deduce the mean temperature of the day, thus forming the normal diurnal march. His interesting remarks upon this table I give in full, but the limits of this note compel me to omit his novel and ingenious idea of chrono-iso-thermal curves.

"From the temperatures computed from the six years of observation we learn many facts regarding the temperature at Toronto which are interesting in themselves and may become particularly so in their comparison with the phenomena in other parts of the Globe.

"Amongst these may be noticed the following:—The mean annual range, or the difference between the mean temperatures of the coldest and the hottest month, (February and July) is 42°.7. The warmest day of the year is July 28, being thirty-seven days after the summer solstice, the coldest day is February 14, being fifty-five days after the winter solstice. The mean temperature of the year is passed through on April 19th and October 15th. The warmest and coldest days, and the days on which the mean temperature is passed through, deduced by a similar process at Konigsberg by Bessel, at Paris, Turin, and Padua by Kamtz, at Berlin by Mädler, and at Prague by Fritsch and Jelinek, are collected by the last named meteorologist in his memoir,—*On the daily march of the principal Meteorological elements, deduced from hourly observations at the Prague Observatory*, published in the Transactions of the Imperial Academy of Sciences at Vienna in 1850, and are as follows:—

	Maximum.	Minimum.	Days on which the mean temperature of the year is passed through.	
Konigsberg	August 1	January 9	April 21	October 20.
Berlin (18 years)	July 18	January 19	April 19	October 21.
Berlin (92 years)	July 22	January 12	April 17	October 16.
Prague (8 to 9 years)	July 24	January 26	April 16	October 20.
Prague (76 years)	July 23	January 19	April 15	October 18.
Paris	July 28	January 15	April 18	October 19.
Turin	July 27	January 3	April 18	October 26.
Padua	July 26	January 15	April 20	October 15.

These may be compared with the corresponding epochs at Toronto as derived respectively from the six-years and the twelve-years series discussed in this paper.

Toronto (1842.5 to 1848.5)	July 28	Feb'y. 14	April 19	October 15.
Toronto (1841 to 1852,)	July 28	Feb'y. 12	April 25	October 17.

The anomalous character of the North American Winter, so visible in the Chrono-iso-thermal Plate is also marked by the very late occurrence of the epoch of the *minimum* temperature, and the great dissimilarity in that respect from all other stations. The systematic character of this anomaly is further shown by the fact that every hour in the twenty-four has its minimum temperature between the 7th and 17th of February; the minimum occurs earliest, viz., on the 7th of February, at the hour of 2 P. M.; the minima of the hours of the night, or from 9 P. M. to 7. A. M. inclusive, fall the latest, viz., on the 15th, 16th and 17th of February; those of the intermediate hours on the intermediate days and in regular progression. The hours from 6 A. M. to 9 P. M. inclusive, or those of the *day*, have their maximum temperature between the 20th and 30th of July; those of the *night* or from 11 P. M. to 5. A. M. inclusive, from the 3rd to the 12th of August. The portion of the twenty-four hours which is warmer than the mean temperature of the day varies considerably at different seasons; in part of November there are fourteen of the observation hours colder, and only ten warmer than the mean temperature of the day; in the greater part of July twelve of the observation hours are colder and twelve warmer; and in all the rest of the year thirteen hours are colder and eleven warmer. On the average of the whole year the mean temperature is passed through about 8h. 31m. A.M., and 7h. 44m. P.M., making intervals of 11h. 13m. and 12h. 47m. The hours from 9 P. M. to 7. A. M. inclusive, are throughout the year colder than the mean temperature of the day; those from 10 A. M. to 7 P. M. are throughout the year warmer than the mean temperature of the day; 8 and 9 A. M., and 8 P. M., are sometimes warmer and sometimes colder than the mean temperature: 8 A. M. is colder except for about three weeks in July, and 9 A. M. is warmer except from November 20 to March 11; 8 P. M. is colder from the middle of March till late in November, and either coincides with the mean temperature, or is slightly warmer during the remainder of the year.

The hours of the highest and lowest temperature on every fifth day of the year, and the amount by which the temperature at those hours exceeds or falls short of the mean temperature of the day may be examined in detail in the Table. From the third week of September until April, 2 P. M. is the warmest hour, with the exception of some days in January and February, when 3 P. M. is warmer: from April to the middle of May, and again from the end of July to the middle of September 3 P. M. is the warmest hour; and from the middle of May to the middle of July, 4 P. M. The coldest hour from the latter part of April to the end of June, and again from the end of October to late in November is 4 A. M.; from the middle of July to the middle of October, in January, and for a short time in the middle April it is 5 A. M.; from the latter end of February to early in April it is 6 A. M.; and generally in December and February 7

A. M. The range from the minimum to the maximum in the day is greatest in July (18°.2,) and least at the end of December (5°.2). The daily range has but one maximum in the year, which is in July; not as at Prague, where June and July have a less range than the months immediately preceding and following them, and where consequently there are two maxima, a phenomenon attributed to greater prevalence of the clouds in June and July.

[The following are the mean daily ranges of temperature for the several months; they must be carefully distinguished from the ranges of the whole months separately, these latter being the differences between the highest and lowest temperatures occuring in each month.

	°		°		°
January	5.78....	May	15.13....	September	13.80
February	9.38....	June	15.69....	October	10.88
March	10.22....	July	18.21....	November	6.68
April	11.97....	August	16.27....	December	5.98

Mean daily range on the average of the whole year 11°.41.]

It may be desirable to add a few words on the assistance to observers of tables which furnish corrections to the mean temperature of the day for every hour of every day in the year, such as the table spoken of. Besides their direct use at the station itself, they have a useful bearing within a reasonable distance from the station, on the selection of observation hours in the many cases in which it may not be possible to observe at hourly or two-hourly intervals, by affording a ready means of estimating the amount of error to which a deduction from any limited combination of hours is subject. If we desire, for example, to seek the observation hours within the command of a single observer, which may give the best approximation to the mean temperature of the day, and to that of the month, and of the year, as well as to *climatic* difference (i. e., the difference between the hottest and the coldest months), we find that, of homonymous hours, the best pairs at Toronto are 9^h—9^h and 10^h—10^h, 10^h—10^h being the better of the two; but that 8^h—8^h, which is a combination frequently adopted by observers, does not suit so well at Toronto as either 9^h—9^h or 10^h—10^h.

For the purpose of combining with an approximate mean temperature of the day an approximation to the hottest and coldest hours of the day, and to the hours of maximum and minimum of other meteorological elements—three equidistant observations are frequently adopted in preference to a binary system, and the hours of 6 a.m, 2 p.m., and 10 p.m., appear to be usually preferred. These hours are still within the command of a single observer, though we often find substituted for them the non-equidistant hours of 7 a.m., 2, p.m. and 9 p.m., doubtless because they suit better the convenience of observers. In comparing the mean temperatures in the different months derived from 6^h, 2^h, 10^h, or 7^h, 2^h, 9^h, with the full complement of twenty-four hours, we find that the approximation to the mean temperature obtained by 7^h, 2^h, 9^h, is not quite so good as by 6^h, 2^h, 10^h; and that either of the triplets gives a less correct mean temperature than 10^h—10^h: 6½, 2, 9½, would appear a more suitable combination as far as regards approximation to the mean temperature.

Three equidistant observations in the twenty-four hours are the utmost that can be perseveringly maintained by a single observer. When there are two or more observers there is no difficulty in multiplying the times of observation so as to comprehend all the objects that may be desired, each in the manner and by the means which are most suitable to it, and will be most satisfactory. But as the work of observation at by far the greater number of meteorological stations is usually carried out by a single observer, and as this is likely to be always the case, it should be a primary object with meteorologists who are furnished with sufficient means, to form tables of corrections to the mean daily temperature for every hour of the day, upon the basis of a sufficient number of years of observation, to be used at the respective localities, or within the distances to which such tables may be severally applicable by persons whose means or convenience may restrict them in respect to the number and choice of hours of observation.

With such a table, the choice is disembarrassed of its chief difficulty, that of selecting hours which by their combination will give an approximate mean temperature for the several months and for the year; and the observer is left free to give a preference, independent of such consideration, either to the hours when the phenomena change least rapidly, and consequently small irregularities in the times of observation will be least injurious, or to the hours which will furnish the best approximation to the daily maxima and minima of the meteorological elements generally, viz.: of the temperature, the tension of vapour, the pressure of the gaseous atmosphere, and the force of the wind; or to the hours which will have the most effective bearing upon other points of meteorological or climatic interest, to which the observer's attention may be directed."

Having thus obtained the necessary corrections for all the the hours, they have been applied to the observations individually, during the next 6 years in which the hourly system of observation was abandoned. The daily means of the whole 12 years were then collected into monthly averages, and Bessel's formula was used to obtain the mean normal temperature for each day of the year. These are entered in table IV along with the differences between these normals and the observed means of each day for the whole 12 years—being in fact the non-periodic variations for these days—and also a column with the average of these differences, or the average non-periodic variation for each day. On this Colonel Sabine remarks:

"We may learn consequently from this column the average non-periodic variation in twelve years of any particular day of the year which may be surmised to be subject to some special physical peculiarity, causing it to be warmer or colder than the general progression of the temperature in the part of the year to which it belongs. An example of its application may be given by the reply which the values in this column furnish to the question, whether the three days of May (the 11th, 12th, and 13th,) which Mädler has stated to be characterised, on the average of 86 years of observation at Berlin, by a depression exceeding 2° Fahr., when compared with the general march of the temperature at that season, undergo a similar depression in North America. On a reference to the month of May in the table, it is seen in the final column that on the average of 12 years from 1841 to 1852, the 11th of May was 0·1 *below*, and on the 12th and 13th of May respectively 3°·1 and 2°·4 *above* the general mean of the temperature in those years. It may be seen also that the average non-periodic variation in the five days from the 8th to the 12th of May inclusive, is in the same 12 years, 1°·1 *above*, and in the five days from the 13th to the 17th inclusive, 1°·1 *above*, the general mean of the temperature. The meteorological observations at Toronto during these 12 years do not therefore support the supposition that the depression of temperature on the 11th, 12th and 13th of May, observed at Berlin, is a general and periodically recurring phenomenon over the whole globe, such as would be occasioned by a partial obscuration of the Sun's disc by the intervention of a periodical stream of aerolites; but they tend rather to indicate that the depression observed in Europe may have been a partial phenomenon, having a local cause."

From the tables mentioned, I have computed by interpolation the normal values for each hour of observation at Toronto on every day in the year, the differences between which and the actual observed values are entered in a column of the register, thus shewing at a glance the non-periodic variation at that time. In this form the monthly meteorological reports will in future appear in the Upper Canada Medical Journal.

The mean monthly temperatures on which these calculations are founded are as follows:—

	°		°		°
January,	24·97	May,	51·18	September,	58·02
February,	23·10	June,	61·05	October,	44·93
March,	30·23	July,	66·41	November,	36.51
April,	41·11	August,	66·16	December,	26·75

July is consequently the hottest month, and February the coldest; there are 6 months above and 6 months below the mean of the year (44°·23), and the mean temperature is passed through in April and October. The hottest month is 22°·18 *above*, and the coldest month 20°·83 *below* the mean, the difference between the hottest and coldest months being 43°·01.

Col. Sabine remarks that "February and March appear to be months most liable to extreme variations; July and August the least so." But it may be doubted whether the series of years is sufficiently long to warrant this conclusion. On a comparison of the iso-thermal curves over the whole surface of the earth, Dove states that September is "the season when the distribution of temperature over the globe is most regular, even America forming no exception. Then begins the Indian Summer, *the time which the Great Spirit of the Red-Skin sends to him that he may follow the chase.* Nature falls gently asleep in Autumn, and awakens with feverish starts in Spring."

On the yearly mean, Col. Sabine states:—"The mean annual temperature derived from the whole body of the observations in twelve years is 44°·23; and on the supposition that no constant errors, instrumental or observational, or occasioned by insufficient protection or defective exposure of the thermometer, are involved, and that the variations of the temperature in different years may be regarded strictly as accidental oscillations round a mean value, and of equally probable occurrence in every year, the probable error of this result is ±0°·18. The probable variability of a *single year* is ±0°·63, shewing that there is an equal chance that the mean temperature of any one year will fall within the limits of 43°·60 and 44°·86, as that it will exceed those limits; a conclusion which, perhaps, would scarcely have been anticipated, considering the great range of the thermometer in the course of the year, and the magnitude of the non-periodic variations in short intervals. *The climate of Toronto presents a remarkable combination of great regularity in the annual temperature with great variability occurring in the course of the year.*

The mean temperatures of the several years differed from the average mean temperature as follows:—

	°		°		°
1841....	−0·31	1845....	+0·35	1849....	−0·14
1842....	−0·27	1846....	+2·13	1850....	+0·22
1843....	−1·88	1847....	−0·53	1851....	−0·25
1844....	+0·25	1848....	+0·85	1852....	−0·39

The excess of cold in 1843 (1°·88), was due chiefly to the occurrence of very low temperatures in February and March of that year; the excess of heat in 1846 (2°·13), was more generally diffused throughout the year, all the months except February and October being above their average."

On comparing the mean monthly temperatures with the normal temperatures due to the geographical latitude of Toronto, it appears that "every month of the year at Toronto is colder than the normal temperature of the parallel in which it is situated, the mean annual temperature being nearly 7° below the normal. The thermic anomaly is least in July and August (between 2° and 3°), and greatest in February, when it exceeds 11°. Its sudden increase in October and decrease in November are deserving of notice. In viewing the bearing of the thermic anomaly at Toronto on the more general question of the thermic anomaly in the part of North America in which it is situated, it is necessary to bear in mind that the thermometer at Toronto was about 342 feet above the sea level, equivalent, as usually estimated, to a diminution of rather more than 1° of Fahrenheit, on account of vertical elevation. Dove's normal temperatures are all reduced to the sea-level, and when the monthly temperatures at Toronto have undergone the same reduction, the thermic anomaly indicated by them is diminished to about 1° in July and August, but in February still reaches the large amount of 10°; in both respects, therefore, confirming Dove's conclusion, that the summers of North America are *not* warmer than is due to their latitude, whilst the winters are much colder." All these results are embodied in the accompanying plate, which is copied from that in Col. Sabine's paper.

The black curve line indicates the annual normal march of the temperature, its vertical ordinate being the number of degrees Fahr., corresponding to the period of the year indicated by the horizontal one.

The fainter straight lines give the actual observed averages of five-day periods for the twelve years, and the vertical distance between the two corresponding points of the faint and dark lines is the non-periodic variation at that period. The points surrounded by small circles are the actual monthly means of the twelve years from which the normal curve is computed, and these are connected by vertical lines with the corresponding monthly means (similarly distinguished), of the temperature due to the latitude of Toronto as calculated by Dove, the march of the latter being denoted by the dotted curve, and the vertical distances between this dotted curve and the dark one are the thermic anomalies for that period of the year. The normal geographical curve is computed for the sea level, but the normal curve itself is formed from the temperatures uncorrected for vertical elevation, so that in geographical comparisons of climate the thermic anomalies must be each diminished by about 1° Fahr.

An examination of these curves will prove highly interesting. I may especially direct attention to the rapid descent of the normal curve between November and December, its prolonged pause throughout most of January, (the *January* thaw) its sudden fall in February and its equally rapid rise in March.

As I have often heard it remarked that a cold winter is followed by a hot summer, I have thrown together the monthly temperatures into the usual seasons (December, January and February for winter, and so on), in the following table:—

YEAR.	SPRING.	SUMMER.	AUTUMN.	WINTER.
	°	°	°	°
1841.........	39·1	65·0	46·0	27·8
1842.........	42·7	62·0	44·7	22·6
1843.........	37·1	63·1	44·8	25·4
1844.........	41·1	63·4	42·4	26.9
1845.........	42·4	65·0	46·4	22.7
1846.........	44·2	66·6	49·8	21·1
1847.........	39·9	63·8	46·1	28.5
1848.........	41·3	65·9	45·0	22.4
1849.........	40·2	66·0	48·7	27·4
1850.........	38·1	66·7	46·9	24·9
1851.........	41·7	62·6	46·8	21·1
1852.........	39·1	61·5	47·2	26·3
Mean.	40·9	64·6	46·5	25·0

Probably the sequence may be better seen in the following form, where the difference of each summer above or below the mean of the summers is entered, and so also those of the winters in their proper order:—

41		42		43		44		45		46		47		48		49		50		51		52	
S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W
+0.4	+2.8	−2.6	−2.1	−1.5	+0.1	−1.2	+1.9	+0.1	−2.3	+2.0	−0.9	−0.8	+3.5	+1.3	−2.6	+1.4	+2.4	+2.1	−0.1	−2.0	−3.9	−0.1	+1.3

It will be seen from this that winters *above* the average *(mild,)* have been followed in two instances by summers *above (hot,)* and in three by summers *below (mild)* the average; and winters *below* the average *(cold,)* have been followed in two instances by hot summers, and in four by mild ones, so that the popular tradition is not at all supported by these observations.

This is not the place to discuss the subject of climate, but many of your readers will, perhaps, be interested in examining the following temperatures of a few places on the opposite shores of Lake Ontario. They are taken from Dove's tables, but are unreduced for both diurnal and annual variation.

It appears from these data (which, however, with the single exception of Toronto, are very rude for such a purpose), that as compared with these stations on the South side of the Lake, our increased severity of winter is much more than compensated for by diminished intensity in summer.

PLACE.	SPRING.	SUMMER.	AUTUMN.	WINTER.	MEAN ANNUAL TEMP.
	°	°	°	°	°
Toronto........	40·9	64·6	46·5	25·0	44·23
Hamilton.......	42·8	64·4	45·9	23.9	44.25
Kingston	41·7	67·7	48·7	18·7	44 17
Rochester......	44·8	67·2	48·3	26·5	46·69
Fort Niagara...	47·2	72·2	57·0	30 5	51·71
Oswego........	41·1	65·9	45.7	21.7	44·36
Sackett's Harbor	44·3	69.7	53.	27·	48·50
Lewiston.......	45 7	68·3	49·9	27·0	47·73

I hope to discuss this subject more fully on a future occasion.

I am, Sir, yours respectfully,

J. B. CHERRIMAN.

Canadian Institute.

NOTICE TO MEMBERS AND SUBSCRIBERS TO THE JOURNAL.

It having been represented to the Postmaster General by the Council of the Canadian Institute, that the postage on the *Journal* was a heavy tax upon its publication, and that other Literary Periodicals published in Canada, enjoyed a total or partial immunity from that outlay, the Postmaster General has been pleased to orde. that the *Canadian Journal* may be transmitted to any part of Canada through the Post, at half the usual Postage.

The following gentlemen have been provisionally elected Members of the Institute by the Council. The customary formalities of their election cannot be complied with until the first General Meeting of the Institute in December next.

The Hon. Francis Hincks, Life Member,.......... Quebec.
Mr. Edward Thompson,...................... Toronto.
Mr. Albert Pellew Salter, P. L. S.,............. "
Mr. Edward Robert Jones, P. L. S.,............ "

Arrangements for the Session of 1853-4.

The Council of the Canadian Institute desirous of making arrangements to suit the convenience of gentlemen whose names are already on their list, as intending contributors of original papers to the Institute, during the Session of 1853-4, as well as of those who may have such an intention, but have not yet notified the Council to that effect, particularly request that the name and address of each intending contributor, together with the title of the paper he proposes to read or communicate, may be transmitted to the Secretary before the first day of November 1853. It will very much facilitate the arrangements of the Council if each contributor name the date of the Saturday on which it will be most convenient for him to submit his paper to the Institute.

Curves and Grades on the Ontario, Simcoe and Huron Railway between Toronto and Barrie.

			Length in Feet.	Length in Miles.
Curves of	5,730 ft.	radius......	8,567......	1.62
do.	2,865 ft.	do.	22,017......	4.17
do.	2,292 ft.	do.	560......	0.106
do.	1,910 ft.	do.	29,468......	5.58
do.	1,432 ft.	do.	5,247......	0.99
			65,860......	12.47
		Tangents..........	273,768......	51.85
			339,628......	64.31

Ascents and Descents.—Toronto to Barrie.

	ASCENT.	DESCENT.	ELEVATION OF SUMMIT ABOVE LAKE ONTARIO.
Toronto to Summit....	190,03 feet.	64,55 feet.	751,37 feet.
Summit to Barrie.....	325,37 "	584,02 "	
Total............	1115,40 feet.	648,57 feet.	

Gradients in Feet per Mile, and lengths in Miles and Parts.

	60 ft.	50 to 60	40 to 50	20 to 40	0 to 20	Level	Total.	Total
Toronto to Summit	8 89	2.58	0.70	4.56	2.33	1.30	20.36	52 8
Summit to Barrie.	·.7	6.17	1.67	10.07	5.47	5.47	42.68	7.44

Maximum grade going North 60 feet per mile - - 10.67 miles.
" " " South 52.8 " " - - 7.44 "

CORRESPONDENCE.

Red-breasted Thrush.

To the Editor of the Canadian Journal.

SIR,—In the *Journal* for June, your correspondent, Mr. R. Whitwell, writes under the head "*Rara Avis*," concerning a well known migrating bird ("Robin Red-breast?") which was noticed by that gentleman to remain in this country throughout "the winter of 1851 and 1852." It must, certainly, have been a rare bird to remain behind the rest of its species, in a latitude where the mercury is often seen to fall "ten or twenty degrees below zero," where "the frigidity of the atmosphere had so thickened his blood and benumbed his frame, that he could not maintain his proper roosting position."

This "*last Robin of Summer*," must have had cause to remain with us during winter. The observer of this phenomenon writes without a pause to reason; however, he states that it is "very rare and uncommon, if not without a parallel," to see a bird of this species remain with us during winter. Might it not have been winged in the summer of 1851?—consequently, it would be a fruitless attempt for a wounded bird to migrate with its companions.

There are two species of this Thrush which migrate annually to Canada and the neighbouring colonies. Of one species, the male and female have red breasts, while the plumage of the other variety is dark, with very little red—but the latter are rare. Gosse, the author of the *Canadian Naturalist*, says: "I perceive no resemblance between him and our English Robin, except in the single circumstance of his having a red-breast.

I have devoted much attention to the natural habits of this bird which in Canada is vulgarly named a Robin,—in Newfoundland a Blackbird. It is, properly speaking, a species of the family TURDUS—Red-breasted Thrush (*Turdus Migratorius*) In many ways it resemble the English Blackbird (*Turdus Merula*) in habits and architecture. Since I begun to make observations on this branch of nature, in 1843, I have never seen a single bird of this species in the woods north of Toronto, later than the month of November. I fed one from the nest in 1846, which is still alive and healthy, and as far as I can judge, the variation of climate have taken little effect on its system—being kept in an equal temperature throughout the year; it sings in winter as well as summer.

Yours, &c.,

WM. COUPER.

Toronto, August 1st, 1853.

Notices of Books.

BOHN'S SCIENTIFIC LIBRARY.—The following numbers of that excellent series entitled Bohn's Scientific Library, have lately come under our notice, viz.: of the Bridgewater treatises, the volumes by Chalmers, Kidd and Whewell, Bacon's "Novum Organum," Oersted's "Soul in Nature," and Schomo's "Earth, Planets and Man," together with Kobell's "Sketches from the Mineral Kingdom." It is scarcely necessary to remark that all these works are published in Mr. Bohn's usual good style, but it may be well to allude to the fact that in the point of cheapness, they rival the publications of our American neighbours. Our English publishers are now very rightly endeavouring to issue standard valuable works at such a price as may place them within the reach of almost all classes of the community, while, at the same time there will be nothing to object to on the score of execution. In evidence of the success attending these effects, we may mention that we have lately purchased an English edition of a copyright work at a lower price than that demanded for a slightly inferior American reprint.

It will be scarcely necessary to do more than allude to the re-issue of the "Bridgewater Treatises," the elegant work of Dr. Chalmers on "The adaptation of External Causes to the moral and intellectual constitution of Man," the profound treatise of Whewell on "Astronomy and General Physics," and the interesting and instructive volume by Kidd, on "The adaption of Internal Nature to the physical condition of man," a kind of programme to the whole series of discourses relating to natural science—are all so well known and so thoroughly appreciated, that we need do no more than recommend the compendious form in which they have now been reproduced before us.

Bacon's *Novum Organum* is a work which, although of olden date, yet most worthily holds its place among the most valuable adjuncts to a student's library, and is equally deserving of the serious attention of the teacher and the philosopher.

Oersted's "Soul in Nature," is a work having somewhat the same objects as Hunt's "Panthea" and "Poetry of Science," and consists of a series of conversations between imaginary characters, on various points of art and science, interspersed with several of the author's speeches on various occasions. We candidly confess that we prefer the elegant and at the same time sufficiently profound works of our own countryman, to the abstract metaphysical disquisitions of the Danish philosopher, the high character of whose productions is in our mind considerably diminished by the colloquial form of most of the articles.

As an express of the German metaphysical school, and as the work of one of the most eminent philosophers of Europe, who from the lowest station raised himself by mere force of genius, to the highest position in science,—the "Soul in Nature," is well deserving of attention.

Schomo's work appeared some twelve years ago in the German translation from the Danish, under the title of Naturschilderungen, or Delineations of Nature, and attracted at the time, considerable attention. Some of the most interesting chapters are on Italian Malaria, Etna, Mountain Rambles in North and South, the various plants most useful to man, as for instance, the Bread fruit tree, the Cotton Plant, Flax, Coffee, Tea, &c., &c. The whole work is written in a pleasing style, and is well worthy of being placed beside Humboldt's "Aspects of Nature."

The second half of this volume contains a series of excellent lectures by Von Kobell, on "precious stones," "ordinary stones," "precious metals," and "ordinary metals," the several treatises are quite of a popular character, but at the same time contain a vast amount of very curious and valuable information, with regard to the history of many of the precious stones and metals, and with respect to mineralogy and geology generally.

We consider this to be one of the best selected volumes of the "Scientific Library."

THE ANGLO AMERICAN MAGAZINE,—*Published by Thomas Maclear, Toronto, August*, 1853.—The history of the War of 1812, is continued in the August number of this admirable periodical, with the same liveliness and perspicuity which distinguished former chapters. The successive descriptions of Canadian cities, will furnish when completed, the best tourists guide through Canada, that can be placed in the hands of the emigrant.

THE CANADIAN AGRICULTURIST,—*William McDougall, Toronto, Aug.*, 1853.—The Reports of the Discussions which take place at various meetings of Farmers' Clubs, and Agricultural Societies, and which now constantly appear in the *Agriculturist*, contain a large amount of information respecting the condition of husbandry in different neighbourhoods, and cannot fail to furnish many valuable hints, derived from observations and experience, to reading as well as to listening practical Farmers. We are glad to see that Mr. Kirkwood's mission to the United Kingdom, is likely to be productive of much good in various ways. We join in the request of the Agriculturist, that readers will notice that a Grand Provincial Exhibition will be held in Montreal on the 27th, 28th, 29th, and 30th September, under the auspices of the

Agricultural Association of Lower Canada. The Annual Exhibition of the Agricultural Association of Upper Canada, will take place in the City of Hamilton, on October 4th, 5th, 6th and 7th. Both exhibitions will be open to competition from all parts of United Canada.

Naturalists' Calendar.

For April, May, June and July, Toronto, 1853.

By William Couper.

BUTTERFLIES:		First seen.	
Camberwell Beauty,	*Vanessa Antiopa*	April	9th
Black Swallow-tail,	*Papilio Asterius,*	"	"
Clouded Sulphur,	*Colias Philodice,*	"	"
Orange Comma,	*Grapta c Album,*	"	"
Grey Vined White,	*Pontia Oleracea,*	May	14th
Tiger Swallow-tail,	*Papilio Turnus,*	"	28th
Small Copper,	*Lycæna Phlæas,*	"	29th
Black Skipper,	*Thymele Brizo?*	"	"
Small Spotted Meadow Brown,	*Hipparchia——?*	June	4th
Spring Azure,	*Polyommatus Lucia*	"	"
The Archippus,	*Danais Archippus,*	"	6th
Pearl-border Fritillary,	*Melitæa Myrina,*	"	10th
Banded Purple	*Limenitis Arthemis,*	"	"
Baltimore Fritillary,	*Melitæa Phaeton,*	"	15th

MOTHS:			
Great Saturnia (class *Attaci*) issue from cocoon,		May	24th
Saturnia Polyphemus issue from cocoon,		"	25th
Saturnia Prometheus issue from cocoon,		June	6th
Ghost Moth,	*Hipiolus Humuli,*	"	"
Royal Tiger	*Arctia Virgo,*	"	9th
Buff Leopard,	*Arctia Isabella,*	"	14th
Twin-eyed Hawkmoth,	*Smerinthus Geminatus.*	"	20th
Eyed Hawkmoth,	*Smerinthus Ocellatus,*	"	24th
Panther,	*Spilosoma Acria,*	"	"
Silver-spotted Buff,	*Pygæra Gibbosa,*	July	8th
Zebra Hawkmoth,	*Sphinx Kalmiæ,*	"	27th
Grey Hawkmoth,	*Sphinx Cinerea,*	"	"

BIRDS:			
Little Grebe, (*Colymbus Minor,*) begins to build its nest—lays six whitish eggs,		April	30th
Ground Lark, begins to build its nest,		"	7th
Humming-birds,		May	7th
Red-winged Starling, (*Sturnus Prædatorius,*) begins to build its nest,		May	18th
Whip-poor-will	*Caprimulgus Vociferus*	June	19th

MISCELLANEOUS:			
Gall-flies. (*Cynips Quercus folii*) deposit their *ova* in the leaves of the Oak,		May	28th
Racoon shot in the neighbouring woods,		"	14th
Tree Frog, (*Hyla Versicolor,*)		"	21st
Ephemera *Biocdata,* with two satæ at the tail, longer than the body,		June	9th
Field Cricket, (*Acheta Campestris,*) pipes its evening song,		"	"
Star crane-fly, (*Bittacomorpha Crassipes*) deposits its *ova* in the earth		"	11th
Cuckoo-spit Insect,	*Tettigonia Spumaria,*	"	"
Rattling Locust,	*Œdipoda Sulphurea?*	"	"
Firefly,	*Lampyris Corusca,*	"	13th
Wild Strawberries	(*Fragaria Virginiana,*) ripe	"	11th
Blue-berries, ripe		July	8th
Tree-hopping Locust,	*Cicada——?*	"	13th
Wild Raspberries,	(*Rubus Idæus*) ripe,	"	"
Wild Black Currant,	(*Ribes Floridum?*) ripe ...	"	28th
Wild Gooseberry,	(*Ribes Cynosbati,*) ripe....	"	30th
Wild Blackberry,	(*Rubus Hispidus,*) ripe...	"	"

New Process of Photographic Engraving on Steel.

BY MR. FOX TALBOT.

I now proceed to give you an account of my newly invented method of making photographic engravings upon steel. Of course, I have no need to observe that the art is at present in its infancy, but I have great hopes that it will very soon be considerably improved in all its details.

The first thing to be done is to select a good steel plate, and to immerse it for a minute or two in a vessel containing vinegar mixed with a little sulphuric acid. The object of this is to diminish the too great polish of the surface, for otherwise the photographic preparation would not adhere well to the surface of the steel, but would peel off. The plate is then to be well washed and dried. Then, take some isinglass and dissolve it in hot water. The solution should be strong enough to coagulate when cold into a firm jelly. This solution of isinglass or gelatine should be strained while hot through a linen cloth to purify it. To this must be added about half as much of a saturated solution of bichromate of potash in water, and they should be well stirred together. When cold, this mixture coagulates into a jelly, which has very much the appearance of orange jelly. The method of using it is, liquify it by gentle heat. Then take a glass rod, hold it horizontally, and spread the liquid uniformly over the plate. Then incline the plate and pour off the superfluous gelatine. Let the steel plate be placed upon a stand, and kept quite horizontal, that the liquid may not run to one side of the plate. Then place a spirit lamp beneath the plate, and warm it gently till the gelatine is quite dried up. When dry, the film of the gelatine ought to be bright yellow and very uniform. If clouded bands appear upon the surface it is a sign that there is too little gelatine in proportion to the bichromate, which must therefore be corrected. The steel plate, now coated with gelatine, is ready to receive a photographic image of any object. First, let us suppose the object is one capable of being applied closely to the surface of the plate; for instance, let it be a piece of black lace or the leaf of a plant. Place the object upon the plate in a photographic copying frame, and screw them into close contact. Place this frame in the direct light of the sun for a short time, varying from half a minute to five minutes. Let it then be removed and the plate taken out, and it will be found impressed with a yellow image of the object upon a ground of a brown color, as might be expected from the well known photographic property of bichromate. The plate is then to be placed in a vessel of cold water for a minute or two, which dissolves out all the bichromate and most of the gelatine also from the photographic image, *i. e.* from those parts of the plate which have not been exposed to the sun, being protected by the object; while, on the contrary, it dissolves little or none of the gelatine film which has been fully exposed to the sun's rays. The consequence of which is, that instead of a yellow image we have now a white one, but still upon a ground of brown. The plate is then removed from the water into a vessel of alcohol for a minute, and it is then taken out and placed upright on its edge in a warm place, where in the course of a few minutes it becomes entirely dried. This terminates the photographic part of the operation. If the plate is carefully examined while in this state, it appears coated with gelatine of a yellowish brown color, and impressed with a white photographic image, which is often eminently beautiful, owing to the circumstance of its being raised above the level of the plate by the action of the water. Thus, for instance, the image of a piece of black lace looks like a real piece of very delicate white lace of similar pattern, closely adhering to, but plainly raised above, the brown and polished surface of the plate, which serves to display it very beautifully. At other times the white image of an object offers a varying display of light when examined by the light of a single candle, which indicates a peculiar molecular arrangement in the particles of gelatine. These photographic images are often so beautiful that the operator feels almost reluctant to destroy them by continuing the process for engraving the plate.

In order to explain how such an engraving is possible, it is, in the first place, to be observed that the photographic image differs from the rest of the plate not only in color, but, what is of much more importance, in the thickness of the film of gelatine which covers it. The coating of gelatine on the rest of the plate is, comparatively speaking, a thick one, but that which originally covered the image has been mostly removed by the action of the water, a small portion, however, almost always remaining. It therefore naturally happens that when an etching liquid is poured on the plate, it first penetrates through the thin gelatine covering the image, and etches the steel plate beneath. But the next moment it penetrates likewise through the thicker coating of gelatine, and thus spoils the result by etching the whole of the plate. Nitric acid, for instance, does this, and therefore cannot be employed for the purpose. Since the other chemical liquids which are capable of etching steel have a certain analogy to nitric acid in their corrosive properties, they also for the most part are found to fail in the same manner.

This was a difficulty. But after some researches I found a liquid which etches steel perfectly well, and at the same time is free from the inconvenient property of penetrating the gelatine film. This liquid is the bichloride of platina. In order, however, to use it successfully, it must be mixed with a certain quantity of water, neither more nor less, (I mean to any material extent,) otherwise its action becomes irregular. The best way is, to make a perfectly saturated solution, and then add to it one-fourth of its bulk of water. Then correcting this by a few trials, a solution of proper strength is finally obtained. Supposing then, that we have prepared such a solution, the operation of etching the plate is performed as follows.—The plate is laid on a table, and a small quantity of the bichloride being poured upon it, it is to be rapidly diffused and spread over the whole plate with a camel hair brush. Not much liquid is poured on, because its opacity would prevent the operator from distinguishing the effect produced by it on the metal. For this reason, it is hardly necessary to make a wall of wax round the plate, that is, if the portions to be etched are confined to the central part of the plate, and do not approach very near to the edge. The effect of the liquid upon the plate is not at first visible, since it disengages no gas; but after the lapse of a minute or two, the white photographic image begins to darken, and soon becomes black in every part. When this change is complete, the image often looks very beautiful, though quite altered from what it was before. The operator should carefully watch the image until he thinks that it is finished, or not likely to be further improved or developed by continuing the process any longer. He then inclines the plate gently, and pours off the liquid by one corner of the plate. The plate is then dried with blotting paper, and then a stream of salt water, which is better than fresh water for this purpose, is poured over the plate, which removes all traces of the etching liquid. The plate is then rubbed with a wet sponge or linen cloth, which in a short time detaches and removes the film of gelatine, and discloses the etching that has been effected. When the object is not of a nature to be applied directly to the surface of the plate, the most obvious method of proceeding is, of course, to place the prepared plate in the focus of a camera, and to direct the camera to the object. But in consequence of the low degree of sensitiveness of bichromate of potash, this would take, generally speaking, too long a time to accomplish. The better way in practice, therefore, is, to take a negative photograph of the object on paper with a camera, and from this to obtain a positive copy either on glass or paper, which should be very uniform in texture, and moderately transparent. Then this positive copy is placed on the plate in a photographic copying frame, and being placed for a few minutes in the sun, it impresses the plate with a photographic image; which image, etched as above described, and printed off upon paper, will finally give a positive representation of the object. If the object depicted upon the plate by the sun's rays is broad and uniform, for instance, the opaque leaf of a plant, then, of course, the etching is uniform also. When this is printed off, it produces an effect which is not always satisfactory. I will therefore now explain a modification of the process which destroys this uniformity, and which in many cases produces a great improvement in the general effect.

For this purpose I must remark, in the first place, that if a piece of black gauze or crape is the object selected for representation, it produces an engraving of itself which is marvellously accurate. But when two folds of the gause are laid across each other obliquely, then the resulting engraving requires a lens, in order to separate from each other and distinguish clearly the lines belonging to the two portions of the gauze. Now, if this engraving is printed off, the result offers to an eye at a moderate distance the appearance of an unifom shading. Now, I avail myself of this circumstance, to modify my original process as follows: suppose the object to be the opaque leaf of a plant, of irregular outline; first, I cover the prepared plate with two oblique folds of black crape or gauze, and place it in the sunshine for two or three minutes. The effect of this is, to cover the plate with a complicated image of lines passing in all directions. Then the leaf is substituted for the crape, and the plate is replaced in the sunshine for two or three minutes more. The leaf being then removed from the plate, it will be seen that the sun has obliterated all the lines that were visible on the parts of the plate exterior to the leaf, converting all those parts to a uniform brown. But the image of the leaf itself is still covered with a network of innumerable lines. Now, let this be etched in the way already described, and let the resulting etching be printed off. The result is an engraving of the leaf, which when beheld by the eye at a certain distance appears uniformly shaded, but when examined closely is found to be covered with lines very much resembling those produced by an engraver's tool, so much so that even a practical engraver would probably be deceived by the appearance. This crape arrangement I call a *photographic veil*: and as I think it likely that the idea will prove useful, I will make a few more remarks upon it. It is clear that an arrangement composed of two thicknesses of ordinary crape or gauze is but a rude attempt at a photographic veil. To realize the practical utility that may result from the idea, supposing it to be borne out by further experience, it would be proper to fabricate a much finer material, and to employ five or six thicknesses of it, or else to cover a sheet of glass in any convenient manner with an innumerable quantity of fine lines, or else with dots and specks, which must be opaque and distinct from each other. The result of practically employing such a method, supposing always that it answers in practice, as I think it probably will, would be an etching apparently uniform, but really consisting of separate small portions, in consequence of which it would hold the ink much better, and other obvious advantages would also be obtained. Another mode of accomplishing the same object is to cover the plate originally with an aquatint ground. But then a fresh one would be required for every plate, whereas a single *veil* would serve for any number of plates in succession. Experience alone can decide between these different methods. When the etching is finished, the plate should be very soon coated with wax to protect it. A few hours' exposure to the atmospheric air rusts and destroys the etchings when newly made, although it does not do so afterwards. The oxidation only attacks the lines of the etching, the rest of the plate sustaining no injury, if the air is tolerably dry.

Having thus described the method of producing the photographic etchings, it would, I think, extend this letter to too great a length were I to add any remarks upon the theory of the process, which will better be deferred to another opportunity.—*Athenæum.*

Lacock Abbey, April 25th.

Deodorizing Properties of Coffee.—The London Medical Gazette gives the result of numerous experiments with roasted coffee, proving that it is the most powerful means, not only of rendering animal and vegetable effluvia innocuous, but of actually destroying them. A room in which meat in an advanced degree of decomposition had been kept for some time, was instantly deprived of all smell, on an open coffee roaster, being carried through it containing a pound of coffee newly roasted. In another room exposing to the effluvium occasioned by the clearing out of a cess pit, so that sulphuretted hydrogen and ammonia in great quantities could be chemically detected, the stench was completely removed within half a minute, on the employment of three ounces of fresh roasted coffee, whilst the other parts of the house were permanently cleared of the same smell by being simply traversed with the coffee roaster, although the cleansing of the cess pit continued several hours after.

The best mode of using the coffee as a disinfectant is to dry the raw bean, pound it in a mortar, and then roast the powder on a moderately heated iron plate until it assumes a dark brown tint, when it is fit for use. Then sprinkle it in sinks or cess pools, or lay it on a plate in the room which you wish to have purified. Coffee acid or coffee oil acts more readily in minute quantities.

CANADIAN EXPORTS OF WHEAT.

Year.	Wheat. Bushels.
1838	296,020
1839	219,471
1840	1,739,119
1841	2,313,836
1842	1,678,102
1843	1,193,918
1844	2,350,018
1845	2,597,392
1846	3,312,757
1847	3,883,156
1848	2,218,016
1849	3,645,320
1850	4,547,224
1851	4,275,896
1852	5,496,718

It appears by the above statement that our exports of wheat in 1852 were about eighteen times as great as they were in 1838. They have doubled four times in fifteen years, i. e. more than once in every four years for the last fifteen years. They are now one-half as much as the exports of wheat from the United States; and at the present ratio of increase—doubling in every four years—*our exports of wheat will, in 1856, be equal to those of the United States.—Leader*

Sir John Franklin.—To those whose knowledge is obtained, and whose judgment is formed, at the fire side, this may indeed appear to be a wild and hopeless expedition; but those whose practical knowledge is derived from exploration, scientific research, and hard experience in those regions towards which our course is now directed, have formed a far different opinion, and their acquisition of knowledge constitutes them the best judges, for in their belief the probability amounts to all but certainty, that either Sir John Franklin, or at least the greater part of his brave band, and most likely all of them, are still alive, and may yet be restored to their families, their friends, and to the world. Against this probability are only to be placed the mutations and chances to which, under ordinary circumstances, human life is everywhere liable: for it is almost certain that Sir John Franklin and his noble crew could not have not been exposed to danger arising from any catastrophe; icebergs in the region to which he has been traced, are things unknown, nor yet are there seas there, in a nautical sense, by which their lives would be imperilled: the only accident that could befall them, would be from the sudden closing in of the ice, characterized by the term of "nipping," but even from that there are almost always time and means to afford escape; and consequently, a carefully formed opinion, based on reliable *data*, is now entertained among scientific and experienced men—such as Sir Roderick Murchison, and Commander Parry of your own nation, and of numbers among us, whose practical knowledge of those regions adds weight to the authority,—that this little band of martyrs to science, or at any rate, the greater part of them, are still alive, and, if the search be faithfully persevered in, that they will yet be found.—*Speech of Dr. Kane, of the Grinnell Arctic Expedition.*

Progress of the Electric Telegraph.—The Mediterranean Electric Telegraph Company, propose to unite Europe with Africa by continuing the electric wires, which now run without interruption between London and Genoa, to Spezzia. From the latter port they will cross the Mediterranean to Africa, passing by the islands of Corsica and Sardinia. It is further proposed to construct a subterranean line from Algeria, along the coast of Africa to Alexandria; and, with the support of the British Government and the East India Company, it will be easy to prolong the wires to Bombay, where they will meet the great line of 3,000 miles now in course of construction by the East India Company. The farther end of this chain may ultimately be carried to Australia.

Sanitary Properties of Wool.—Professor Simpson, of Edinburgh, has been the means of bringing to light a curious corroboration of the sanitary value of the ancient practice of annointing with oil. It appears, that the learned Professor, when recently visiting the manufacturing town of Galashiels, was casually informed that the workers in the wool-mill in that place were exempt from the attacks of consumption and scrofula. On inquiring of the medical men in the vicinity, the truth of the statement was confirmed, and it was then deemed expedient to pursue investigation on a broader scale. Communications were accordingly sent to physicians residing in Dunfermline, Alloa, Tillicoultry, Inverness, and other districts where wool-mills are in operation; and in the case of all, it was ascertained that similar immunity was enjoyed from the fatal diseases mentioned. It further appeared that, in some of the localities, scarlatina, only preserved health; but children of delicate constitution were sent to the wool-workers for the express purpose of acquiring strength—a result in almost every instance attained.

Extract from Dr. Owen's Report on Wisconsin.—It had been usually believed, up to the date of my Annual Report of 1848, that the lowest members of the sandstone formation of which I am now speaking, were devoid of fossils. The geologists of our own country had set down the Lingula beds of the New York Potsdam Standstone as the oldest fossilferous rocks in the United States. And, in Europe, with the exception of the *Obolus Appolinis* of Eichwald, abundantly found in the inferior sandstones of the protozoic strata of Russia, no fossils whatever, (according to any established system) had been described or discovered beneath what has been usually regarded as the equivalent of the above named Lingula beds. I am now able to exhibit a new and interesting geological feature with regard to this formation. The present survey has brought to light the fact, that in Western America, are found strata underlying coarse Lingula grits, and at a depth of seventy-five to one hundred feet beneath them, which are highly fossiliferous, and contain not the *Lingula* and *Obolus* alone, but *Orbiculus, Trilobites*, and compressed subconical bodies, resembling some forms of *Cephalopoda*, but probably not actually of that order. The sedimentary strata, in which, on the Mississippi and most of its tributaries, these fossils occur, either rest immediately on the igneous rocks of Wisconsin, or are separated from them by an inconsiderable thickness of chlorite and ferruginous slates; and are, in all probability the oldest fossil bearing rocks yet brought to light in any part of this Continent, if not of the world

Dr. Owen's Description of a new mode of Drawing Fossils.—The fossil itself serve as a guide and model to work from. After the specimen is fixed permanently on the machine, ore arm, pointed with steel, traverses all its inequalities of surface, in close parallel waving lines, and imparts a corresponding movement to a diamond point, in contact with the steel plate, which cuts similar lines through the prepared asphaltum surface down and slightly into the steel plate; subsequently these lines are corroded deeper—in the language of the engraver, bitten—into the metal by means of dilute nitric acid. Thus is produced an engraving, in a delicate silvery effect of light and shadow, capable of giving, if desired, 100,000 impressions of as perfect a counterpart of the original as can be accomplished by the daguerreotype process, provided the subject has not too great relief and can be placed in a horizontal position in the machine.

Though the plates in this work are the first application of this art to the representation of fossil remains, it has been a wonderfully successful experiment which will doubtless be the means of its introduction whenever the form and character of the subjects admit of its application. All structure visible to the naked eye can be brought out by this process; and minuter structure, indistinctly visible to the unassisted eye, can be worked up by a skillful artist, after the plate comes from the machine.

Loss of Sulphur in Smelting Ores.—The *Cornwall Gazette*, after quoting our description in the Journal, of 19th March, of Mr. Andrew Crosse's patent for extracting metals from their ores by electricity, alludes to the great advantages which would ensue nationally were measures adopted for securing the sulphur contained in a majority of the copper ores, now dissipated in the atmosphere by the present mode of roasting the ores for smelting. The principal portion of the copper ores of Cornwall are pyrites, containing in addition to the copper and earthly matters, a considerable portion of iron and a large amount of sulphur. The iron is comparatively of little value, and would not pay for recovering; but taking the copper pyrites at 12,000 tons per month, probably near the average, 18,000 tons of sulphur are wasted per annum, which, by proper chemically scientific principles, might be saved, increase the mineral wealth of the counties of Cornwall and Devon by £150,000 a year, render us to a certain extent independent of Sicily and the copper smelting works cease to be the destructive nuisances which they are at present. We have, on many previous occasions, in former years inserted valuable correspondence on this subject from Messrs. Leishton, Prideaux, Birkmyre, and others; and still consider it of much national importance, and worthy of scientific and experimental research.—*Mining Journal.*

Permeability of Metals by Mercury.—M. J. Nickles, in experiments on the metals, has discovered that those which will form an amalgam with mercury are easily permeated by it. Horsferd and others establish the permeability of tin, lead, gold, silver, zinc, and cadmium, to which M. Nickles adds copper and brass. This fact was discovered by accident—he was using a Bunsen's battery; the connecting pieces of copper were rivetted to the zinc, and on amalgamating the latter metal it often happened that the mercury spread itself over the copper, and after a certain time this latter metal became brittle, having a white fracture, proving itself an amalgam. With a stylet, he then traced a furrow on plates to be experimented on, and placed a little mercury therein. In order to hasten the amalgamation, a drop of bi-chloride of mercury, acidified with hydro-chloric acid, is introduced By this means the amalgamation takes place instantly, and the surface is fitted to retain at once the quantity of mercury necessary to produce the effect.

Occasional Readings

Of two Thermometers, one with blackened bulb, the other unblackened, laid on the grass in front of the Provincial Observatory door, facing South, with the tops of the Thermometer slightly raised, and corresponding readings of the standard Thermometer in the shade, with Northern aspect.

August, 1853.	Time.	Sun. Black Bulb.	Sun. unbl'ked	Sh'de. Stand.
10th. Mean 76°·93	Noon	130°5	111.4	87°·5
	12 15	136·2	114 5	88 0
Max 88°·6 } R'ge 23°6	12 30	112 6	100 2	87 9
Min. 65°·0 }	12 45	130 8	117 8	88 2
	1·00	132 5	118·5	88 4
11th.	11.00	129 4	111.2	85 9
Mean 79°·25	12·00	123 8	109 2	88 1
	12 30	131 0	113 0	89 0
Max 91° 9 } R'ge 25°5	1 00	116·8	106·5	89 2
Min. 69°·4 }	2 30	119 2	110 8	91 6
	3 30	103.8	98 5	89 9
12th.	10·40	117·0	106 0	87 0
Mean 79°·83	11·00	126·0	112 4	88 2
	11 30	110 0	100 0	86 8
Max. 1°·6 } R'ge 22°1	noon	118 0	104 4	87 6
Min. 69°·5 }	12 30	125 0	109 0	90 0
	10 30	111 0	104·0	83·6
13th.	10 50	118 0	110.0	84·2
Mean 78°·53	11·30	122 0	112 0	84.7
	12·00	123·0	115 0	86·2
Max. 90°·8 } Rg'e 19°8	12 20	121·0	113·0	87 6
Min. 71°·0 }	12 40	122 0	108·0	87·7

Monthly Meteorological Register, St. Martin, at Isle Jesus, Canada East, July, 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 ft.**

Day.	Barom: corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapour.			Humi'y of the Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; a cloudless sky by 0.			REMARKS.
	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2. P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P. M.		6 A. M.	2 P. M.	10 P. M.	
1	29.573	29.504	29.518	67.2	75.6	60.0	0.534	0.498	0.350	.81	.58	.66	NW b N	NW b N	NW b N	6 96	5.33	12.05		Clear.	Cum. Str. 5	Clear.	
2	.792	.627	.648	60.0	74.7	63.1	.360	.435	.470	.68	.52	.80	N b W	N W	N E b E	3 16	5.37	3.75		Clear.	Clear.	Clear.	
3	.642	.501	.425	67.6	74.2	68.0	.455	.648	.650	.69	.78	.98	E b N	S S E	S E	1.15	7.50	2 30	0.436	Clear.	Rain.	Cu. Str. 9.	
4	.471	.369	.412	68.0	81.9	64.0	.646	.659	.542	.94	.61	.92	SE b E	S W	S b E	2 08	7.57	5.50	0.918	Cir. Str. 8.	Cum'l. 4.	Showers.	
5	.423	.392	.552	65.4	70.9	63.2	.449	.506	.435	.72	.67	.75	W b S	W b N	W	5.00	8.61	4.99		Clear.	Cir. Str. 6.	Str. 6.	
6	.544	.555	.684	63.1	74.0	58.4	.461	.373	.308	.79	.45	.63	W N W	W N W	NW b W	6.81	9.29	12.70		Cum Str. 4.	Clear.	Clear.	
7	.795	.790	.720	50.0	71.6	56.4	.301	.414	.432	.81	.55	.91	NW b W	NW b W	SW b S	2 50	10 89	5.00		Clear.	Clear.	Clear.	Very Faint Aurora.
8	.631	.604	.503	58.0	72.9	69.9	.412	.532	.541	.84	.53	.74	S b W	W S W	W S W	2 06	8.15	10.15	0.080	Cum. Str. 6.	Cum. Str. 8.	C. Str. 2.	
9	.586	.535	.515	64.1	78.4	67.6	.450	.550	.534	.75	.58	.81	W S W	W S W	S W b W	7 30	5.16	5.03		Clear.	C.C. St. 8.	Clear.	
10	.597	.497	.499	65.6	83.4	66.2	.499	.532	.440	.80	.48	.68	W S W	W S W	W S W	5 20	7.12	3.31		Light Cir.	Clear.	Clear.	Aurora Borealis.
11	.577	.536	.614	64.0	77.6	60.9	.450	.458	.393	.75	.50	.75	W N W	W N W	N	1 15	4.60	4.98		Clear.	Cuml. Str. 4	Clear.	Aurora Borealis.
12	.721	.698	.700	57.0	68.6	60.3	.355	.379	.416	.74	.55	.79	N N W	N b E	N b W	4.33	3.80	1.00		Cirr. Str. 2.	Cuml. Str. 8.	Clear.	Aurora Borealis.
13	.785	.697	.700	60.4	80.8	62.8	.416	.787	.445	.79	.78	.79	N E	S E	S E	0 03	1.75	0.82		Clear.	Clear.	Clear.	
14	.722	.585	.543	57.0	85.5	67.1	.422	.597	.506	.89	.50	.76	S E	W b S	S b W	Calm.	2.00	Calm		Clear.	Clear.	Hazy.	
15	.445	.333	.233	64.0	82.2	73.8	.460	.599	.489	.78	.55	.61	S b E	S b W	W b N	1.21	2 62	4.12	Inap.	Light Cirr.	Cuml. Str. 4.	Rain 9.40.	
16	.210	.183	.282	68.5	80.8	62.2	.646	.648	.472	.96	.61	.81	E N E	W	W	1.59	7 89	8.95	0 556	T. S. 1 a. m.	Cir. Str. 2.	Cir. Str. 8.	Thunder Stm. 1 a.m
17	.358	.405	.426	56.1	61.0	61.0	.385	.425	.456	.81	.71	.84	W N W	W	W	0.28	10.00	8.06		Str. 8.	Str. 4.	Str. 6.	
18	.587	.545	.574	61.6	77.0	63.7	.407	.506	.488	.75	.55	.81	W	W	E S E	Calm.	0.10	0 10		Cl., Au.B 1.	Clear.	Cir. 4	Aur. Bor. 1 a.m.
19	.605	.602	.570	57.7	70.0	63.7	.462	.541	.568	.94	.74	.84	N E	E N E	N E	0.37	0.37	3.60		Cirr. Str. 8.	Cuml. St. 5.	Rain 8·45.	P. M.
20	.465	.450	.508	62.4	73.3	60.2	.499	.515	.467	.89	.61	.89	W	N b W	N	6.29	0 88	3.75	0.403	Cirr. Str. 6.	Cuml. Str. 5	Sh. 4·50.	P. M.
21	.443	.377	.389	56.4	86.0	70.8	.432	.681	.468	.94	.56	.78	W	SW b W	W	1 50	4 75	2.12		Clear.	Clear.	Clear.	
22	.440	.369	.369	68.0	90.4	70.1	.523	.578	.541	.76	.42	.74	W S W	W S W	S W b S	1.45	2 81	2 00		Clear.	Clear.	Clear.	
23	.376	.291	.278	69.1	92.9	70.5	.486	.550	.628	.69	.40	.86	W	W	S b W	0.82	1.57	0.89		Clear.	Clear.	Clear.	Faint Aurora.
24	.309	.259	.213	69.1	91.0	72.2	.513	.739	.578	.72	.53	.74	W	W S W	S b W	1.45	3.30	2.58		Clear.	Clear.	Clear.	
25	.193	.169	.115	75.1	85.0	70.1	.776	.727	.659	.90	.61	.90	S E b E	E b S	S b W	0 37	5.76	6.29	0.579	Cir. Str. 8.	Str. 10.	Cir. Str. 2.	Thunder 12·25 p.m.
26	.264	.260	.311	57.0	73 8	60.3	.355	.489	.416	.74	.61	.79	NW b N	W N W	W	9.31	1 78	3 03		Cir. Str. 2.	Lt. Cir. 2.	Clear.	Faint Aurora.
27	.418	.433	.313	58.0	78.8	59.0	.412	.428	.426	.81	.45	.84	N N E	N E	S S W	0.27	0.53	0.93		Clear.	Cir. Str. 3.	Str. 8.	
28	.388	.400	.412	63.6	72.8	66.1	.461	.556	.489	.79	.71	.76	SW b W	SW b W	W S W	1.75	3.75	2.22		Str. 10.	Stra. 10.	Str. 10.	
29	.471	.492	.388	69.5	85.0	67.7	.541	.801	.593	.96	.68	.89	S W	S W	S b W	1.00	3.75	2 31		Clear.	Clear.	Clear.	
30	.374	.251	.229	65.0	90.7	73.0	.555	.578	.692	.89	.42	.86	S S W	SW b W	S b W	2.30	1 60	2.22	0.100	Clear.	Cir. Str. 3.	Rain 7·55.	P. M. Thunder.
31	.268	.244	.272	69.0	73.0	64.2	.601	.659	.523	.85	.82	.67	N E b N	N b W	E b N	2.26	5.00	Calm.	0.010	Str. 4.	Clear.	Clear.	Faint Aurora.

Barometer.
- Highest, the 7th day - - - - - - 29.795
- Lowest, the 25th day - - - - - - 29.115
- Monthly Mean - - - - - - - 29.479
- " Range - - - - - - - 0.680

Thermometer
- Highest, the 23rd day - - - - - 96°.4
- Lowest, the 2nd day - - - - - 46.5
- Monthly Mean - - - - - - 68.01
- " Range - - - - - - 39.90

Greatest Intensity of the Sun's Rays—143.0.

Mean of Humidity—.727.

Lowest point of Terrestial Radiator 43.°7.

Amount of Evaporation—3.98 inches.

Most Prevalent wind—W.

Least do. do. N.

Most Windy Day—the 6th day, mean—9.56 miles per hour

Least Windy Day—18th, mean—0.06 miles per hour.

Rain fell on 9 days—amounting to 3.112 inches, and was accompanied by thunder and Lightning on three days.

Aurora Borealis visible on 7 nights.

Possible to see Aurora on 12 nights.

The electrical state of the atmosphere has been marked *generally* by Positive Electricity of a moderate intensity, and during the storm of the 4th day, indicated very high intensity of negative electricity.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—July, 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. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of the air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	M'N.	Rain in Inch.	S'nw in Inch.
						o	o	o	o												Miles		
a	1	29.628	29 635	29.656	29.613	64 3	71 2	60 0	66 08	0 516	0.522	0.420	0 501	88	71	83	80	N b W	S b W	N N W	4.33	- -	- -
a	2	.725	.693	.603	.668	58 2	68.6	63.2	65.07	.392	.363	.412	.391	83	53	73	66	N b E	E b N	E N E	6.16	0 020	- -
a	3	.508	.491			63 9	74.7			.536	.619			93	78			Calm	E		2.74	0.050	- -
a	4	.501	.436	.516	.481	68.2	82 9	64 6	72 67	.573	.375	514	.483	86	34	87	66	Calm	W b S	N N W	6.28	0 020	- -
b	5	.491	.467	.588	.521	61.3	76 2	60.3	65 38	.450	.357	.402	.411	85	67	79	72	Calm	W N W	N W	6 43	- -	- -
b	6	.617	.710	.760	.711	56 4	73 6	58 5	63.55	.405	.333	.301	.329	92	41	61	61	Calm	N b W	Calm	3.10	- -	- -
b	7	.826	.810	.725	.780	55.9	74.9	59.8	65.00	.368	.424	.403	.395	84	51	80	68	Calm	S S E	S S W	1.89	0.055	- -
b	8	.655	.647	.644	.646	62 9	74.9	62 5	66 67	.469	.594	.394	.486	83	71	72	76	Calm	S b W	Calm	2 37	- -	- -
c	9	.615	.619	.616	.616	63·2	73.3	61.8	66.12	.508	.510	.420	.470	90	65	71	77	Calm	S W b W	S S W	2 07	- -	-
d	10	.669	.623			59 5	76.4			.415	.492			89	56			Calm	S		2.23	- -	-
b	11	.685	.701	.716	.716	58.9	72 7	58.6	64 40	.307	.423	.303	.317	63	51	63	59	Calm	S b E	N b W	3 30	- -	- -
e	12	.802	.807	.814	.812	56 0	71.4	60.7	63 10	.323	.458	.468	.406	71	61	90	73	N	S E b S	Calm	3.83	- -	- -
	13	.889	.865	.839	.865	56 4	74.1	61 7	63.22	318	.433	.315	.379	78	53	82	68	N b E	S S E	S S E	4 21	- -	- -
b	14	.777	.693	.588	.675	56.1	72.8	65.8	66 80	.316	.375	.490	.410	73	47	79	69	N E	E	Calm	2 62	0.025	- -
c	15	.473	.297	.373	.369	63.9	69 6	61 3	66.40	.520	.593	.505	.549	90	81	95	87	Calm	S	Calm	4.27	0.480	- -
e	16	.383	.499	.585	.499	60.4	60 0	57.1	59.20	.439	.323	.367	.351	56	63	80	74	N W	N N W	N N W	7.99	- -	-
c	17	.635	.646			50.6	67.9			.309	.404			85	61			N N W	S b E		4.55	- -	- -
b	18	.705	.729	.731	.720	53.3	65.3	51.2	58 93	.366	.443	.371	.403	86	73	90	83	N b E	E	Calm	1.97	- -	- -
a	19	.777	.740	.775	.761	51.8	71.8	57.9	61.85	.329	.485	.369	.396	78	53	79	71	Calm	S E b S	W b S	4.12	Inap	- -
	20	.787	.719	.706	.732	56.1	77 1	64 9	67.13	.357	.461	.316	.380	81	51	53	60	N	S b W	N b W	4 66	- -	- -
	21	.692	.650	.664	.671	61 3	78 7	62 2	69 23	437	.446	.347	.437	83	48	63	61	N b W	S S E	S	3.07	- -	- -
c	22	.688	.643	.601	.611	56.2	83.1	62 9	69.27	.336	.303	.455	.388	76	28	82	61	S	S E b S	Calm	2 16	- -	- -
c	23	.613	.562	.559	.572	56.4	82 9	65.2	70.72	.334	.433	.438	.418	75	40	73	61	Calm	S E b S	Calm	0 63	- -	- -
b	24	.583	.532			59.2	85.4			.376	.531			78	45			Calm	S E b S		2.63	0 080	- -
b	25	.331	.312	.470	.399	69 5	77 2	60.7	68.62	.552	.654	385	.551	84	75	75	79	S S E	S b W	N N W	7 95	Inap	- -
c	26	.598	.633	.677	.638	51.9	68 1	52 5	58.57	.326	.366	.307	.328	77	51	80	69	N b E	S b E	Calm	4.25	- -	- -
c	27	.687	.673	.694	.685	49 4	76 5	61.5	61·80	.206	.406	.415	.363	59	46	83	61	S b E	S E b S	S b E	3.78	- -	- -
c	28	.737	.761	.791	.769	55 6	73 6	61 1	64.15	.478	.553	.424	.478	87	69	81	79	Calm	S	Calm	4 06	- -	- -
b	29	.825	.768	.722	769	53.1	80 4	61 2	67.52	.335	.504	·462	.455	85	50	79	70	S S W	S E	E N E	3 16	- -	- -
b	30	.708	.664	.662	.678	63.2	80 4	65.7	71.20	.391	.531	·392	.468	70	53	64	61	Calm	S b E	Calm	1.75	- -	- -
b	31	.686	.670			65 3	80 3			.491	.611			81	61			N	S E b S		2 14	0.180	- -
	M	29 663	29.645	29.658	29 655	58 77	74 40	60 96	65.60	0 401	0.450	0.402	0 425	81	56	77	70	MPs 1.62	MPs 7 44	MPs 2 07	3.70	9.15	- -

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

North.	West.	South.	East.
1013.05	516.77	1068.57	768.43

Mean direction of the wind E. by S.
Mean velocity of the wind - - 3.70 miles per hour.
Maximum velocity - - - - - - 17 3 miles per hour, from 2 to 3 p m. on 5th.
Most windy day - - - - - 16th: Mean velocity, 7 99 miles per hour.
Least windy day - - - - - 23rd: Mean velocity, 0.63 ditto.
Raining 12.7 hours.

The column headed "Magnet" is an attempt to distinguish the character of each day, as regards the frequency or extent of the fluctuations of the Magnetic declination, indicated by the self-registering instruments at Toronto. The classification is, to some extent, arbitrary, and may require future modification, but has been found tolerably definite as far as applied. It is as follows:—

(*a*) A marked absence of Magnetical disturbance.
(*b*) Unimportant movements, not to be called disturbance.
(*c*) Marked disturbance—whether shewn by frequency or amount of deviation from the normal curve—but of no great importance.
(*d*) A greater degree of disturbance—but not of long continuance.
(*e*) Considerable disturbance—lasting more or less the whole day.
(*f*) A Magnetical disturbance of the first class.

The day is reckoned from noon to noon. If two letters are placed, the first applies to the earlier, the latter to the later part of the trace. Although the Declination is particularly referred to, it rarely happens that the same terms are not applicable to the changes of the Horizontal Force also.

Highest Barometer - - 29 906, at 8 A.M., on 13th. } Monthly range:
Lowest Barometer - - 29 274, at 4 P.M., on 15th. } 0.632 inches.
Highest regist'd Temp. - 91 3, at — P.M., on 24th } Monthly range:
Lowest regist'd Temp. - 41 6, at — A.M., on 27th } 49.7
Mean Maximum Temperature - - - - 77 02 } Mean daily range:
Mean Minimum Thermometer - - - - 53 22 } 23.80
Greatest daily range - - - - -30 7 from P M. of 4th, to A.M. of 5th.
Warmest day - - 4th - - - Mean Temperature - 72 67 } Difference
Coldest day - - -26th - - - Mean Temperature - 58 57 } 14.10

The "Means" are derived from six observations daily, viz., at 6 and 8 A. M., and 2, 4, 10 and 12, P. M.

Possible to see Aurora on 25 nights.
Impossible to see Aurora on 6 nights.
Aurora actually observed on 6 nights.
Brilliant display of Aurora on 12th.

Comparative Table for July.

Year.	Temperature. Mean.	Max. obs'rvd.	Min. obs'rvd	Range.	Rain. D'ys	Inches.	Snow. Dy's	Inch.	Wind Mean Velocity.
	o	o	o	o					Miles.
1840	66 0	79.1	48 2	31 2	6	5.270	0	--	--
1841	65 0	86.3	43 2	43 1	10	8.159	0	--	--
1842	64 7	90 5	42.0	48 5	4	3.050	0	--	--
1843	61 5	86.1	40.2	45 9	8	4 605	0	--	0.44 lb
1844	66.0	86.1	40.5	45.6	12	2 815	0	--	0.19
1845	66 2	91.6	45.6	49 0	7	2.195	0	--	0.30
1846	68 0	91 0	41 9	49 1	9	2 895	0	--	0.29
1847	68 0	87.5	43 8	43 7	8	3 355	0	--	0 19
1848	65.5	82.7	46.7	36 0	10	1.899	0	--	4 91 m
1849	68 4	89 1	51.0	38 1	4	3 415	0	--	3 52
1850	68 9	84 9	52.8	32.1	12	5.270	0	--	4 56
1851	65 0	82.7	52 1	30 6	12	3 625	0	--	4 13
1852	66 8	90.1	49 5	40 6	8	4 025	0	--	3 33
1853	65.6	85 4	49 4	36.0	10	0.915	0	--	3.70
Mean	66 33	87.10	46.42	40 68	8 6	3.677	0		4.03

This month may be considered the dryest that has ever been known for the whole 13 years, the whole fall of rain not amounting to one inch, and the number of hours during which it fell being only 12·7: the mean temperature of the month is 0°.7 below the average of the same number of years, but the march of the temperature has been tolerably steady, a series of 4 cold days occuring from 16th to 19th.

A heavy storm occurred on the 15th, accompanied with violent discharge of hail, westward of Toronto: an observer at Weston states that "five per cent of the hailstones were as large as pullets' eggs, and generally they were as large as cherries," the outline of some of the largest, of a quadrangular shape, measured 2¼ by 2 inches.

Gold Testing.—The gold dust buyers of Southampton use an immense magnet as one means of testing the purity of the gold. By plunging this magnet into a heap of gold dust the freedom of the latter from metalliferous admixture or otherwise is discovered by the quantity and degree of firmness with which the dust adheres to the magnet. It is this test which detects the superior purity of Australian, as compared with Californian gold.