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THE

CANADIAN

Naturalist and Geologist,

AND PROCEEDINGS OF THE

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OF MONTREAL,

CONDUCTED BY A COMMITTEE OF THE NATURAL HISTORY SOCIETY.

VOLUME III.

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1858.

CONTENTS.

MISCELLANEOUS.

REVIEWS AND NOTICES OF BOOKS.

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This Magazine will appear bi-monthly, and be conducted by the following Committee, appointed by the Natural History Society of Montreal:—

J. W. Dawson, A. M., F. G. S., *Principal of McGill College.*
T. Sterry Hunt, A.M., *Chemist to Geological Survey of Canada.*
E. Billings, *Palæontologist* " " "

David Allan Poe, W. H. Hingston, M. D.
James Barnston, M. D. A. N. Rennie, Esq.

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☞ The Editors beg to apologise for the delay in the issue of this number, which has been caused by severe affliction in the family of the artist. The engravings to illustrate Article VII. will appear on a separate page in the next number.

THE

CANADIAN

NATURALIST AND GEOLOGIST.

VOLUME III. FEBRUARY, 1858. NUMBER 1.

ARTICLE I.—*Things to be observed in Canada, and especially in Montreal and its vicinity.* The introductory Lecture of the Popular Course of the Montreal Natural History Society, winter of 1857-8.—By the President.

There are in all places some things which every one sees, and other things which, though equally or more interesting, very few see. Every visitor to Montreal is likely to know something of our public works and buildings, our mountain and its scenery, our rapids, and many other prominent objects, interesting to naturalists no doubt, but equally so to other men. It is not necessary to refer to such things as these; and I propose this evening to direct your attention to some more obscure and less noteworthy objects, deserving attention from those among us who love the study of nature.

In order to receive much pleasure and some advantage from the study of natural history, it is not necessary to be a great naturalist. In this subject we do not repel the tyro with the harsh warning, drink deep or taste not. We hail every young inquirer as an aid, and are glad to have the smallest contributions which are the result of earnest and well directed inquiry. In truth a large proportion of the new facts added to natural science, are collected by local naturalists, whose reputation never becomes very extensive, but who are yet quoted by larger workers, and receive due credit for their successful efforts. A few men highly gifted and widely travelled, or thoroughly conversant with all the details of special subjects, are consulting naturalists, and the reducers into a more general and scientific form of the facts obtained from many quarters; but still the great majority of naturalists, and among them many of the most estimable and useful, are very limited in their field of actual observation.

We have several such men in Montreal, as well as a few of somewhat more extended reputation; and there are no doubt a number of young persons who might be induced to devote some portion of their leisure to such studies, did they know of a profitable field of enquiry. To such I have no doubt that the topics of this lecture will be of interest.

Good works of art are rare and costly, good works of nature are scattered broadcast around our daily paths; and are neglected only because their familiarity prevents us from observing their surpassing beauty and interest. Nor are all of these objects known even to naturalists. There are, more especially in these new countries, scarcely any objects that have been thoroughly investigated, and there are vast numbers that are quite unknown to science. I cannot in the space of one lecture point to even the greater number of these objects,—nor is it possible to conjecture the results which may attend inquiries prosecuted in new directions. It may, however, be possible to direct your attention to some leading departments of the great field of nature, that deserve your attention.

Let us inquire in the first place for the most promising local fields of inquiry in the domain of zoology.

To begin with the lower members of the animal kingdom, I am not aware that anything has been done with our spongillæ or fresh-water sponges. Such organisms must exist in our lakes and streams, and though very low and simple in their structure, much interest attaches to their growth, nutrition and reproduction. They are soft gelatinous structures, with an internal skeleton of silicious spicula, greenish in colour, and resembling some of the fresh water algæ which live with them. Dr. Bowerbank of London is preparing a monograph of the sponges, and informs me that he will be glad to receive specimens from our waters. Here then is an opening for a young naturalist. I quote the following from Dr. Bowerbank's printed circular, and shall be glad to receive and forward specimens:—

"The writer would also be particularly obliged by specimens of spongillæ, or fresh-water sponges, as he is engaged on a monograph of that tribe. They are found in rivers, lakes or tanks, and pools, attached to dead wood, rocks or stones, and are occasionally found surrounding the branches of trees, dipping into the water during periodical floods; and if they contain their granular, seed-like bodies, they are the more valuable. Dry them just as they come from the water. If it be deemed necessary to preserve parts or the whole of delicate specimens of either marine or fresh-water sponges in fluid, the best material is strong spirit, or water with a *considerable* excess of undissolved salt in it, but *never* alum. Jars or pickle and fruit bottles, well corked and sealed, or tied over with bladder, are the best vessels for the purpose."

Rising a little higher in the scale of life, little has been done with our fresh-water polyps, whether the simple hydra-like forms or the more complex fresh-water bryozoa. Great reputations have been made by the study of such creatures in Europe,—and in a land of streams and lakes like this, much could certainly be done in collecting new forms, and adding to our knowledge of the habits and range of organization of the fresh-water radiates. These animals should be sought in lakes and streams, especially on submerged wood, fresh-water shells, and the leaves of aquatic plants. They may easy be kept in water for examination, and careful drawings should be made of their forms and internal structures as seen under the microscope. It is difficult to preserve them; but I would recommend immersion in glycerine or the method above given for sponges, as likely to succeed.

The mollusks also offer tempting fields of inquiry, more cultivated than those formerly noticed, but still having large promise. Many species of unio, alasmodon and anodon, exist in our river, most of them no doubt identical with species described by American naturalists, but some perhaps new, and many requiring more careful study as to their habits, reproduction, and the real limits of species and varieties. The univalve mollusks are also very numerous, both in the waters and on the land, and require study, more especially in relation to the animals as distinguished from the empty shells. Such studies demand patience and nicety, and would be greatly aided by vivaria, in which these creatures can be easily kept alive and examined at leisure. Mr. Billings, one of our members, has done some work in this field, portions of which have appeared in the *Canadian Naturalist*. Prof. Hall will bring before us this winter some interesting facts respecting the occurrence of pearls in the fresh-water mussels, and Mr. Bell of the Geological Survey has collected many species in the lower part of the river.

Many members of this Society have opportunities of collecting marine shells in the Gulf of St. Lawrence,—this is also a useful field of inquiry. Rear Admiral Bayfield has made large collections in the course of his survey. My own collection contains many species. More recently Mr. Bell exhibited to us a very interesting collection from the head of the Gulf between Gaspé and Quebec. I have no doubt that much may still be done, and these shells would be of great interest for comparison with those found fossil in the tertiary clays, long since deserted by the sea. While speaking of the marine fauna, I may add that the echinoderms, the zoophytes and crustaceans, also afford fields of much interest and promise, still very imperfectly cultivated.

Of the huge province of the articulates I am almost afraid to speak. There is work here for all the naturalists in Canada for the next century. Mr. Couper of Toronto has collected and identified several hundreds of species of coleoptera; and his collection, now in the McGill College, affords a good basis for any one desirous of commencing the study of these creatures. Mr. D'Urbain of our own Society has entered on the investigation of the butterflies. With the exception of what has been done for us by the Arctic explorers, and the naturalists of the United States, the other orders of Canadian insects are almost a terra incognita. In the mean time the country is suffering so seriously from the ravages of many of the insect tribes, that the attention of Government has been attracted to the subject, and the essays produced in answer to its call, by Prof. Hind and others, show that comparatively little examination of these creatures or inquiry into their habits has been made within the limits of the Province; nearly all the facts contained in these essays, having been collected from abroad though the value of the essays published, and the large number of competitors, show that we have persons qualified for the work. For hints very useful to the young naturalist, I may refer to the papers on collecting insects, and on the distribution of insects, by Mr. Couper, published in the *Naturalist.*

Who knows anything of the myriads of minute crustaceans and aquatic worms that swarm in our waters in summer. I have seen enough to be assured that their name is legion, but I am not aware that any one has collected or determined the species occurring here. The subject is a difficult one, but many of these creatures are exceedingly curious in structure and habits; and collections of facts and specimens might be made, by any one having time to devote to such pursuits.

Among the vertebrated animals, though there is little ground so completely untraversed as in some of the lower forms of life, much may still be done. In one department the late Prof. McCulloch and Prof. Hall long since set a good example, in collecting birds and other vertebrates, and preparing lists of those frequenting or rarely visiting this locality. The geographical distribution of the higher animals as illustrated by such collections and lists, is in itself a very important subject.

The fishes of our rivers afford a fertile subject of inquiry. Many of the smaller species are probably undescribed, and there are some of peculiar interest which deserve study in their habits and modes of life. I refer especially to the Lepidosteus* and the Amia,† those ancient forms of ganoid fishes which remind us so strongly of the antique species found fossil in the Palæozoic rocks, and a minute acquaintance with whose habits might throw most interesting light on the condition of the world in those bygone periods. Information on their spawning grounds, their haunts at different stages of growth, their food, their winter and summer resorts, their migrations, their peculiar instincts, if carefully collected, would be of inestimable value. Living specimens, which might be kept in vivaria and examined at leisure, would also be of great interest, and might be procured by many persons who have not themselves time or inclination for such studies. Agassiz, who has already so ably illustrated the structures and affinities of these animals, has invited collectors to contribute specimens for his great work now in progress; and any facts relating to the habits of these inhabitants of our waters, will be gladly received for this journal. I should add here, that Mr. Fowler, one of our members, has prepared a number of accura'e and beautiful drawings of Canadian fishes, and can thus perpetuate for us the fleeting tints of our specimens.

Even the smaller quadrupeds of Canada are by no means well ascertained. The mice, the shrews, the bats, are very imperfectly known. There may be unknown species. There certainly are many unknown facts in distribution and habits. Mr. Billings has

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* Bony Pike, Gar Fish, Poisson armée.

† Marsh fish, Mud fish, Poisson de marais, Poisson Castor.

published in our journal an interesting summary of facts on Canadian quadrupeds; and much curious information exists in the work of Mr. Gosse, as well as in the standard works of Richardson & Audubon. I would especially invite attention to the mice and other small rodents, and the shrews. Only a few days ago a fine pair of specimens of the old Black Rat of Europe, which I did not know as a resident of Canada, were procured by Mr. Hunter, beautifully prepared by him, and presented by a friend to the College Cabinet, affording an illustration of the curious facts that may be learned even within the limits of our city.

I had almost forgotten to refer to the reptiles of Canada. The magnificent volumes of Professor Agassiz shew what may be done with one family, that of the tortoises. None of us, perhaps, can enter into the study in the manner in which this great naturalist has pursued it, but many may collect important facts and specimens. We do not yet know much about the numerous snakes, frogs, toads and newts of Canada, though many specimens exist in the collections of this Society, of Dr. M'Culloch, and of the University. Even a catalogue of the specimens in these collections would be valuable. Unattractive though these creatures may appear to the popular view, they afford more than most other animals evidences of the wonders of creative skill.

One little batrachian reptile I regard, as a geologist, with peculiar interest, and would commend to your notice. I refer to the Menobranchus, or Proteus,‡ a creature most unattractive in aspect, but most singular in its habits and mode of life, and a representative of the earliest forms of air-breathing life introduced upon our planet. No gift would afford me greater pleasure than a few living specimens of this animal, which might enable me to become better acquainted with its mode of life, and thus better to appreciate the probable habits of some of its extinct congeners, whose bones I have disinterred from the carboniferous rocks. Some time ago a living specimen was procured by Mr. Hodgins of Toronto; but the few observations of its habits which he has recorded in the *Canadian Journal*, only stimulate the desire for further information.

It would be ungracious to leave the animal kingdom, without notice of Ethnology as a field of investigation. The remarkable collection of Mr. Kane, exhibited here during the meeting of the American Association last summer, must have strongly impressed

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‡ Water—Azard.

your minds with the interest of the subject, as it relates to the Indian tribes. Mr. Kane was fortunate in having so able an expositor of his collection as Dr Wilson; and I may add that Canada is fortunate in having an ethnologist so well fitted to lead in this department. Surely, some of our members might contribute something to this great subject. Specimens relating to it are not often laid before us. We received, however, last year, through the Bishop of Montreal, a curious ancient urn, which excited much interest. I have since been in correspondence with the gentleman who made known the discovery, and hope to obtain further information and specimens. On the return of his Lordship, who possesses the original notes on the subject, I trust this interesting relic will be figured and described in our Journal.

Plants afford as many local attractions as animals, but I shall occupy less time with the subject of Botany than with that of Zoology. A very large herbarium has been collected by the oldest living member of this Society, Professor Holmes; and as we now have it arranged by Professor Barnston, in the Cabinet of McGill College, it affords an invaluable means of reference to the student. Dr. Barnston is now engaged in preparing a catalogue of this and his own collections, which will, I trust, be published under the auspices of this Society; and it will then be for subsequent collectors to add to this already extensive list such species as may still remain undiscovered.

The Canadian Botanist should not, however, content himself with the mere determination of plants. I cannot doubt that much remains to be done in investigating the uses of native plants not now applied to practical purposes in the arts or in domestic life; and that as Canada becomes more populous, and agriculture less rude in its practice, the cultivation of many neglected plants fitted to contribute to minor practical uses, will be undertaken. Nor should our forests and the means for their preservation and restoration to such an extent as may be desirable for shelter and for the supply of wood, be neglected by scientific men. Rich gleanings, applicable to Canadian practice, may be made in this direction, from the expedients employed in European countries; and in a country in which one-third of the soil should probably remain in forest to supply the permanent demand for fuel and other uses, this subject is of great practical importance.

Another subject less practical, but profoundly interesting, is the geographical distribution of plants, so ably expounded by De Candolle, and on our side of the Atlantic by Professor Gray.

The curious facts respecting the geographical distribution of the Ranunculaceæ, so pleasantly stated by Mr. George Barnston, in an article in the last volume of the *Canadian Naturalist*, show how much can be done in this field. But it is not merely in relation to botany that this inquiry is of interest. Edward Forbes has shewn that great questions in geology are illustrated by it; and nowhere better than on the American Continent can it be studied in this aspect. Let us inquire respecting any plant, what are its precise geographical limits? To what extent do these depend on climate, elevation, exposure, soil. What inferences may be deduced as to the centre from which it originally spread, and what as to the changes in the extent of the land and the relative levels of land and sea that have occurred since its creation? Here are fertile subjects of inquiry, leading to the grandest conclusions in reference to the history of life upon our planet.

But I must turn for a moment from this great subject to the humbler members of the vegetable kingdom, no less curious than the higher, and less known. One of our number, the Rev. Mr. Kemp, has directed his attention to the fresh-water Algæ, and has contributed a valuable paper as the first result of his inquiries. Mr. Poe, another of our members, is an enthusiastic student of the Fungi, and other more minute and simple forms of plant life. A summary of what is known of these objects, as occurring in Canada, will be given to us by Mr. Poe in the present winter; and I have no doubt will excite some interest in these singular and anomalous structures, so curious in their habits and often so injurious to our property.

The Mosses, Lichens, Lycopodiaceæ, Ferns, and other allied families, offer many rewards to any diligent student; and the excellent arrangement and descriptions in Professor Gray's new edition of his Manual, give facilities heretofore within the reach of few. There may be Canadian botanists engaged in this study, but I have no evidence that this is the case. Our mountain and the neighbouring hills afford peculiar facilities for it; and I suspect that curious facts as to the distribution of these plants might be obtained, from their study on these isolated trappean eminences, in a limestone and alluvial country.

The naturalists and professional men of Montreal have devoted much attention to the microscope; and our city possesses many good instruments, daily increasing in number, and affording a most delightful and instructive means of scientific observation in all departments of Natural History. Among our members, Mr.

Poe and Mr. Murphy deserve especial mention, as having devoted much time and effort to the improvement and increase of our means of study in this department.

Geology presents on every side ample harvests to the inhabitants of this city. Our noble mountain.—the skeleton of an old silurian volcano, with its multitudinous trap-dykes of various age and composition, is itself a study capable of throwing new light on the phenomena of volcanic agency as manifested in those ancient periods. The stratified rocks at its base, full of fossils,—many of them no doubt undescribed, and, in some of their beds, actually made up of the comminuted fragments of shells and corals,—invite the attention of the most unobservant. Every block of building-stone from our quarries is a mass of animal debris, presenting under the microscope hundreds of beautiful forms bearing the impress of creative skill, though belonging to perished races of animals. Our worthy associate, Mr. Billings, now most usefully connected with the Geological Survey, is a brilliant example of reputation, and, what is better, accurate and extensive knowledge, gathered from the study of the Lower Silurian limestones.

I need scarcely remind you of the tertiary clays to which I had the pleasure of directing the attention of this Society at one of its late meetings. They have yielded in the past summer about thirty species of animal remains not previously known to exist in them; and many of these have been brought to light by the industry of our College students. Some even of the boys of the High School now have collections of these fossils, and have been successful in adding to the number of species. Much yet remains to be done in this field; and I look forward to the time when we shall have nearly complete lists of the shells peculiar to each level of the Peistocene sea, and to the present Gulf of the St. Lawrence, and an accurate knowledge of the position of the shores of each successive salt-water area, as the sea gradually left our noble valley. We shall then be in a position to offer a large contribution to the tertiary geology of America, and of the world.

With the present facilities for travelling, the whole geology of Canada lies before us; and we need not apprehend that Sir Wm. Logan will grudge us space in this large field. He has done, and is doing, a great work; but, even with his skill and energy, were he to live far beyond the allotted age of man, he would but find the number of openings for investigation increasing before him. He has well and effectually opened up an immense territory; but there is room in it for hundreds of geologists to earn reputation, by following on his track. He will thank you for anything that you can do in the accumulation of facts; that is, provided you do not embarrass him and oppose the interests of truth by those crude and hasty generalizations, or baseless hypotheses, in which unskilful and hasty observers are too prone to indulge, and which sometimes impose upon the credulity of the public to the serious injury of the science. No department of natural science presents greater temptations to such vagaries than geology, and none has suffered more seriously from their effect on the popular mind. No science is more grand in its ultimate truths, none more valuable in its practical results, than geology, when pursued in the spirit which characterises the head of our survey. None is more dangerous or misleading in the hands of pretenders.

The subject of geology I may remind you includes within itself many subordinate fields, which have been or are being successfully cultivated, by observers in various parts of Canada ; and here as in most other parts of America, geological investigations have been more eagerly and extensively pursued than other branches of natural science. The mineralogical researches of Dr. Holmes, and of Dr. Wilson of Perth, who, though not one of our citizens has contributed much to our collection, and the geological observations of Dr. Bigsby, some of which relate to the vicinity of this city, preceded the work of the Provincial Survey, and not only made many important discoveries, but may be regarded as among the causes which led to the institution of that great enterprise, so successful and so creditable to the Province, Nor must I here omit the interesting paper on the Montreal mountain, long since contributed to this Society by our late Treasurer, Dr. Workman, a paper to which I all the more readily give prominence here, as I have had the pleasure of visiting some of the localities in company with its author, and as it was inadvertently omitted in the list of authorities referred to in the paper on that subject, which I lately read before this Society. Were it expedient to attempt extending such notices beyond the more immediate limits of our own sphere of operation, I might name many useful men who have variously distinguished themselves in this science, by way of encouragement to our embryo geologists. One name I cannot pass by, that of a man of much more than Canadian reputation, and of eminent usefulness in promoting the growth of Canadian geology, Prof. Chapman, of University College, Toronto, whose able papers and notices in the Canadian Journal we shall do well if we can approach in the journal of this Society. I shall farther take the liberty of mentioning the collection of the Rev. Mr. Bell, now in Queen's College, and that of Sheriff Dickson, of Kingston, from both of which I have derived much pleasure and instruction, and those of Dr. Van Cortlandt, and of the Silurian Society of Ottawa, and of our more venerable sister the Literary and Historical Society of Quebec, the study of which is a pleasure, I trust, yet in store for me.

I have probably sufficiently trespassed on your patience, and shall say little of the aids which intelligent public appreciation can render to meteorological investigations, such as those of Prof. Smallwood and Prof. Hall, or to the important chemical inquiries of Prof. Hunt. The results attained by these gentlemen are full of material for thought, and in many minor departments of their work I have no doubt they might be aided by local co-operation on the part of some of our members. If in no other way, we can aid these gentlemen by studying and expounding to the public the conclusions which they reach. Independently of their interest to science, now appreciated far beyond the limits of Canada, the tables of Prof. Smallwood and Prof. Hall, and the analyses of Prof. Hunt, are full of facts of immense practical value in agriculture and the arts of life. I had occasion, not long since, in connection with my lectures on agriculture to study the analyses of soils in the reports of the Geological Survey, and I am convinced that those analyses contain the germ of a revolution in Canadian agriculture, which will be effected so soon as they are thoroughly understood by the people.

Enough has been said to indicate some of the paths of inquiry open to the members of this Society. But, it may be asked, why should we leave our offices, our business, our social amusements, for such occupations. It is not necessary that we should do so. All of us have public, social, and private duties, that have prior claims on our attention. We must not neglect these; but, if we have a little leisure for rational amusement, I know none more agreeable or inspiring than the study of nature, or of some small department of it, such as the observer in his own locality can take time fully to master. Let him provide himself with, or secure access to, the best books in the department he may select, and this need not, in the first instance, be a very extensive one. Let him read, collect, observe, and note; and, in an incredibly short time, he will find a new world of beauty opening to him. Objects before unregarded will become friends, and will speak to him of the wonders of the Universe of God, until he will long to make known to others the utterances which have broken on his own inner ear, and rejoice in being able to add his mite to the treasury of our knowledge of nature.

I might here speak of the facilities which this city presents in access to books and collections. They are small in comparison with those in many cities of the old world. Yet they are not despicable. The collection of the Geological Survey, the collection and library of this Society, and those of our educational institutions, offer many aids to the student, as well as many objects deserving of farther study and explanation. The meetings of this Society also afford a valuable means of improvement and profitable intercourse; and our Journal, the *Canadian Naturalist*, has for one of its objects the introduction of inquirers to profitable fields of research. Already, in the two volumes published, there are valuable summaries of the facts most necessary to the student in many of the departments referred to in this lecture.

It is scarcely necessary to add that such studies as those which I have recommended, even if they afford no new facts or principles, are in themselves capable of yielding much rational pleasure; and that in this aspect of the subject the field of inquiry is much more extensive than in the former; since here we are not restricted to the absolutely unknown, but may find for ourselves quite as much interest and novelty in ground previously trodden by others, but new to us.

In conclusion, I may say on behalf of all those members of this Society engaged in the pursuit of any department of Natural History, that they will welcome with pleasure any inquirer fired with the true ardour of a naturalist; and that they will most thankfully avail themselves of, and honourably acknowledge any aid that they may receive in collecting the material of their investigations. Nor need this statement be limited to Montreal. My subject being local, I have confined myself chiefly to things and persons in our city; but there are men in other parts of Canada, and beyond its limits, working at these subjects; and while it is desirable that here we should rival them in these pursuits, no reason exists to prevent our emulation from being accompanied by mutual and friendly aid. In this spirit I close by asking pardon, if, in the above remarks, I have unwittingly omitted or done injustice to any labourer in the departments of science to which I have adverted.

J. W. D.

ARTICLE II.—*On the Metallurgy of Iron and the Processes of Chenot.*[*]

The new metallurgical processes of Adrien Chenot attracted in a particular manner the attention of the Jury at the Exhibition at Paris in 1855, and were the object of a special study by the Jurors of the first class, who awarded to the inventor the *Gold Medal of Honour*. M. Chenot there exhibited a series of specimens, serving to illustrate the processes which bear his name, and which have been the result of extraordinary labors on his part, continued through the last twenty-five years. As the industry of iron-smelting promises for the future to be one of great importance to Canada, it may be well to advert briefly to the history and theory of the metallurgy of iron, in order to explain the processes now in use, and to prepare the way for an exact understanding of those of Chenot.

The most ancient and simplest mode of obtaining iron from its ores is that practiced in the Corsican and Catalan forges, where pure ores are treated with charcoal in small furnaces, and by variations in the mode of conducting the process, are made to yield at once either malleable iron, or a kind of steel. But this method requires very pure ores, and a large expenditure of fuel and labour, while from the small size of the furnaces it yields but a limited quantity of iron. It is scarcely used except in the Pyrennees, Corsica, some parts of Germany, and northern part of the State of New York.

The high or blast-furnace, which converts the ore directly into cast metal, furnishes by far the greater part of the iron of commerce. This furnace may be described as consisting essentially of a crucible in which the materials are melted, surmounted by a vertical tube or chimney some thirty feet in height, in which the reduction of the ore is effected. Into this furnace a mixture of ore and fuel is introduced from the top, and the fire, once kindled, is kept up by a blast of hot or cold air, supplied by a proper apparatus, and admitted near the bottom of the furnace. The ores submitted to this process are essentially combinations of iron with oxygen, often containing besides water and carbonic acid, and always mingled with more or less earthy matter, consisting of

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[*] From the recently published volume of Reports of the Geological Survey of Canada for 1853-54-'55-'56. Pp. 392-404.

silica, alumina, &c. The water and carbonic acid, being readily volatile, are often expelled by a previous process of roasting. When these oxyds of iron are heated to redness in contact with charcoal, this material combines with the oxygen of the ore, and the iron is set free or reduced to the metallic state, after which by the further action of the combustible it is fused, and collects in a liquid mass in the crucible below. The earthy ingredients of the ore, with the ashes of the fuel, are also melted by the intense heat, and form a kind of glass or *slag*, which floats upon the surface of the molten metal, and from time to time both of these are drawn off from the crucible. It is very important to give to these earthy matters that degree of fluidity which shall permit their ready separation from the reduced and melted iron, and to attain this end, the different ores are generally mixed with certain ingredients termed fluxes, which serve to augment the fusibility of the slags. Limestone, sand, and clay may each of them be used for this object with different ores. It will be kept in mind that the fuel employed in the process of smelting, serves for two distinct objects: first, as a combustible to heat the materials, and secondly, as a reducing agent to remove the oxygen from the ore.

The contents of a blast furnace in action consist then of a great column of mingled ore and fuel, continually moving downward towards the crucible, and constantly replenished from the top, while a current of air and gases is continually traversing the mass in a contrary direction. The investigations by Leplay and Ebelman on the theory of this operation have prepared the way for the processes of Chenot, and we shall therefore state in a few words, the results of their researches. They have shown in the first place, that the direct agent in the reduction of the ore is a portion of the carbon of the fuel in a gaseous state, and secondly, that this reduction is effected at a temperature far below that required for the fusion of the metal. The oxygen of the air entering by the blast, is at first converted by combination with the ignited coal, into carbonic acid, in which an atom of carbon is combined with two atoms of oxygen, but as this gas, rising in the furnace, encounters other portions of ignited coal, it takes up another equivalent of carbon and forms carbonic oxyd gas, in which the two atoms of oxygen are combined with two of carbon. This gas is the reducing agent, for when in its upward progress it meets with the ignited oxyd of iron, the second atom of carbon in the gas takes from the iron two atoms of oxygen to form a new portion of carbonic acid, which passes on, while metallic iron remains.

The interior of the blast furnace may be divided into four distinct regions; the first and uppermost is that in which the mixture of ore and fuel is roasted; the water and volatile matters are there driven off, and the whole is gradually heated to redness. In the second region, immediately below the last, the already ignited ore is reduced to the metallic state by the ascending current of carbonic oxyd gas; the metal thus produced is however in the condition of malleable iron, nearly pure and very difficultly fusible; but in the third region it combines with a portion of carbon, and is converted into the fusible compound known as cast iron. In addition to this, small portions of manganese, aluminium and silicium, whose combinations are always present in the contents of the furnace, become reduced, and alloying with the iron, affect very much its quality for better or worse. Cast iron generally contains besides these, small portions of sulphur, phosphorus, and other impurities less important.

In the fourth and lowest region of the furnace, which is near to the blast, the heat becomes more intense, the carburetted metal melts, together with the earthy matters, and both collect at the bottom of the crucible upon what is called the hearth, from which the two are drawn off from time to time. The cast iron thus obtained is very fusible, but brittle, and is far from possessing those precious qualities which belong to malleable iron or steel.

To convert the cast metal into malleable iron, it is exposed to a process which is called *puddling*, and consists essentially in fusing it in a furnace of a peculiar kind, where the metal is exposed to the action of the air. The carbon, manganese, silicium, and other foreign matters, are thus burned away, and the once liquid metal is converted into a pasty granular mass, which is then consolidated under hammers or rollers, and drawn out into bars of soft malleable iron.

To convert into steel the soft iron thus obtained, it is heated for a long time in close vessels with powdered charcoal, a small quantity of which is absorbed by the iron, and penetrating through the mass changes it into steel. This process is known by the name of *cementation.* The change is however irregular and imperfect; it is therefore necessary to break up these bars of cemented or blistered steel, as it is called, and after assorting them according to their quality, either to weld them together, or to melt down each sort by itself in large crucibles. The metal is then made into ingots, and forms cast steel, which is afterwards wrought under the hammer and drawn out into bars.

Such is an outline of the long and expensive processes by which malleable iron and steel are obtained from the ores of iron. The reduction of the iron to the metallic state constitutes but a small part of the operation, and consumes comparatively but little fuel, but as we have already seen the reduced iron is first carburetted as it descends in the furnace, then melted by an intense heat into the form of cast iron, which is again fused in the puddling furnace before being converted into malleable iron, the transformation of which into cast steel requires a long continued heat for the cementation, and still another fusion.

In Derbyshire in England, there are consumed for the fabrication of one ton of cast iron, two tons and twelve quintals of ore, and two tons of mineral coal, while in Staffordshire two tons eight quintals of coal, and two tons seven quintals of ore are employed for the production of a ton of cast metal. In the furnaces of the Department of the Dordogne, in France, where charcoal is employed, two tons and seven quintals of ore, one ton and three quintals of charcoal are employed for a ton of iron. For the production of a ton of wrought iron in England about one ton and one-third of cast iron, and from two to two and a-half tons of mineral coal are consumed, while the same amount of the cast iron of the Dordogne requires to convert it into a ton of wrought iron, one ton and a half of charcoal. Thus in England the fabrication of a ton of wrought iron, from poor ores yielding from thirty-eight to forty per cent. of metal, requires a consumption of about five tons of mineral coal, and in Dordogne a little over three tons of wood charcoal, which costs there about fifty-eight shillings currency the ton. The average price of charcoal in France, however, according to Dufrénoy, is about seventy-four shillings, while in Sweden it costs only about fourteen shillings, and in the Ural Mountains eleven shillings the ton. In France, much of the pig iron manufactured with charcoal is refined by the aid of mineral coal.

The questions of the price and the facility of obtaining fuel are of the first importance in the manufacture of iron. The ores of this metal are very generally diffused in the earth's surface, and occur abundantly in a great many places where fuel is dear. The iron which is manufactured either wholly or in part with wood-charcoal, is of a quality much superior to that obtained with mineral coal, and commands a higher price. One principal reason of this difference is that the impurities present in the coal contaminate the iron, but it is also true that the ores treated with mineral coal are for the greater part of inferior quality. Interstratified with the beds of coal in many parts of Great Britain, Europe and North America there are found beds of what is called *clay iron-stone*, or argillaceous carbonate of iron, yielding from twenty to thirty-five per cent. of the metal. This association of coal with the ore offers great facilities for the fabrication of iron, which is made in large quantities, and at very low prices from these argillaceous ores.

These poor ores will not admit of being carried far for the purpose of smelting, and it is not less evident that the large quantity of coal required for their treatment could not be brought from any great distance to the ores. As a general rule the richest and purest ores of iron belong to regions in which mineral coal is wanting, while the carboniferous districts yield only poorer and inferior ores. On this continent, which contains vast areas of coal-bearing rocks, the great deposits of magnetic and hematitic iron ores are chiefly confined to the mountainous district north of the Saint Lawrence, and the adjacent region of northern New York, to which may be added a similar tract of country in Missouri. In the old world it is in Sweden, the Ural Mountains, Elba and Algiers, that the most remarkable deposits of similar ores are met with; and it is not, perhaps, too much to say, that if favourable conditions of fuel and labour were to be met with in these regions, these purer and more productive ores would be wrought to the exclusion of all others. But where charcoal is employed the forests in the vicinity of large iron furnaces are rapidly destroyed, and fuel at length becomes scarce. In a country like ours where there is a ready market for fire-wood near to the deposits of ore, the price of fuel will one day become such as to preclude their economic working by the ordinary processes. As the industrial arts progress, the consumption of fuel is constantly increasing, and its economic employ becomes an important consideration.

From these preliminaries it is evident that a great problem with regard to the manufacture of iron, is to find a process which shall enable us to work with a small amount of fuel, those rich ores which occur in districts remote from mineral coal. Such was the problem proposed by Adrien Chenot, and which in the opinion of the International Jury, he has in a great measure resolved.

To return to the blast furnace; we have seen that the second and moderately heated region, is that in which the reduction of the ore is effected, and that the intense heat of the lower regions of the furnace only affects the carburation and fusion of the metal.

Mr. Chenot conceived the idea of a furnace which should consist only of the roasting and reducing regions; his apparatus is but the upper portion of an ordinary blast furnace, the carburetting and fusing regions being dispensed with. In this the ore is reduced at a low red heat, and the metal obtained in the form of a gray, soft, porous mass, constituting a veritable metallic sponge, and resembling spongy platinum. The furnace of Chenot is a vertical prismatic structure forty feet high, open at the top for the reception of the ore, and having below a moveable grate by which the charge can be removed; the bottom is susceptible of being closed air-tight. The lower part of the furnace is of iron plate, and is kept cool, but about mid-way the heat is applied for the reduction of the ore, and here comes in a most important principle, which will require a particular explanation, It is required to heat to moderate redness the entire surface of the rectangular vertical furnace throughout a length of several feet, a result by no means easy to be effected by the use of a solid combustible, but readily attained by a gaseous fuel such as is employed by Mr. Chenot.

We have already explained the theory of the production of carbonic oxyd. The possibility of employing this gas as a combustible was first suggested by Karsten, and in 1841 Mr. Ebelman of the School of Mines at Paris, made a series of experiments on the subject by the direction of the Minister of Public Works. The process employed by this chemist consisted essentially in forcing a current of air through a mass of ignited coal of such thickness that the whole of the oxygen was converted into carbonic oxyd; this escaping at an elevated temperature was brought into contact with the outer air, and furnished by its combustion a heat sufficient for all the ordinary operations of metallurgy. A consideration of great importance connected with this process is, that it permits the use of poor earthy coals, and other waste combustibles, which could hardly be employed directly, while by this method the whole of their carbonaceous matter is converted into inflammable gas. Wood and turf may be made use of in the same way, and the gas thus obtained will be mingled with a portion of hydrogen, and probably with some hydrocarburet; a similar mixture may be obtained with charcoal or anthracite, if a jet of steam be introduced into the generating furnace, a modification of the process which has however the effect of reducing the temperature of the evolved gases.

This mode of employing combustibles becomes of great importance in the process of Chenot, who generates the gas in small furnaces placed around the great prismatic tube, and conducts it into a narrow space between this and an outer wall; through this, by openings, a regulated supply of air is introduced for the combustion of the gas, by which the ore contained in the tube is raised to a red heat. The next step is to provide the reducing material which shall remove the oxygen from the ignited ore, and for this purpose we have already seen, that even in the ordinary smelting process carbonic oxyd is always the agent; but instead of the impure gas obtained from his furnaces, and diluted with the nitrogen of the air, M. Chenot prefers to prepare a pure gas, which he obtains as follows. A small quantity of carbonic acid gas, evolved from the decomposition of carbonate of lime, is passed over ignited charcoal, and thus converted into double its volume of carbonic oxyd gas; this is then brought in contact with ignited oxyd of iron, which is reduced to the metallic state, while the gas is changed into carbonic acid, ready to be converted into carbonic oxyd by charcoal as before. In this way the volume goes on doubling each time the two-fold operation is repeated. By introducing the carbonic oxyd thus obtained into the furnace charged with ignited iron ore, and withdrawing a portion of the gas at a higher level, for the purpose of passing it again over ignited charcoal in a smaller tube apart, the process may be carried on indefinitely, the carbonic acid serving as it were to carry the reducing combustible from the one tube, to the ore in the other.

A modification of this process consists in mingling the ore with an equal volume of small fragments of charcoal, and admitting a limited supply of air into the body of the apparatus, by openings at mid-height, the heat being as before applied from without. In this case the action is analogous to that which takes place in the ordinary blast furnace; carbonic oxyd and carbonic acid are alternately formed by the reactions between the oxygen of the air, the ore and the charcoal; but the supply of air being limited, and the temperature low, neither carburation nor fusion of the metal can take place, and five-sixths of the charcoal employed, remain unchanged and serve for another operation. This simpler way has the disadvantage that one-half of the furnace is occupied with charcoal, so that the product of metal is less than when the reducing gas is prepared in a separate generator. In either case the product is the same, and the iron remains as a soft porous substance, retaining the form and size of the original masses of ore. This metallic sponge is readily oxydized by moisture, and if prepared at a very low temperature, takes fire from a lighted taper, and burns like tinder, yielding red oxyd of iron. In order to avoid the inconvenience of this excessive tendency to oxydation, the metal is exposed in the process of manufacture to a heat somewhat greater than would be required for the reduction; this renders the sponge more dense, and less liable to oxydation in the air.

The part of the furnace below the action of the fire is so prolonged, that the reduced metal in its slow descent, has time to become very nearly cold before reaching the bottom. It is then removed at intervals, by an ingenious arrangement, which enables the operator to cut off, as it were, the lower portion of the mass, without allowing the air to enter into the apparatus. In the case where the ore has been mixed with charcoal, the larger masses of metal are now separated from it by a screen, and the smaller by a revolving magnetic machine.

This spongy metallic iron may be applied to various uses. If we grind it to powder and then submit it to strong pressure, coherent masses are obtained, which at a welding heat, contract slightly, without losing their form, and yield malleable iron. By this process of moulding, which may be termed a casting without fusion, the metal may be obtained in forms retaining all the sharpness of the mould, and possessing the tenacity, malleability and infusibility of wrought iron. The masses thus compressed have in fact only to be forged, to give wrought iron of the finest quality; and it is found that during the hammering, any earthy matters mechanically intermixed, are eliminated like the scoriæ of the iron from the puddling furnace.

But without overlooking the great advantage of this method of making malleable iron, and moulding it into the shapes required, it is especially as applied to the manufacture of steel, that the metallurgical methods of Chenot deserve attention. In the ordinary process, as we have already seen, the bars of malleable are carburetted by a prolonged heating in the midst of charcoal powder; but the operation is long and expensive, and the metal obtained by this mode of cementation is not homogeneous. Mr. Chenot avails himself of the porosity of the metallic sponge, to bring the carbon in a liquid state, in contact with the minutest particles of the iron. For this purpose he plunges the sponge into a bath of oil, tar, or melted resin, the composition of the bath varying according to the quality of the steel which it is desired to obtain. The sponge thus saturated, is drained, and heated in a close vessel. The oily or resinous matter is expelled, partly as a gas, but for the greater part distils over as a liquid, which may be again employed for cementation. A small portion of carbon from the decomposition of the oil rests however with the iron, and at the temperature of low redness, employed near the end of the distillation, appears to have already combined chemically with the metal. This treatment with the bath and distillation, may be renewed if the carbonization is not sufficient after one operation.

The cemented sponge is now ground to powder and moulded by hydraulic pressure into small ingots, which may be heated and directly wrought under the hammer, like the compressed iron sponge; the metal thus obtained may be compared to refined blistered steel. If however the cemented and compressed sponge be fused in crucibles, as in the ordinary process for making cast steel, the whole of the earthy impurities which may be present, rise to the surface as a liquid slag, which is easily removed, while the fused metal is cast into ingots. In this way, by cementation, and a single fusion, the iron sponge is converted into a cast steel, which is from the mode of its preparation, more uniform in quality than that obtained by the ordinary process, and which was found by the Jury to be of remarkable excellence.

Such is a brief outline of the methods invented by Adrien Chenot for the reduction of iron ores, and the fabrication of wrought iron and steel, constituting in the opinion of one eminently fitted to judge the case, (Mr. Leplay, of the Imperial School of Mines, and Commissary General of the Exhibition,) the most important metallurgical discovery of the age.

The peculiar condition of the iron sponge has enabled the inventor to make many curious alloys, some of which promise to be of great importance; by impregnating it with a solution of boracic acid, a peculiar steel is obtained, in which boron replaces carbon, and by a similar application of different metallic solutions various alloys are produced, whose formation would otherwise be impossible.

The processes of Mr. Chenot are now being applied to the fabrication of steel at Clichy, near Paris, where I had an opportunity of studying in detail the manufacture. The iron ore is imported from Spain, and notwithstanding the cost of its transport, and the high prices of labor and fuel in the vicinity of the metropolis, it appears from the data furnished by Mr. Chenot to the Jury, that steel is manufactured by him at Clichy, at a cost which is not more than one-fourth that of the steel manufactured in the same vicinity from the iron imported from Sweden. According to Mr. Chenot, at the works lately established on his system by Villalonga & Co., near Bilboa in Spain, they are enabled to fabricate the metallic sponge at a cost of 200 francs the ton, and the best quality of cast steel at 500 francs, or $100 the ton of 1000 kilogrammes, (2.200 pounds avoirdupois) The conversion of the ore to the condition of sponge is, I was assured by Mr. Chenot, effected with little more than its own weight of charcoal.*

The differences in the nature of the steel made from various ores have long been well known, but until the recent experiments of Chenot, the subject was but very imperfectly understood. According to him the nature of the ore has much more to do with the quality of the metal than the mode of treatment, and he compares the different steels to the wines of different localities, which owe their varied qualities far more to the nature of the grapes, than to any variations in the mode of their fermentation. The process of cementation employed by Chenot furnishes, according to him, an exact measure of the capability of the iron to produce steel. The sponges of the iron from Sweden and the Ural Mountains, after taking up six per cent. of carbon, yield a metal which is still malleable, while that of Elba with four per cent., becomes brittle and approaches to cast iron in its properties. While the ores of Sweden and the Urals are famous for the excellent quality of their steel, the ore of Elba is known to yield a very superior iron, but to be unfit for the fabrication of steel; and Chenot concludes, from a great many observations, that the steel producing capacity of any iron is measured by the quantity of carbon which it can absorb before losing its malleability and degenerating into cast iron.

Desirous to avail myself of these researches of Mr. Chenot, I placed in his hands, in September, 1855, specimens of the different iron ores from Canada, which had been sent to the Exhibition at Paris, and engaged him to submit them to the process of reduction, and to test their capabilities for the production of steel. Mr. Chenot has also obtained remarkable alloys of chromium and titanium with iron, his processes enabling him to effect the direct reduction of chromic and titaniferous iron ores; specimens of these two ores from Canada were therefore furnished him, but the sudden and lamented death of Chenot, by an accident in the month

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* We have since the printing of this report learned that several large companies have been formed in France and Belgium for the use of Chenot's patents, and are now applying his processes on an extensive scale.
T. S. H.

of November following, deprives us for a time of the advantages of his experiments. His sons however are instructed in his processes, and have promised to undertake at an early day the examination of our Canadian ores. I am disposed to attach great importance to these investigations, from the hope that among our numerous deposits of iron ore, belonging in great part to the same geological formation as the iron ores of Scandinavia, there may be found some capable of yielding a steel equal to that of the Swedish iron. With the new and economical processes of Chenot a valuable steel ore will be sought for, even in a distant country, and may be advantageously transported to the localities where fuel and labour are most available.

One great condition for the successful application of these processes is, that the ores should be comparatively pure and free from earthy mixtures. We have already alluded to the impurity of the ores which are smelted in the coal districts of England, and even the ore brought by Chenot from Spain, and employed by him in his works at the gates of Paris, contains about ten per cent. of fixed, and as much volatile matter, it being a decomposed spathic iron. Many of the magnetic and hematite ores of Canada are almost chemically pure:* such are those of Marmora, Madoc, Hull, Cresby, Sherbrooke, MacNab and Lake Nipissing, which even if they should not prove adapted to the manufacture of superior steel, offer for the fabrication of metallic iron, by the processes of Chenot, very great advantages over the poorer ores, which in many parts of this continent are wrought by the ordinary processes.

The small amount of fuel required by the new methods, and the fact that for the generation of the gas which is employed as combustible, turf and other cheap fuels are equally available, are considerations which should fix the attention of those interested in developing the resources of the country. With the advantages offered by these new modes of fabrication, our vast deposits of iron ore, unrivalled in richness and extent, may become sources of national wealth, while by the ordinary method of working they can scarcely, at the present prices of iron and of labour, compete with the produce of much poorer ores, wrought in the vicinity of deposits of mineral coal.

T. S. H.

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* See Mr. Billings on the Iron Ores of Canada. This Journal, vol II, p. 20.

ARTICLE III.—*Entomology.* No. I. By WILLIAM COUPER Toronto.

In concluding my Notes on the Distribution of Insects, Vol. II. p. 40, I promised to make some remarks on insects injurious to vegetation, more particularly the parasites that destroy the staff of life, and concerning which so much has been written of late.

Harris, one of the best English writers on American insects, in his history of the Dipterous Order, must have been unacquainted with the fact that many species of the two-winged flies pass the winter in a semi-torpid state. In the month of January of the present year, I discovered two species in society. One of these, belonging to the genus *Musca* apparently a cuckoo-fly, was found in an old decayed stump, that had originally been perforated by beetles of the genus *Monohammus.* Through the holes thus made the flies reached the interior. They were found in clusters of from thirty to forty; each portion occupied a dry crevice, and were in a semi-torpid state. I have placed two specimens in my cabinet, and a description will appear in another paper.

The other is a *Cecidomyiæ.* Its head, antennæ, thorax, and body are black; femoræ whitish; tibiæ black; wings have a bluish colour, rounded at tip. Length 1¼ lin. These insects take up their winter quarters in the stems of the *Rubus villosus* (a very common fruit-bearing plant in Upper Canada), made tubular by the larva of *Saperda* (Oberia) *tripunctata* having devoured the pith during the month of June of the preceding year. They occupied every stem examined, each containing about two hundred specimens, huddled together in a semi-torpid state. In many instances these insects enter holes made in the sides of the plant by other insects; in other examined specimens there were no side entrances, but an opening on top, which to all appearance had been originally the work of a *Saparda* or *Cephus*, as I found the larva of the last genus devouring the pith immediately beneath the torpid *Cecidomyiæ.*

Are they destructive insects? If so, with nothing to obstruct their exit, what can prevent their issuing forth in hundreds at any favourable season to produce millions? It is therefore advisable to destroy every medullary plant growing in the vicinity of cultivated lands, as it is an unmistakeable truth that they protect many minute insects from moisture and cold.

I do not wish to say it is a cereal parasite; but, when we discover so many instances of this kind among the Tipulidæ, we have every reason to suspect that the greater number of species of a like nature will look for winter quarters, particularly when we have before us examples of one animal forming a place of retreat for another. It therefore requires a close search to discover them. No one can make reliable observations without practice; it is the only way to arrive at a proper mode of studying the habits of insect life. Now that entomologists, both of Upper and Lower Canada, have no difficulty in communicating their observations, I trust that hereafter more attention will be paid to them with a view to their early publication. The knowledge obtained by an entomologist, unless rendered available to others, may be of no gain to science; at his death all his thoughts perish, and all his knowledge is lost for ever. "Who can calculate the loss sustained by the death of Edward Forbes? Simply, in his case, by the loss of undeveloped, half-formed ideas. But suppose—and such instances do occur—he had amassed stores of information, which he was treasuring up to form, at some distant day, a valuable scientific work; and suppose that every scrap of knowledge he was thus collecting were carefully kept to himself, not to be made known to others till the due period had arrived, is it not evident that the knowledge he thus obtained might be no real gain to science, for it might all be lost again?"

An entomologist may have a fund of information, and, without meaning to be selfish, may, from supineness, indifference, love of ease, or the *dolce far niente*, allow his information to be useless to others. We want no such men in the practice of entomology. What we want are men who think more of what is still left for them to do, than to extract what has already been done by others.

Of what benefit are entomological essays to the agricultural community? This question can be answered more than one way. However, it is very evident that unless a writer particularly on entomology, be practically acquainted with the science, his production can never command a higher name than a compilation; for a good reason, we find nothing new—we discover that no search has been made for material to establish new facts. An individual, therefore, can at any time select sufficient from former authors to issue an essay of 139 pages, this only exhibits a want of entomological acuteness; and, as a work of reference, is of no more value than waste paper.

ART. IV.—*Remarks on the Geographical Distribution of Plants in the British Possessions of North America.* By GEORGE BARNSTON, Esq., Honorable Hudson's Bay Company.

Group—ALBUMINOSÆ.

Order—*Nymphæaceæ.*

This order, containing a very few genera, and these purely aquatic plants, is very ornamental to our small lakes and shallow rivers. A certain depth of water, and in the streams a sluggish current, are necessary for them. In such situations, their dark green and generally cordiform leaves are seen floating on the surface, and here and there a bright yellow or pure white cupshaped flower of considerable size will be seen to attract the eye, and gratify the beholder. Are these the offspring of the water? is the first enquiry of the untutored stranger. But a slight investigation sets queries at rest. The long pliant peduncles and leaf stalks are found to be attached to a massive root of some hardness and consistency, embedded in the oozy bottom.

The *Nymphæa odorata*, or white water lily, no stranger to Canada, is rarely seen in the regions north of the Province, but the *Nuphar lutea*, or yellow pond lily, is fond of the colder latitudes. Sir John Richardson brings it up to latitude 55°, or places in his first zone on the east side, and as far as 58° on the west side of the continent. In the longitude of lake Winipeg, 55° is certainly within its bounds, but it may be observed here that Sir John defines this zone of 45° to 55° as an isothermal one, not exactly one of latitude. It corresponds nearly with the strongly wooded district south of the lichen covered barren grounds, from which we may suppose it to be separated, by a line running from latitude 52° or 53°, on the Labrador peninsula. up to 58° or even 60°, in the longitude of 120°, or the neighbourhood of the Rocky Mountains. In this section of the country, viz: Lake Winipeg, the Nuphar lutea is particularly abundant. Its shining yellow flowers, less chaste and delicate than those of nymphæa, are everywhere to be seen on our shoal and muddy lakes, and they greet us at every turn of those winding streams, that drag their dull courses through the dark and continuous forests, that cover the Chippewa and Cree lands. A thick fringe of sedges and reeds may in these lazy rivers occupy the approach to the shore, but where the water deepens, the Nuphar lutea dots the expanse, its leaves and flowers clinging to the surface, as if they had been actually glued thereto. The dash of the paddle or stroke of the oar alone disturbs their quiet.

Order—*Sarraceniaceæ.*

One genus of plants constitutes this remarkable order. and it comprises only six species, confined almost entirely, I believe, to North America. We have but one species in the British possessions, the *Sarracenia purpurea.* It occurs every where, extensively diffused throughout the marshy and swampy wastes, as far as Bear's Lake north, and the Rocky Mountain West. Where timber is stinted in growth, and the moss is unshaded, it springs from its damp sphagnous bed in great perfection. Its vase-shaped leaf is attractive as a rare form of vegetable growth. Fairies might adopt it as a drinking cup. After rain it may be had nearly filled with water, and the goblet then tells many a tale of death, disaster and woe. Many small insects—often of the dipterous order, Chironomi, Tanypi, and other minute airy forms—retiring probably for shelter from the storm, in this house of refuge end their short day. Overwhelmed by some drop, to them a water spout, they may have died struggling in the abyss profound, or perhaps, having performed the great mission of their life, they may have tranquilly given up the ghost, within this deep funereal urn, by nature prepared for them, and chosen by themselves—*memorials even they* of their Great Creator's marvellous attributes, power and skill.

At the season when the flower of the Sarracenia purpurea is in full expansion, the plague of mosquitoes has commenced, and then 'tis only the most determined, zealous botanist who will penetrate into the swampy recesses, where this singular plant abides. In early winter when the frozen surface affords firm footing, and the snow has scarcely covered the ground, the sportsman crashes over its frosted and brittle cup that rises from the moss and seems to claim from him a more cautious step. It is but a leaf, yet a rare specimen of nature's incomprensible handywork, and therefore a vessel which her thoughtful admirers dislike to destroy.

Sir John Richardson in his excellent tables places this plant in the eastern prairies, as well as in the western district. He probably means that it is to be found in those outskirting woods and swamps that encroach in many places on the prairie lawns. We must not conclude that it occurs on those dry plains and grassy meadows, which, ocean-like, spread over the interior of the country.

Order—*Papaveraceæ.*

From the genus Papaver, the poppy, Jussieu, the reviver, if not the founder of the natural system of botany, drew the name for this order of plants, of which Torrey has given nine or ten genera, as pertaining to North America. These genera contain but one or two species each, with the exception of Eschscholtzia or Chryseis, of which there are five enumerated by him, natives of California. The milky juices of the Papaveraceæ may serve sometimes as a guide to the young collector, when he is at a loss in determining the place of a plant, possessed of two deciduous sepals, four cruciform petals, and hypogynous stamens.

The *Papaver nudicaule* is the most northern plant of the poppy kind. It is found by travellers along the whole extent of our northern coast from latitude 64° on the eastern side of McKenzie river, and from 68° on the western side to the ocean. We hear of it also on the islands of the Arctic Sea, in Greenland and Spitzbergen. It therefore closely encircles the great polar basin by an arc of 180° of longitude, or half the circumference of the whole arctic region. It was found as an alpine production by Drummond at great heights on the Rocky Mountains, from latitude 52° to latitude 55°. We have good reason to conclude, that following the great ridges northwards, this plant may keep its *climatal* altitude, descending by degrees in its elevation until it reach the coast level, thus keeping up a strict and decided connection along 20° of latitude, between its arctic and highest alpine habitats. This most interesting little plant, hardy yet slender, endures the storms, and braves all the inclement weather of the boreal regions, and like the Esquimaux, courts not the shelter of the woody district. It prefers the bleak coast and dreary barrens, indifferent to all the rude treatment it receives from the boisterous elements. It is decreed by nature that each of her subjects shall occupy a certain position on the earth's surface, and everything has been arranged and kindly fitted by her for such her purpose. This is the only poppy truly native of North America. Those species seen in uncultivated waste ground in Canada and the States have been introduced.

The *Sanguinaria Canadensis* or bloodroot, common in the milder parts of Canada, is not to be met with north of the Province. Torrey assigns it place as far south as Florida, and west to the Mississippi. In Canada the flowers rise as soon as the snow is gone, about the end of April; further south, March is the month it appears in. Lindley in his system (page 8) has called it the "Puccoon," which I suspect is a mistake, that name being given to another plant, the Batschia canescens, the root of which is used to *dye a red* by the native tribes. The root of the Sanguinaria having a red juice may have led the compiler to consider it the Puccoon.

There are soil and situations suitable for the Sanguinaria below Quebec, but I have not observed it so low down on the St. Lawrence, and certainly it does not pass below the Saguenay.

That beautiful genus, the Eschscholtzia of Chamisso, changed by Torrey to the name of Chryseis, is not known native, east of the Rocky Mountains. The five species now discovered all keep to the belt of country bordering on the Pacific, south of the river Columbia. In the valley of the Multnomah or Walhamet, on which is built the city of Oregon, the rich colour and brilliant *Chryseis californica* occurs, in latitude 43°, proceeding southward into California. In that still warmer land the closely allied species *C. crocea*, *C. cæspitosa*, *C. tenuifolia*, and *C. hyperoides*, beautify the plains and meadows. The Chryseis Californica was first discovered by Menzies, but afterwards described by the Russian naturalists accompanying Kotzbue. The other species were made known by Douglas, who was for a short time engaged botanizing California.

Although growing in a country where there is scarcely any winter frost, and where the summer heat is intense, this genus nevertheless appears to possess that hardiness that fits it to become an ornament to gardens even in the coldest parts of our Province. In latitude 54° north, it is cultivated as a hardy annual with the greatest care, and if left to itself, it becomes a weed in the borders, still retaining, however, undiminished beauty. The other genera of this order, existing native of North America are found south, and are never seen, unless in a cultivated state, within the British territory. The *Argemone Mexicana* and *Meconopsis diphylla* are both denizens of the Western States. The *Meconopsis heterophylla*, and *M. crassifolia*—with a single species each of the new genera, Dendromecon, Meconella, Platystigma and Platysteman,—hold ground still farther to the westward, in California and the Oregon.

With the exception of papaver nudicaule, all the plants of this order, just passed under review, prefer a mild climate, and the Sanguinaria, of which there is but one species, is the sole representative of the order in Canada. The southern half of the temperate zone holds the others.

Generally speaking, the constitution of the papaveraceæ may be said to be more sensitive and less able to bear change than the Ranunculaceæ to which they are closely allied. The area over which each species spreads itself is much more narrowly limited than with the Ranunculaceæ. The eastern species do not traverse the great water shed to the westward, neither do the western species cross to this side. We may therefore decidedly infer, that compared with the other order, they have less pliability of habit, and greater susceptibility under changes of climate. The Eschscholtzia, however, when cultivated, accommodates itself to very different temperatures and situations from those whence it was originally taken. As for our little northern poppy it takes a wide range in place, but a small one in temperature and climate.

Lindley says that two-thirds of the species of Papaveraceæ are found in Europe, yet of his total thirteen genera, we have produced seven, as occurring in North America. In fact this Continent possesses as nearly as many genera as Europe, but as most of them contain but one species, we need be little surprised at Europe having a greater number of individual species. In all other quarters of the globe Papaveraceæ are scarce.

Order—*Fumariaceæ.*

The Fumariaceæ are in many points akin to the Papaveraceæ, such as the number of deciduous sepals, the four cruciate petals and usually one called capsules. They shew also a tendency to imitate some of the Ranunculaceæ in the spurred inflorescence and divided leaves. We have three genera existing in Canada, Dielytra, Adlumia and Corydales.

The first of these is familiar enough to our rusticating children in the pretty *Dielytra cucullata*, or Dutchman's breeches. At the confluence of the Ottawa with the St. Lawrence it is plentiful in different localities. From our north shores it extends south to Kentucky. It has never been seen in the central Prairies. Yet the Blue Mountains round which the south fork of Lewis and Clarke winds, is noted as one of its residences. Elsewhere west of the Rocky Mountains it has not, to my knowledge, been heard of. It may however occur in the volcanic ranges of mounts Hood and Rainier. A great distance indeed have these Cucullarias strayed from their kith and kin on the banks of the St. Lawrence.

The *Dielytra Canadensis*, or squirrel corn, very like the last, is its companion in Canada and the States, but does not trouble itself by travelling so far westward as the Cucullaria. Neither of them appear in the Hudson's Bay Company's Territories.

The *D. formosa* is a southern species, confined apparently to the States of Virginia and South Carolina. The *D. saccata* of Nuttall is the *D. eximia* of Hooker, and inhabits the shady woods of the Oregon.

The single species of the genus Adlumia I have never had the pleasure of collecting, although it be native of Canada. Like the Dielytras, it extends southwards into the States, but not to the northward of the Province.

Last to be mentioned as a genus of the Fumariaceæ inhabiting British North America is Corydalis. The *C. aurea* has a very extended range. It occurs throughout Canada to as far as Georgia, and westward from that to the Rocky Mountain, along the Arkansas and Missouri. It is seen occasionally on the canoe route into the far northwest, tufted among the spongy ground, where springs spread over upon the rocks along shore. In the useful tables of Sir John Richardson three species of Corydalis are assigned to the zone occupying the space from the Arctic circle to 72° north, or to the coast; this species must be one of these. Possibly it does not enter this zone until it gets westward to the banks of the Coppermine and McKenzie's Rivers. Drummond found it in the Rocky Mountains from 52° to 57° north latitude.

Corydalis glauca must be the other Corydalis that reaches the Arctic circle in the eastern district. It is a more common plant along our rivers than the *C. aurea*, and probably is as hardy. It is met with generally in more exposed situations, and in drier ground. It stretches from the north shore of the St. Lawrence, from below the entrance of the Saguenay, extending itself through Canada, and is met with as far south as North Carolina. In canoe travelling in the interior of the north it forms an agreeable object to the sight, often pendant upon the steeply inclined rocks, rising out of the debris and moss collected in their clefts, its variegated flowers and glaucous leaves, shewing to great advantage upon the sombre back ground.

The third Corydalis mentioned by Sir John as an Arctic species should be the *C. pauciflora* of Persoon. Kotzbue Sound is the locality given it. This is near the island of St. Lawrence in Behrings Straits, where Chamisso also noted it. Has it crept from the Asiatic continent by taking passage on some navigating drift stick, or has it had place on our continent before we were seperated from Asia by some mighty throe of the volcanic elements?

Two perennial species, one the *C. Scouleri* of Hooker, named after Dr. Scouler of Glasgow, who accompanied Douglas on his first voyage to the Columbia, and the other the *C. monophylla* of Nuttall, are confined to the northwest coast. The C. Scouleri is plentiful at the confluence of the Columbia with the Pacific, and extends in shady woods along the coast. If it be the same as the *C. pænoiæ folia* of Siberia, why should it not also be found at the Russian settlements towards Sitka? Has the question as to the identity of these two plants been yet determined? The Corydalis macrophylla has been passed over by Douglass as being the same as the C. Scouleri. I know for a certainty he explored repeatedly the Wahlamet woods and prairies, especially about the falls, where the city of Oregon has since been founded, and he must have observed such a plant growing in abundance in that vicinity. If it be specifically different from the C. Scouleri, we are indebted to Mr. Nuttall's discrimination for an addition to the original American stock of this elegant genus.

Lindley in his list gives fifteen genera to the order Fumariaceæ, but only the three that I have gone over belong to North America. The Corydales take a much more extended range than the Dielytræ, and choose also more rocky ground. With them I close my remarks upon the first family or alliance of the large group of albuminose plants,—the RANALES of Lindley, from which he excludes the Sarraceniaceæ. I believe, however, that whatever relation Sarracenia as a genus may hold to other plants, its position as chosen for it by Torrey, between Nymphæaceæ and Papaveraceæ, will by most people be considered correct.

ARTICLE V.—*Report of the Geological Survey of Canada, 1853 to 1855.* (494 *pages 8vo., with 4to. Atlas of Maps.*

It is some compensation for the absence of regular reports of progress, caused by the occupation of Sir W. E. Logan with the exhibition of Canadian products in Paris, to find the accumulated reports of several years now issued in a respectable volume, with an amount of elaboration and illustration giving them a much more readable and permanent character than that which usually attaches to reports of progress. The present report is in effect a treatise on several important parts of the geology of Canada, illustrated with valuable and accurate maps, and embracing not only the usual accounts of the progress of the survey, but systematic descriptions of many important fossils, and carefully prepared essays on theoretical and practical points that have occurred during the work of the explorers in past years.

The portion of the volume relating to the personal explorations of the head of the survey, is occupied with the intricate and difficult subject of the structure of that great Laurentian district stretching along the whole northern side of the settled portion of Canada, and as we have long thought practically limiting the extension of population in this direction. This question must, however, depend on several points only to be ascertained by such labour as that at present being performed by the survey. The streams and valleys of a country such as that in question are sure to extend along its better parts; and the ordinary traveller passing along these, and knowing nothing of the intervening forest-clad ridges and table lands, except their effect as distant objects in the landscape, must form exaggerated ideas of the value of the country as a field for immediate settlement. On the other hand, he sees little of the mineral riches which may be present, and which in a different way may render such regions available.

The previous reports of Sir W. E. Logan have left on the minds of Geologists the conviction that all that part of Canada lying north of a line drawn from the S. E. angle of Georgian Bay to Kingston, and thence along the north side of the St. Lawrence to Labrador, consists mainly of gneissose rocks, like those of the highlands of Scotland and Scandinavia, with the exception of a triangular patch between the mouth of the Ottawa and the St. Lawrence, and a narrow stripe reaching thence as far as Quebec. In short, those great regions lying north of the river and great lakes, and of the lines above indicated, are mapped as consisting of the rock formations of which a specimen is seen in the Thousand Islands, and are presumably similar to these in their agricultural capabilities. Canada, for practical purposes, thus appears to consist of the Silurian regions lying south of the river and around the mouth of the Ottawa, and of the great Silurian and Devonian peninsula of the Upper Province. The remainder, though presenting cultivable valleys, may in the main be regarded as unproductive, and not likely for some time to enter into competition wlth the rich lands of the west.

It is very probable that these views may have had some connection with the selection of Ottawa as a seat of Government. Situated nearly at the apex of the triangular tract above referred to, it forms the last outpost to the northward, of the great Silurian plains of Canada, and might therefore be regarded as a favourable point for bringing the wealth and population of the more valuable parts of the province to bear on the improvement of the rocky and intractable Laurentian country. It seems inconceivable that any civilized Government in settling such a question should leave out of sight those geological conditions which determine beforehand the resources and population of countries. A glance at the beautiful little map attached to the essay prepared by Sir William and Mr. Hunt for the Paris exhibition, is sufficient to show that this important element of the question admits of no other interpretation than that which we have given; and taking this into account, it would be extreme folly to place the capital of a great and fertile country in the midst of a desolate region, apparently destined through all time to have a comparatively sparse and poor population, unless with some such view as that above hinted.

All this depends however, on the relative extent, within the Laurentian region, of rocks capable of affording fertile soils; and in the present report Sir W. E. Logan has addressed himself to this question. We shall give his results, so important to a correct estimate of this great subject, in his own words:—

"*Limestone and Lime-feldspars.*—The crystalline limestones of the Laurentian series are quite as good for all the economic purposes to which carbonate of lime is applied, as the earthy limestones of the fossiliferous formations. It is from the latter, however, that is obtained nine-tenths of the material used throughout the country, for the very good reason that more than nine-tenths of the works of construction, both public and private, are raised upon the fossiliferous rocks, and for such present works these rocks therefore afford the nearest sources of supply. Thus the inhabitants are well acquainted with the aspect of the fossiliferous limestones, and can easily recognise them, but very few of them understand the nature of the highly crystalline calcareous beds of the Laurentian series. Hence it is that settlers in the back townships, who have dwelt many years upon these rocks, have been accustomed, when in want of lime for the manufacture of potash, or the construction of their chimneys, to send to the fossiliferous deposits for it—the distance being sometimes thirty miles—when it might have been obtained at their own doors. In following out the calcareous bands of the gneiss district, in 1853, therefore, especial pains were taken to point out their character to the settlers, wherever exposures were met with; and in visiting some of the same localities last season, I had the satisfaction of finding lime-kilns erected, and lime burnt in four of them.

The fossiliferous rocks, in a large part of Canada, maintaining an attitude approaching horizontality, give a much more even surface than the corrogated series coming from beneath them, and this, combined with a generally good soil, renders them more favourable for agricultural purposes. It is over them, too, that the River St. Lawrence maintains its course, affording an unrivalled means of exit for the produce of the land, and of entrance for the materials that are to be received in exchange. It is only a natural result of these conditions that the area supported by the fossiliferous rocks should be the first settled. This area, however, constitutes only between 60,000 and 80,000 square miles, while the whole superfices of Canada comprehends 330,000 square miles. or about five times the amount.

Four-fifths of Canada thus stand upon the lower unfossiliferous rocks, and it becomes a question of some importance, before it has been extensively tested by agricultural experiments, to know what support this large area may offer to an agricultural population. An undulating surface, derived from the contorted condition of the strata on which it rests, will more or less prevail over the whole of this region ; but the quality of its soil will depend on the character of the rocks from which it is derived.

These rocks, as a whole, have very generally been called granite, by those travellers who with little more than casual observation have described them, without reference to geological considerations. The ruins of granite are known to constitute an indifferent soil from their deficiency in lime, and hence an unfavourable impression is produced in respect to the agricultural capabilities of any extended area, when it is called granitic. Such soils are however never wanting in those essential elements the alkalies, which are abundant in the feldspars of the granite.

In the reports of the survey, the Laurentian rocks have been described in general terms as gneiss, interstratified with important masses of crystalline limestone. The term gneiss, strictly defined, signifies a granite with its elements, quartz, feldspar and mica, arranged in parallel planes, and containing a larger amount of mica than ordinary granite possesses, giving to the rock a schistose or lamellar structure. When hornblende instead of mica is associated with quartz and feldspar, the rock is termed syenite, but as there is no distinct specific single name for a rock containing these elements in a lamellar arrangement, it receives the appellation of syenitic gneiss.

Gneiss rock then becomes divided into two kinds, granitic and syenitic gneiss, and the word gneiss would thus appear rather to indicate the lamellar arrangement than the mineral composition. Granitic and syenitic gneiss were the terms applied to these rocks in the first reports; but as granite and syenite are considered rocks of igneous origin, and the epithets derived from them might be supposed to have a theoretical reference to such an origin of the gneiss, while at the same time it appears to me that the Laurentian series are altered sedimentary rocks, the epithets, micaceous and hornblendic have been given to the gneiss, in later reports, as the best mode of designating the facts of mineral composition, and lamellar arrangement, without any reference whatever to the supposed origin of the rocks. When the general term gneiss therefore is used, it may signify both kinds, or either; and the epithets micaceous and hornblendic are applied to the rock to indicate that the mica greatly preponderates or excludes the hornblende, or the hornblende the mica.

In no part of the area included in this report is hornblende completely absent from the gneiss, and sometimes it predominates over the mica; hornblende contains from ten to fifteen per cent. of lime, so that the ruins of the rocks of the area, such as they have been described, whether gneiss, greenstone, syenite, or porphyry, would never give a soil wholly destitute of lime. Of this necessary ingredient, the lime feldspars would be a more abundant source. Different species of them from andesin to anorthite, may contain from about five up to twenty per cent. of lime, and the range of those Canadian varieties which have been analyzed by Mr. Hunt. is from seven to about fifteen per cent. The personal exploration which is the subject of the present report, has shewn, for the first time, that these lime feldspars occur in this province, and probably in other regions, in mountain ranges, belonging to a stratified deposit, and not in disseminated or intrusive masses. The breadth of these displayed in the district examined, demonstrates their importance; and the fact that the opalescent variety of labradorite was ascertained by Dr. Bigsby to exist, *in situ*, on an island on the east cost of Lake Huron, while the name of the mineral reminds us of its existence at the eastern extremity of the Province, sufficiently points out that the lineal range of the lime-feldspars will be co-extensive with Canada. We may therefore anticipate a beneficial result from their influence upon the soils, over the whole breadth of the province.

The ruins of the crystalline limestone constitute a most fruitful soil, so much so that the lots first cleared in any settled area of the Laurentian country, usually coincide with its range. In these limestones phosphate of lime is sometimes present in great abundance, and there is scarcely ever any large exposure of them examined, in which small crystals of the phosphate are not discernable by the naked eye. Mica and iron pyrites are present, to furnish other essential ingredients, and the easily disintegrating character of the rock readily permits its reduction to a soil. The effects of these limestones and lime-feldspars are not however confined to the immediate localities in which the beds are found, for boulders of them are met with transported to southern parts, even far on the fossiliferous rocks beyond; and there can be little doubt that their fragments are very generally mixed with the soils of the Laurentian country. Thus while the diversity of minerals in the different rocks of the series furnishes the ingredients required to constitute good soils, the agency of the drift has mingled them, and considering the resistance to disintegration offered by most of the rocks, with the exception of the limestome, the deficiencies that may exist will rather be in the quantity of soil covering the rocks in elevated parts, than in its quality where the materials have been accumulated."

The question of the agricultural value of the Laurentian district thus hinges on the proportion of limestone and lime-feldspar. but especially of the former, as it alone gives a deep and low-lying soil, containing the elements of fertility. The settlers, without knowing anything, of the causes, have discovered the relative value of these soils, and hence we are informed that the clearings stretch along the limestone valleys almost exclusively. These narrow belts, which we may roughly estimate as amounting, in the districts referred to in this report, to from one-sixth to one-tenth of the whole, may be regarded as of great agricultural value. Such portions of the intervening hilly country as have received a considerable share of calcareous debris, and are not too steep, rocky, or stony, to admit of cultivation, may, when labour becomes cheaper, be profitably converted into farms or sheep pastures. In the meantime, they will supply an enormous quantity of valuable timber. Gradually there will grow up in the glens of the Laurentian territory, a race of hardy Canadian hill-men, who, if sufficiently leavened by the elevating influences of Christianity and education, will be of inestimable value to the country, both in peace and war. For a long time, however, it is evident that the west must drain from this country its agricultural population, and that the lumberer will have it as his special patrimony.

The miner, however, has found his way thither, and will without doubt find remuneration for his toil. Among the useful minerals and rocks of the region, mentioned in this report, are magnetic iron ore, the most valuable of all the ores of that metal; plumbago; lead; mica for stove fronts, &c.; buhrstone, the well-known material of the French millstones; garnet, useful as a substitute for emery; marble and building stones of many varieties. The Labradorite of the lime-feldspar region is a beautiful ornamental stone, presenting fine opalescent reflections, and admits of being polished for a great variety of ornamental purposes. The time may come when hundreds of tons of this rock may be daily borne about on the persons of fair ladies, in brooches, bracelets, and other articles of bijouterie, greatly to the profit of the industrious lapidaries, who may locate themselves on the sunny sides of the ridges of lime-feldspar.

We have as yet said nothing as to the scientific value of the labors of Sir W. E. Logan in the Laurentian district. This subject has been already referred to in our notices of the American Association, at the last meeting of which two papers on these rocks were read. It is only necessary to add that the curious unravelling of the intricacies of these deposits, evidenced in the present report, displays great scientific skill, and will lead to most interesting deductions as to the original nature and arrangement of the sediments out of which these highly metamorphosed and strangely distorted rocks have been formed.

In the conclusion of his special portion of the Report, Sir William refers to his general geological map now in progress. We know that almost incredible pains and precaution have been taken to ensure absolute accuracy in the representation of Canada in this map. When published, accompanied as we trust it will be by a suitable letter-press description, embracing the substance of the reports of progress, it will mark an era in the scientific and industrial progress of Canada. Its internal evidence of accuracy, and the reputation of its author, will render it a standard authority in physical geography; and it will do much to spread throughout the world the reputation not only of the material resources of our country, but of the enlightenment and public spirit of its legislature and people.

The second part of the report includes a large amount of painstaking and accurate work done by Mr. Murray in the difficult region lying between Georgian Bay and the Ottawa, an unpromising country, consisting in great part of ridges of gneiss alternating with swamps, though containing pine, cedar, and other kinds of timber in considerable quantity. It bids fair also to be productive of iron and copper and the other minerals of the Laurentian and Huronian rocks.

The remainder of the report, consisting of the investigations of Mr. Richardson, Mr. Billings, and Prof. Hunt, contains so much matter both of commercial and scientific importance that we must defer its consideration to another number. J. W. D.

(*To be continued.*)

ARTICLE VI.—*A List of Indigenous Plants found growing in the Neighbourhood of Prescott, C. W., under the Nomenclature of Gray.* By B. BILLINGS, Jr.

RANUNCULACEÆ.

Clematis Virginiana,	Linn.	Common Virgin's Bower.
Anemone Virginiana,	Linn.	Tall Anemone.
" *Pennsylvanica,*	Linn.	Pennsylvanian Anemone.
Hepatica acutiloba,	De Candolle	Sharp-lobed Hepatica.
Thalictrum dioicum,	Linn.	Early Meadow-Rue.
" *Cornuti,*	Linn.	Tall Meadow-Rue.
Ranunculus abortivus,	Linn.	Small-flowered Crowfoot.
" *recurvatus,*	Poiret.	Hooked Crowfoot.
" *repens,*	Linn.	Creeping Crowfoot.
" *acris,*	Linn.	Tall Crowfoot.
Caltha palustris,	Linn.	Marsh Marigold.
Coptis trifolia,	Salisbury.	Three-leaved Goldthread.
Aquilegia Canadensis,	Linn.	Wild Columbine.
Actæa spicata, alba,	Michaux.	White Baneberry.

MENISPERMACEÆ.

Menispermum Canadense,	Linn.	Canadian Moonseed.

BERBERIDACEÆ.

Caulophyllum thalictroides,	Michaux.	Blue Cohosh.
Podophyllum peltatum,	Linn.	May-Apple.

NYMPHÆACEÆ.

Nymphæa odorata,	Aiton.	Sweet-scented Water-Lily.

PAPAVERACEÆ.

Sanguinaria Canadensis,	Linn.	Blood-root.

FUMARIACEÆ.

Dicentra Cucullaria,	De Candolle.	Dutchman's Breeches.
" *Canadensis,*	De Candolle.	Squirrel-Corn.

CRUCIFERÆ.

Nasturtium palustre,	De Candolle.	Marsh Cress.
Dentaria diphylla,	Linn.	Pepper-root.
Turritis stricta,	Graham.	*Straight Tower Mustard.
Erysimum cheiranthoides,	Linn.	Worm-seed Mustard.
Sisymbrium officinale,	Scopoli.	Hedge Mustard.
“ *canescens,*	Nuttall.	Tansy Mustard.
Sinapis arvensis,	Linn.	Field Mustard.
Capsella bursa-pastoris,	Mœnch.	Shepherd's Purse.

VIOLACEÆ.

Viola blanda,	Wildenow.	Sweet White Violet.
“ *cucullata,*	Aiton.	Common Blue Violet.
“ *rostrata,*	Pursh.	Long-Spurred Violet.
“ *Muhlenbergii,*	Torrey:	American Dog Violet.
“ *pubescens,*	Aiton.	Downy Yellow Violet.

HYPERICACEÆ.

Hypericum perforatum,	Linn.	Common St. John's-wort.
“ *corymbosum,*	Muhlenberg,	*Corymbed St. John's-wort.
“ *Canadense,*	Linn.	*Canadian St. John's-wort.
Elodea Virginica,	Nuttall.	*Virginian Elodea.

CARYOPHYLLACEÆ.

Silene noctiflora,	Linn.	Night-flowering Catch-fly.
Agrostemma Githago,	Linn.	Corn-Cockle.
Stellaria media,	Smith.	Common Chickweed.
“ *longifolia,*	Muhlenberg.	Stitchwort.
Cerastium viscosum,	Linn.	Larger Mouse-ear Chickweed.

PORTULACACEÆ.

Portulacca oleracea,	Linn.	Common Purslane.
Claytonia Caroliniana,	Michaux.	Broad-leaved Spring Beauty.

MALVACEÆ.

Malva rotundifolia,	Linn.	Common Mallow.

TILIACEÆ.

Tilia Americana,	Linn.	Basswood.

OXALIDACEÆ.

Oxalis stricta,	Linn.	Yellow Wood-Sorrel.

GERANICEÆ.

Geranium maculatum,	Linn.	Wild Cranesbill.

BALSAMINACEÆ.

Impatiens fulva,	Nuttall.	Spotted Touch-me-not.

ANACARDIACEÆ.

Rhus typhina,	Linn.	Staghorn Sumach.

NITACEÆ.

Nitis cordifolia,	Michaux.	Frost Grape.
Ampelopsis quinquefolia,	Michaux.	Virginian Creeper.

RHAMNACEÆ.

Ceanothus Americanus,	Linn.	New Jersey Tea.

CELASTRACEÆ.

Celastrus scandens,	Linn.	Climbing Bitter-sweet.

SAPINDACEÆ.

Acer Pennsylvanicum,	Linn.	Striped Maple.
" *spicatum,*	Lambert.	Mountain Maple.
" *saccharinum,*	Wang.	Sugar Maple.
" " *nigrum,*	Gray?	Black Sugar Maple.
" *rubrum,*	Linn.	Red Maple.

LEGUMINOSÆ.

Trifolium pratense,	Linn.	Red Clover.
" *repens,*	Linn.	White Clover.
" *procumbens,*	Linn.	Low Hop-Clover.
Robinia Pseudacacia,	Linn.	Common Locust.
Desmodium nudiflorum,	De Candolle.	*Naked-flowered Desmodium.
" *acuminatum,*	De Candolle.	*Acuminate-leaved Desmodium.
Vicia Cracca,	Linn.	Tufted Vetch.
Lathyrus palustris,	Linn.	Mars Vetchling.
Phaseolus perennis,	Walter.	Wild Bean.

ROSACEÆ.

Prunus Americana,	Marsh.	Wild Yellow or Red Plum.
" *Pennsylvanica,*	Linn.	Wild Red Cherry.
" *Virginiana,*	Linn.	Choke Cherry.
" *serotina,*	Ehrhart.	Wild Black Cherry.
Spiræa salicifolia,	Linn.	Common Meadow-Sweet.
" *tomentosa,*	Linn.	Hardhach.
Agrimonia Eupatoria,	Linn.	Common Agrimony.
Geum album,	Gmelin.	*White Avens.
" *strictum,*	Aiton.	*Yellow Avens.
" *rivale,*	Linn.	Water Avens.
Waldsteinia fragarioides,	Tratt.	Barren Strawberry.
Potentilla Norvegica,	Linn.	*Norway Cinquefoil.
" *Anserina,*	Linn.	Silver-Weed.
" *palustris,*	Scopoli.	Marsh Five-Finger.
Fragaria Virginiana,	Ehrhart.	*Wild Strawberry.
" *vesca,*	Linn.	*Common Strawberry.
Rubus odoratus,	Linn.	Purple Flowering-Raspberry.
" *triflorus,*	Richardson,	Dwarf Raspberry.
" *strigosus,*	Michaux.	Wild Red Raspberry.
" *occidentalis,*	Linn.	Black Raspberry.
" *villosus,*	Aiton.	Common or High Blackberry.

ROSACEÆ.

Rosa lucida,	Ehrhart.	Dwarf Wild-Rose.
Cratægus coccinea,	Linn.	Scarlet-fruited Thorn.
" *tomentosa punctata,*	Linn.	Black or Pear Thorn.
Pyrus arbutifolia, melanocarpa,	Linn.	Choke-berry.
Amelanchier Canadensis,	Torry & Gray.	Shad-bush.

ONAGRACEÆ.

Epilobium angustifolium,	Linn.	Great Willow-herb.
" *coloratum,*	Muhlenberg.	*Colored Willow-herb.
Œnothera biennis,	Linn.	Common Evening Primrose.
Ludwigia palustris,	Elliot.	Water Purslane.
Circæa Lutetiana,	Linn.	*Common Enchanter's Nightshade.
" *alpina,*	Linn.	*Alpine Enchanter's Nightshade.
Myriophyllum spicatum,	Linn.	*Spiked Water Milfoil.

GROSSULACEÆ.

Ribes Cynosbati,	Linn.	Wild Gooseberry.
" *floridum,*	Linn.	Wild Black Currant.

CRASSULACEÆ.

Penthorum sedoides,	Linn.	Ditch Stone-cross.

SAXIFRAGACEÆ.

Mitella diphylla,	Linn.	*Two-leaved Bishop's-cap.
" *nuda,*	Linn.	*Heart-leaved Bishop's Cap.
Tiarella cordifolia,	Linn.	False Mitre-wort.
Chrysosplenium Americanum,	Schweinitz.	Golden Saxifrage.

HAMAMELACEÆ.

Hamamelis Virginica,	Linn.	Witch-Hazel.

UMBELLIFERÆ.

Sanicula Canadensis,	Linn.	*Canadian Sanicle.
Pastinaca sativa,	Linn.	Common Parsnip.
Cicuta maculata,	Linn.	Spotted Cowbane.
" *bulbifera,*	Linn.	*Bulb-bearing Cowbane.
Sium lineare,	Michaux.	*Narrow-leaved Water Parsnip.
Cryptotenia Canadensis,	De Candolle.	Honewort.
Osmorrhiza brevistylis,	De Candolle.	Hairy Sweet Cicely.

ARALIACEÆ.

Aralia racemosa,	Linn.	Spikenard.
" *nudicaulis,*	Linn.	Wild Sarsaparilla.
" *Quinquefolia,*	Gray ?	Ginseng.
" *trifolia,*	Gray ?	Dwarf Ginseng.

CORNACEÆ.

Cornus Canadensis,	Linn.	Dwarf Cornel.
" *stolonifera,*	Michaux.	Red-Osier Dogwood.
" *alternifolia,*	Linn.	Alternate-leaved Cornel.

CAPRIFOLIACEÆ.

Linnæa borealis,	Gronovius.	Twin-flower.
Lonicera parviflora,	Lambert.	Small Honeysuckle.
" *ciliata*,	Muhlenberg.	Fly Honeysuckle.
Diervilla trifida,	Mœnch.	Bush Honeysuckle.
Sambucus Canadensis,	Linn.	Common Elder.
" *pubens*,	Michaux.	Red-berried Elder.
Viburnum nudum,	Linn.	Withe-rod.
" *Lentago*,	Linn.	Sweet Viburnum.
" *dentatum*,	Linn.	Arrow-wood.
" *acerifolium*,	Linn.	Maple-leaved Arrow-wood.
" *lantanoides*,	Michaux.	Hobble-bush.

RUBIACEÆ.

Galium asprellum,	Michaux.	Rough Bedstraw.
" *trifidum*,	Linn.	Small Bedstraw.
" *triflorum*,	Michaux.	Sweet-scented Bedstraw.
" *circæzans*,	Michaux.	Wild Liquorice.
" *latifolium*,	Michaux.	
" *boreale*,	Linn.	Northern Bedstraw.
Cephalanthus occidentalis,	Linn.	Button-bush.
Mitchella repens,	Linn.	Partridge-berry.

COMPOSITÆ.

Eupatorium purpureum,	Linn.	Trumpet-Weed.
" *perfoliatum*,	Linn.	Thoroughwort.
" *ageratoides*,	Linn.	White Snake-root.
Aster macrophyllus,	Linn.	*Large-leaved Aster.
" *cordifolius*,	Linn.	*Heart-leaved Aster.
" *miser*,	Linn., Aiton.	*Starved Aster.
" *tenuifolius*,	Linn.	*Slender-leaved Aster.
" *puniceus*,	Linn.	*Red-stalked Aster.
" *acuminatus*,	Michaux.	*Acuminate-leaved Aster.
Erigeron Canadense,	Linn.	Horse-weed.
" *Philadelphicum*,	Linn.	Fleabane.
" *annuum*,	Persoon.	Daisy Fleabane.
" *strigosum*,	Muhlenberg.	*Stigose Fleabane.
" *vernum*,	Torrey & Gray.	
Solidago bicolor,	Linn.	*Two-colored Golden-rod.
" *cæsia*,	Linn.	*Purple-stalked Golden-rod.
" *Muhlenbergii*,	Torrey & Gray.	*Muhlenberg's Golden-rod.
" *altissima*,	Linn.	*Tall Rough Golden-rod.
" *nemoralis*,	Aiton.	*Woolly-stalked Golden-rod.
" *Canadensis*,	Linn.	*Canadian Golden-rod.
" *serotina*,	Aiton.	*Late-flowering Golden-rod.
" *lanceolata*,	Linn.	*Bushy Golden-rod.
Inula Helenium,	Linn.	Common Elecompane.
Helianthus divaricatus,	Linn.	*Rough-leaved Sunflower.
" *decapetalus*,	Linn.	*Thin-leaved Sunflower.

COMPOSITÆ.

Bidens chrysanthemoides,	Linn.	Bur-Marigold.
" *bipinnata,*	Linn.	Spanish Needles.
Maruta Cotula,	De Candolle.	Common May-weed.
Achillea Millefolium,	Linn.	Common Yarrow.
Leucanthemum vulgare,	Lambert.	Ox-Eye Daisy.
Gnaphalium decurrens,	Ires.	Everlasting.
" *uliginosum,*	Linn.	Low Cudweed.
Antennaria margaritacea,	R. Brown.	Pearly Everlasting.
" *plantaginifolia,*	Hooker.	Plantain-leaved Everlasting.
Erecthites hieracifolia,	Rafinesque.	Fireweed.
Centaurea Cyanus,	Linn.	Bluebottle.
Cirsium lanceolatum,	Scopoli.	Common Thistle.
" *discolor,*	Sprengel.	Two-Coloured Thistle.
" *arvense,*	Scopoli.	Canada Thistle.
Lappa major,	Gærtner.	Common Burdock.
Hieracium Canadense,	Michaux.	Canada Hawkweed.
" *scabrum,*	Michaux.	Rough Hawkweed.
Nabalus albus,	Hooker.	Rattlesnake-root.
" *altissimus,*	Hooker.	Tall White Lettuce.
Taraxacum Densleonis,	Desfontaines.	Common Dandelion.
Lactuca elongata,	Muhlenberg.	Wild Lettuce.
Sonchus asper,	Villars.	Spring-leaved Sow-Thistle.

LOBELIACEÆ.

Lobelia cardinalis,	Linn.	Cardinal-flower.
" *inflata,*	Linn.	Indian Tobacco.

COMPANULACEÆ.

Companula aparinoides,	Pursh.	Marsh Bellflower.

ERICACEÆ.

Gaylussacia resinosa,	Torrey & Gray.	Black Huckleberry.
Vaccinium macrocarpon,	Aiton.	Common American Cranberry.
Chiogenes hispidula,	Torrey & Gray.	Creeping Snowberry.
Gaultheria procumbens,	Linn.	Creeping Wintergreen.
Pyrola rotundifolia,	Linn.	Round-leaved Pyrola.
" *elliptica,*	Nuttall.	Slim-leaf.
" *secunda,*	Linn.	One-sided Pyrola.
Moneses uniflora,	Salisbury.	One-flowered Pyrolla.
Chimaphila umbellata,	Nuttall.	Prince's Pine.
Monotropa uniflora,	Linn.	Indian Pipe.

AQUIFOLIACEÆ.

Ilex verticillata,	Gray ?	Black Alder.
Nemopanthes Canadensis,	De Candolle.	Mountain Holly.

PLANTAGINACEÆ.

Plantago major,	Linn.	Common Plantain.

PRIMULACEÆ.

Trinitalis Americana,	Pursh.	Star-flower.
Lysimachia stricta,	Aiton.	*Upright Loosestrife.
“ *ciliata,*	Linn.	*Ciliate Loosestrife.
Naumburgia thrysiflora,	Reichenb.	Tufted Loosestrife.

OROBANCHACEÆ.

Epiphegus Virginiana,	Barton.	Beech-drops.

SCROPHULARIACEÆ.

Verbascum Thapsus,	Linn.	Common Mullein.
Linaria Vulgaris,	Miller.	Toad-Flax.
Chelone glabra,	Linn.	Snake-head.
Mimulus ringens,	Linn.	Monkey-flower.
Veronica Anagallis,	Linn.	Water Speedwell.
“ *Americana,*	Schweinitz.	American Brookline.
“ *scutellata,*	Linn.	Marsh Speedwell.
“ *serphyllifolia,*	Linn.	Thyme-leaved Speedwell.
Pedicularis Canadensis,	Linn.	Common Lousewort.

VERBENACEÆ.

Verbena hastata,	Linn.	Blue Vervain.
“ *urticifolia,*	Linn.	White Vervain.
Phryma Leptostachya,	Linn.	Lopseed.

LABIATÆ.

Teucrium Canadense,	Linn.	American Germander.
Mentha Canadensis,	Linn.	Wild Mint.
Lycopus Virginicus,	Linn.	Bugle-weed.
“ *Europæus, sinuatus,*	Linn.	*Common Water Hoarhound.
Lophanthus scrophulariæfolius,	Bentham.	*Purple Giant Hyssop.
Nepeta Cataria,	Linn.	Catnip.
Brunella vulgaris,	Linn.	Common Self-heal.
Scutellaria galericulata,	Linn.	*Common Skullcap.
“ *lateriflora,*	Linn.	*Mad-dog Skullcap.
Galeopsis Tetrahit,	Linn.	Common Hemp-Nettle.
Strachys palustris, glabra,	Linn.	*Marsh Hedge Nettle.
Leonurus Cardiaca,	Linn.	Common Motherwort.

BORRAGINACEÆ.

Echium vulgare,	Linn.	Blue-weed.
Lythospermum officinale,	Linn.	Common Gromwell.
Echinospermum Lappula,	Lehmann.	Stickseed.
Cynoglossum officinale,	Linn.	Common Hound's-Tongue.
“ *Morisoni,*	De Candolle.	Beggar's Lice.

CONVOLVULACEÆ.

Calystegia sepium,	R. Brown.	Hedge Bindweed.

SOLONACEÆ.

Solanum Dulcamara,	Linn.	Bittersweet.
“ *nigrum,*	Linn.	Common Nightshade.

SOLONACEÆ.

Hyoscyamus niger,	Linn.	Black Henbane.
Datura Stramonium,	Linn.	Common Stramonium.

APOCYNACEÆ.

Apocynum androsæmifolium,	Linn.	Spreading Dogbane.

ASCLEPIADACEÆ.

Asclepias Cornuti,	Decaisne.	Common Milkweed.
“ *phytolacoides,*	Pursh.	Poke Milkweed.
“ *incarnata,*	Linn.	Swamp Milkweed.

OLEACEÆ.

Fraxinus Americana,	Linn.	White Ash.
“ *pubescens,*	Lamarck.	Red Ash.
“ *sambucifolia,*	Lamarck.	Black Ash.

ARISTOLOCHIACEÆ.

Asarum Canadense,	Linn.	Wild Ginger.

CHENOPODIACEÆ.

Chenopodium album.	Linn.	Lamb's Quarter.
Blitum capitatum,	Linn.	Strawberry Blite.

AMARANTACEÆ.

Amarantus hybridus,	Linn.	Green Amaranth.
“ *albus,*	Linn.	

POLYGONACEÆ.

Polygonum amphibium aquaticum,	Linn.	Water Persicaria.
“ “ *terrestre,*	Linn.	
“ *Persicaria,*	Linn.	Lady's Thumb.
“ *Hydropiper,*	Linn.	Smart-weed.
“ *acre,*	H. B. K.	Wild Smart-weed.
“ *aviculare,*	Linn.	Knotgrass.
“ *saggitatum,*	Linn.	Arrow-leaved Tear-Thumb.
“ *Convolvulus,*	Linn.	Black Bind-weed.
“ *cilinode,*	Michaud.	*Fringe-jointed Knotweed.
Rumex verticillatus,	Linn.	Swamp Dock.
“ *Hydrolapathum,*	Hudson.	Great Water-Dock.
Rumex crispus,	Linn.	Curled Dock.
“ *Acetosella,*	Linn.	Sheep Sorrel.

THYMELEACEÆ.

Dirca palustris,	Linn.	Leatherwood.

SANTALACEÆ.

Comandra umbellata,	Nuttall.	*Bastard Toad-flax.

EUPHORBIACEÆ.

Euphorbia Helioscopia,	Linn.	Sun Spurge.

URTICACEÆ.

Ulmus fulva,	Michaux.	Red Elm.
“ *Americana,*	Linn.	White Elm.
“ *racemosa,*	Thomas.	Corky White Elm.
Urtica gracilis,	Aiton.	Tall Wild Nettle.
“ *urens,*	Linn.	Small Stinging-Nettle.
Laportea Canadensis,	Gaudich.	Wood Nettle.
Pilea pumila,	Lindley.	Richweed.
Bœhmeria cylindrica,	Wildenow.	False Nettle.
Canabis sativa,	Linn.	Hemp.

JUGLANDACEÆ.

Juglans cinerea,	Linn.	Butternut.
Carya alba,	Nuttall.	Shell-bark Hickory.
“ *amara,*	Nuttall.	Bitter-nut.

CUPULIFEREÆ.

Quercus macrocarpa,	Michaux.	Bur-Oak.
“ *alba,*	Linn.	White Oak.
“ *rubra,*	Linn.	Red Oak.
Fagus ferrugina,	Aiton.	American Beech.
Corylus rostrata,	Aiton.	Beaked Hazel-nut.
Carpinus Americana,	Michaux.	Hornbeam, Water Beech.
Ostrya Virginica,	Wildenow.	Hop-Hornbean, Iron-wood.

BETULACEÆ.

Betula papyracea,	Aiton.	Paper Birch.
“ *excelsa,*	Aiton.	Yellow Birch.
“ *lenta,*	Linn.	Cherry Birch.
Alnus incana,	Wildenow.	Speckled or Hoary Alder.

SALICACEÆ.

Salix discolor,	Muhlenberg.	Glaucous Willow.
“ *rostrata,*	Richardson.	Long-beaked Willow.
“ *fragilis,*	Linn.	Brittle Willow.
“ *lucida,*	Muhlenberg.	Shining Willow.
“ *pedicellaris,*	Pursh.	Stalk-fruited Willow.
Populus tremuloides,	Michaux.	American Aspen.
“ *grandidentata,*	Michaux.	Large-toothed Aspen.
“ *balsamifera,*	Linn.	Balsam Poplar.

Salix Babylonica, S. Babylonica annularis, and *Populus dilitata* and *P. Alba,* are cultivated species growing here as indigenous.

CONIFERÆ.

Pinus strobus,	Linn.	White Pine.
Albies balsamea,	Marshall.	Balsam Fir.
“ *Canadensis,*	Michaux.	Hemlock Spruce.
Larix Americana,	Michaux.	American or Black Larch.
Thuja occidentalis,	Linn.	American Arbor Vitæ.

Taxus baccata, Linn. var. *Canadensis.* American Yew.

ARACEÆ.

Calla palustris,	Linn.	Water Arum.

TYPHACEÆ.

Typha latifolia,	Linn.	Common Cat-tail.
Sparganium ramosum,	Hudson.	*Branching Bur-Reed.

ALISMACEÆ.

Alisma Plantago,	Linn.	Water Plantain.
Sagitaria variabilis,	Englemann.	*Common Arrowhead.

ORCHIDACEÆ.

Orchis spectabilis,	Linn.	Showy Orchis.
Plantanthera Hookeri,	Lindley.	Smaller Two-leaved Orchis.
" *fimbriata,*	Lindley.	Larger Purple-fringed Orchis.
Goodyera pubescens,	R. Brown.	*Rattlesnake Plantain.
Spiranthes cernua,	Richardson.	*Nodding Ladies' Tresses.
Corallorhiza innata,	R. Brown.	*Vernal Coral-root.
" *multiflora,*	Nuttall.	*Large Coral-root.
Cypripedium parviflorum,	Salisbury.	Smaller Yellow Lady's Slipper.

IRIDACEÆ.

Iris versicolor,	Linn.	Larger Blue Flag.
Sisyrinchium Bermudiana,	Linn.	Blue-eyed Grass.

SMILACEÆ.

Smilax herbacea,	Linn.	Carrion-Flower.
Trillium erectum,	Linn.	Purple Trillium.
" *grandiflorum,*	Salisbury.	Large White Trillium.
" *erythrocarpum,*	Michaud.	Painted Trillium.
Medeola Virginica,	Linn.	Indian Cucumber-root.

LILIACEÆ.

Polygonatum biflorum,	Elliott.	Smaller Solomon's Seal.
Smilacina racemosa,	Desfontaines.	False Spikenard.
" *bifolia,*	Ker.	*Two-leaved Smilacina.
Clintonia borealis,	Rafinesque.	*Large-flowered Clintonia.
Allium tricoccum,	Aiton.	Wild Leek.
Erythronium Americanum,	Smith.	Yellow Adder's-tongue.

MELANTHACEÆ.

Uvuleria grandiflora,	Smith.	Large-flowered Bellwort.
Streptopus roseus,	Michaux.	*Rose Twisted Stalk.

JUNCACEÆ.

Juncus effusus,	Linn.	Common or Soft Rush.
" *Balticus,*	Wildenow.	*Baltic Rush.
" *scirpoides,*	Lamarck.	
" *nodosus,*	Linn.	*Knotty Rush.
" *tenuis,*	Willdenow.	*Slender Rush.
" *bufonius,*	Linn.	*Toad Rush.

CYPERACEÆ.

Cyperus inflexus,	Muhlenberg.	*Dwarf Odorous Galingale.
Dulichium spathaceum,	Persoon.	*Dulichium.
Eleocharis obtusa,	Schultes.	*Obtuse Spike Rush.
" *palustris,*	R. Brown.	*Common Spike Rush.
Scirpus lacustris,	Linn.	Bulrush.
" *Eriophorum,*	Michaux.	Wool-Grass.
Eriophorum Virginicum,	Linn.	*Rusty Cotton-Grass.
" *gracile,*	Koch.	
Carex crinita,	Lamarck.	*Fringed Sedge.
" *lacustris,*	Wildenow,	*Lake Sedge.
" *hystricina,*	Wildenow.	*Porcupine Sedge.
" *tentaculata,*	Muhlenberg.	*Long-pointed Sedge.
" *intumescens,*	Rudge.	*Swollen Sedge.
" *lupulina,*	Muhlenberg.	*Hop-like Sedge.
" *rostrata,*	Schweintz.	*Beaked Sedge.
" *cylindrica,*	Schweintz.	*Cylindrical Sedge.

GRAMINEÆ.

Leersia oryzoides,	Swartz.	Rice Cut-Grass.
Phleum pratense,	Linn.	Timothy.
Agrostis vulgaris,	With.	Red-Top.
" *alba,*	Linn.	White Bent-Grass.
Oryzopsis melanocarpa,	Muhlenberg.	*Black-fruited Mountain Rice.
Glyceria Canadensis,	Trinius.	Rattlesnake-Grass.
" *nervata,*	Trinius.	*Nervel Mana-Grass.
" *aquatica,*	Smith.	Reed Meadow-Grass.
" *fluitans,*	R. Brown.	*Common Manna-Grass.
Poa serotina,	Ehrhart.	False Red-Top.
" *pratensis,*	Lion.	Common Meadow-Grass.
" *compressa,*	Linn.	Blue Grass.
Bromus secalinus,	Linn.	Chess.
Triticum repens,	Linn.	Couch-Grass.
Hordeum jubatum,	Linn.	Squirrel-Tail Grass.
Gymnostichum Hystrix,	Schreber.	Bottle-brush Grass.
Phalaris arundinacea,	Linn.	Red Canary-Grass.
" *Canariensis,*	Linn.	Canary-Grass.
Panicum capillare,	Linn.	*Hair-stalked Panic-Grass.
" *dichotomum,*	Linn.	*Hairy Panic-Grass.
" *Crus-galli,*	Linn.	Barnyard-Grass.
Setaria glauca,	Palisot de Beauvois.	Foxtail.
" *viridis,*	Palisot de Beauvois,	Green Foxtail.

EQUISETACEÆ.

Equisetum arvense,	Linn.	*Field Horse-tail.
" *sylvaticum,*	Linn.	*Wood Horse-tail.
" *hyemale,*	Linn.	Scouring Rush.
" *scirpoides,*	Michaux.	*Smallest Rough Horse-tail.

FILICES.

Polypodium Dryopteris,	Linn.	*Three-branched Polypody.
Pteris aquilina,	Linn.	Common Brake.
Adiantum pedatum,	Linn.	Maidenhair.
Asplenium thelypteroides,	Michaux.	*Thelypteris-like Spleenwort.
" *Filix fœmina,*	R. Brown.	Female Spleenwort.
Cystopteris bulbifera,	Bernhardi.	*Bulb-bearing Bladder-Fern.
Aspidium Thelypteris,	Swartz.	*Marsh Shield-Fern.
" *spinulosum,*	Swartz.	*Dilated Shield-Fern.
" *cristatum,*	Swartz.	*Crested Shield-Fern.
" *acrostichoides,*	Swartz.	*Terminal Shield-Fern.
" *marginale,*	Swartz.	*Marginal Shield-Fern.
Onoclea sensibilis,	Linn.	*Sensitive Fern.
Osmunda regalis,	Linn.	Flowering Fern.
Osmunda Claytoniana,	Linn.	*Interrupted Flowering Fern.
Osmunda cinnamonea,	Linn.	Cinnamon Fern.
Botrychium Virginicum,	Swartz.	Rattlesnake Fern.

LYCOPODIACEÆ.

Lycopodium lucidulum,	Michaux.	*Shining Club-Moss.
" *annotinum,*	Linn.	*Interrupted Club-Moss.
" *dendroideum,*	Michaux.	Ground-Pine.
" *clavatum,*	Linn.	Common Club-Moss.

MUSCI.

Sphagnum acutifolium,	Ehrhart.
Trichostomum vaginans,	Sullivant.
Tetraphis pellucida,	Hedwig.
Polytrichum juniperinum,	Hedwig.
Timmia megapolitana,	Hedwig.
Bryum pyriforme,	Hedwig.
Mnium offine,	Bland.
Funaria hygrometrica,	Hedwig.
Cryphœa glomerata,	W. P. Schimper.
Pylaisœa intricata,	Bryol Europ.
Platygyrium repens,	Bryol Europ.
Climacium dendroides,	Weber & Mohr.
Hypnum tamariscinum,	Hedwig.
" *uncinatum,*	Hedwig.

HEPATICÆ.

Madotheca platyphylla,	Dumort.
Marchantia polymorpha,	Linn.

The orders *Cyperaceæ, Graminæ, Musci,* and *Hepaticæ,* as also the genus *Salix,* would require a suplementary list, which I intend to supply at some future time.

ART. VII.—*Professor Owen on the Classification of the Mammalia.*

None of our living Naturalists displays a greater mastery over those general truths that relate to the difficult subject of classification, than Professor Owen, and we are especially indebted to him for asserting that predominance of the brain and nervous system, in indicating the real affinities of animals, which is one of the leading truths of modern Zoology. The nervous system is the primary material element in the animal, that which marks more than any other its grade of intelligence and consequent rank in nature. It is thus the basis of the animal frame; and though less obvious than the skeleton and other superadded structures, is really that which has moulded their form and proportions. No one ground of arrangement will suffice to express all those grades of relationship impressed on animals by their Maker, and perceptible by us; but some are more general and important than others; and we have long thought that the nervous system bears to the whole the relation of a grand dominant end to which all others have been bent and made subservient.

In an elaborate paper communicated to the Linnean Society, Professor Owen has applied this principle of arrangement to the mammals; and we commend the following extracts, giving a sketch of his views, to all of our readers who take an interest in Zoology.

Primary Divisions of the Mammalia.—The question or problem of the truly natural and equivalent primary groups of the class *Mammalia* has occupied much of my consideration, and has ever been present to my mind when gathering any new facts in the anatomy of the Mammalia, during dissections of the rarer forms which have died at the Zoological Gardens, or on other opportunities.

The peculiar value of the leading modifications of the mammalian brain, in regard to their association with concurrent modifications in other important systems of organs, was illustrated in detail in the Hunterian Course of Lectures on the Comparative Anatomy of the Nervous System, delivered by me at the Royal College of Surgeons in 1842. The ideas which were broached or suggested, during the delivery of that course, I have tested by every subsequent acquisition of anatomical knowledge, and now feel myself justified in submitting to the judgment of the Linnean Society, with a view to publication, the following fourfold primary division of the mammalian class, based upon the four leading modifications of cerebral structure in that class.

The brain is that part of the organization which, by its superior development, distinguishes the Mammalia from all the inferior classes of VERTEBRATA; and it is that organ which I now propose to show to be the one that by its modifications marks the best and most natural primary divisions of the class.

In some mammals the cerebral hemispheres are but feebly and partially connected together by the 'fornix' and 'anterior commissure;' in the rest of the class a part called 'corpus callosum' is added, which completes the connecting or 'commissural' apparatus.

With the absence of this great superadded commissure is associated a remarkable modification of the mode of development of the offspring, which involves many other modifications; amongst which are the presence of the bones called 'marsupial,' and the non-development of the deciduous body concerned in the nourishment of the progeny before birth, called 'placenta;' the young in all this 'implacental' division being brought forth prematurely, as compared with the rest of the class.

This first and lowest primary group, or subclass, of Mammalia may be termed, from its cerebral character, *Lyencephala*,—signifying the comparatively loose or disconnected state of the cerebral hemispheres. The size of these hemispheres (fig. 1, A) is such that they leave exposed the olfactory ganglions (*a*), the cerebellum (C), and more or less of the optic lobes (B); their surface is generally smooth; the anfractuosities, when present, are few and simple.

The next well-marked stage in the development of the brain is where the corpus callosum (indicated in fig. 2, by the dotted lines *d*, *d*) is present, but connects cerebral hemispheres as little advanced in bulk or outward character as in the preceding subclass; the cerebrum (A) leaving both the olfactory lobes (*a*) and cerebellum (C) exposed, and being commonly smooth, or with few and simple convolutions in a very small proportion, composed of the largest members of the group. The mammals so characterized constitute the subclass *Lissencephala*, (fig. 2).

In this subclass the testes are either permanently or temporarily concealed in the abdomen: there is a common external genito-urinary aperture in most; two precaval veins ('superior' or 'anterior venæ') terminate in the right auricle. The squamosal in many, retain their primitive separation as distinct bones. The orbits have not an entire rim of bone. Besides these more general characters by which the Lissencephala, in common with the Lyencephala, resemble Birds and Reptiles, there are many other remarkable indications of their affinity to the Oviparous Vertebrata in particular orders or genera of the subclass. Such, *e. g.*, are the cloaca, convoluted trachea, supernumerary cervical vertebræ and their floating ribs, in the 3-toed Sloth; the irritability of the muscular fibre, and persistence of contractile power in the Sloths and some other Bruta; the long, slender, beak-like edentulous jaws and gizzard of the Anteaters; the imbricated scales of the equally edentulous Pangolins, which have both gizzard and gastric glands like the proventricular ones in birds; the dermal bony armour of the Armadillos like that of loricated Saurians; the quills of the Porcupine and Hedgehog; the proventriculus of the Dormouse and Beaver; the prevalence of disproportionate development of the hind-limbs in the *Rodentia*; coupled, in the Jerboa, with confluence of the three chief metatarsals into one bone, as in birds; the keeled sternum and wings of the Bats; the aptitude of the *Cheiroptera*, *Insectivora*, and certain *Rodentia* to fall, like Reptiles, into a state of true-torpidity, associated with a corresponding faculty of the heart to circulate carbonized or black blood:—these, and the like indications of co-affinity with the *Lyencephala* to the Oviparous air-breathing Vertebrata, have mainly prevailed with me against an acquiescence in the elevation of different groups of the Lissencephala to a higher place in the Mammalian series, and in their respective association, through some single character, with better-brained orders, according to Mammalogical systems which, at different times, have been proposed by zoologists of deserved reputation. Such, *e.g.*, as the association of the long-clawed *Bruta* with the *Ungulata*, and of the shorter-clawed Shrews, Moles and Hedgehogs, as well as the Bats, with the *Carnivora*; of the Sloths with the *Quadrumana*; of the Bats with the same high order; and of the *Insectivora* and *Rodentia* in immediate sequence after the Linnean 'Primates,' as in the latest published 'System of Mammalogy,' from a distinguished French author.

The third leading modification of the Mammalian cerebrum is such an increase in its relative size, that it extends over more or less of the cerebellum; and generally more or less over the olfactory lobes. Save in very few exceptional cases of the smaller and inferior forms of *Quadrumana* (fig. 3) the superficies is folded into more or less numerous gyri or convolutions,—whence the name *Gyrencephala*, which I propose for the third subclass of Mammalia (fig. 4.)

In this subclass we shall look in vain for those marks of affinity to the *Ovipara*, which have been instanced in the preceding subclasses. The testes are, indeed concealed, and through an obvious adaptive principle, in the Cetacea; but, in the rest of the subclass, with the exception of the Elephants, they pass out of the abdomen, and the Gyrencephalous quadrupeds, as a general rule, have a scrotum. The vulva is externally distinct from the anus. With the exception, again, of the Elephants, the blood from the head and anterior limbs is returned tc the right auricle by a single precaval trunk. The mammalian modification of the Vertebrate type attains its highest physical perfection in the *Gyrencephala*, as manifested by the bulk of some, by the destructive mastery of others, by the address and agility of a third order. And, through the superior psychological faculties—an adaptive intelligence predominating over blind instinct—which are associated with the higher development of the brain, the *Gyrencephala* afford those species which have ever formed the most cherished companions and servitors, and the most valuable sources of wealth and power, to Mankind.

In Man the brain presents an ascensive step in development, higher and more strongly marked than that by which the preceding subclass was distinguised from the one below it. Not only do the cerebral hemispheres (figs. 5 & 6, A) overlap the olfactory lobes and cerebellum, but they extend in advance of the one, and further back than the other (fig. 6, c). Their posterior development is so marked, that anatomists have assigned to that part the character of a third lobe; it is peculiar to the genus *Homo*, and equally peculiar is the 'posterior horn of the lateral ventricle,' and the 'hippocampus minor,' which characterize the hind lobe of each hemisphere. The superficial grey matter of the cerebrum, through the number and depth of the convolutions, attains its maximum of extent in Man.

Peculiar mental powers are associated with this highest form of brain, and their consequences wonderfully illustrate the value of the cerebral character; according to my estimate of which, I am led to regard the genus *Homo*, as not merely a representative of a distinct order, but of a distinct subclass of the Mammalia, for which I propose the name of '*Archencephala*,' (fig. 6).

Prosessor Owen then proceeds to subdivide his primary groups into orders. We can only give extracts bearing upon groups of special interest.

LYENCEPHALA.

In the Lyencephalous Mammalia some have the 'optic lobe' simple, others partly subdivided, or complicated by accessory ganglions, whence they are called 'bigeminal bodies.' The Lycenephala with simple optic lobes are 'edentulous' or without calcified teeth, are devoid of external ears, scrotum, nipples, and marsupial pouch: they are true 'testiconda;' they have a coracoid bone extending from the scapula to the sternum, and also an epicoracoid and episternum, as in Lizards; they are unguiculate and pentadactyle, with a supplementary tarsal bone supporting a perforated spur in the male. The order so characterized is called 'MONOTREMATA,' in reference to the single excretory and generative outlet, which, however, is by no means peculiar to them among Mammalia. The Monotremes are insectivorous, and are strictly limited to Australia and Tasmania.

The MARSUPIALIA are Mammals distinguished by a peculiar pouch or duplicature of the abdominal integument, which in the males is everted, forming a pendulous bag containing the testes; and in the females is inverted, forming a hidden pouch containing the nipples and usually sheltering the young for a certain period after their birth: they have the marsupial bones in common with the Monotremes; a much-varied dentition, especially as regards number of incisors, but usually including 4 true molars; and never more than 3 premolars: the angle of the lower jaw is more or less inverted.

With the exception of one genus, *Didelphys*, which is American, and another genus *Cuscus*, which is Malayan, all the known existing Marsupials belong to Australia, Tasmania, and New Guinea. The grazing and browsing Kangaroos are rarely seen abroad in full daylight, save in dark rainy weather. Most of the Marsupialia are nocturnal. Zoological wanderers in Australia, viewing its plains and scanning its scrubs by broad daylight, are struck by the seeming absence of mammalian life; but during the brief twilight and dawn, or by the light of the moon, numerous forms are seen to emerge from their hiding-places and illustrate the variety of marsupial life with which many parts of the continent abound. We may associate with their low position in the mammalian scale the prevalent habit amongst the Marsupialia of limiting the exercise of the faculties of active life to the period when they are shielded by the obscurity of night.

LISSENCEPHALA.

The Lissencephala or smooth-brained Placentals form a group which I consider as equivalent to the Lyencephala or Implacentals; and which includes the following orders, *Rodentia*, *Insectivora*, *Cheiroptera* and *Bruta*. The RODENTIA are characterized by two large and long curved incisors in each jaw, separated by a wide interval from the molars; and these teeth are so constructed, and the jaw is so articulated, as to serve in the reduction of the food to small particles by acts of rapid and continued gnawing, whence the name of the order. The orbits are not separated from the temporal fossæ. The testes pass periodically from the abdomen into a temporary scrotum, and are associated with prostatic and vesicular glands. The placenta is commonly discoid, but is sometimes a circular mass (Cavy), or flattened and divided into three or more lobes (Lepus). The Beaver and Capybara are now the giants of the order, which chiefly consists of small, numerous, prolific and diversified unguiculate genera, subsisting wholly or in part on vegetable food. Some Rodents, *e. g.* the Lemmings, perform remarkable migrations, the impulse to which, unchecked by dangers or any surmountable obstacles, seems to be mechanical. Many Rodents build very artificial nests, and a few manifest their constructive instinct in association. In all these inferior psychical manifestations we are reminded of Birds. Many Rodents hibernate like Reptiles. They are distributed over all continents.

The transition from the Marsupials to the Rodents is made by the Wombats; and the transition from the Marsupials is made, by an equally easy step, through the smaller Opossums to the INSECTIVORA. This term is given to the order of small smooth-brained Mammals, the molar teeth of which are bristled with cusps, and are associated with canines and incisors; they are unguiculate, plantigrade, and pentadactyle, and they have complete clavicles. The testes pass periodically from the abdomen into a temporary scrotum, and are associated with large prostatic and vesicular glands: like most other *Lissencephala*, the Insectivora have a discoid or cup-shaped placenta. Their place and office in South America and Australia are fulfilled by Marsupialia; but true Insectivora exist in all the other continents.

The order CHEIROPTERA, with the exception of the modification of their digits for supporting the large webs that serve as wings, repeat the chief characters of the Insectivora; but a few of the larger species are frugivorous and have corresponding modifications of teeth and stomach. The mammæ are pectoral in position, and the penis is pendulous in all Cheiroptera. The most remarkable examples of periodically torpid Mammals are to be found in the terrestrial and volant Insectivora. The frugivorous Bats differ much in dentition from the true Cheiroptera, and would seem to conduct through the Colugos or Flying Lemurs, directly to the Quadrumanous order. The Cheiroptera are cosmopolitan.

The order BRUTA, called *Edentata* by Cuvier, includes two genera which are devoid of teeth; the rest possess those organs, which, however, have no true enamel, are never displaced by a second series, and are very rarely implanted in the premaxillary bones. All the species have very long and strong claws. The ischium as well as the ilium unites with the sacrum; the orbit is not divided from the temporal fossa. I have already adverted to the illustration of affinity to the oviparous Vertebrata which the Three-toed Sloths afford by the supernumerary cervical vertebræ supporting false ribs and by the convolution of the windpipe in the thorax; and I may add that the unusual number—three and twenty pairs—of ribs, forming a very long dorsal, with a short lumbar region of the spine in the Two-toed Sloth, recalls a lacertine structure. The same tendency to an inferior type is shown by the abdominal testes, the single cloacal outlet, the low cerebral development, the absence of medullary canals in the long bones in the Sloths, and by the great tenacity of life and long-enduring irritability of the muscular fibre, in both the Sloths and Anteaters.

The order Bruta is but scantily represented at the present period. One genus, *Manis* or Pangolin, is common to Asia and Africa; the *Orycteropus* is peculiar to South Africa; the rest of the order, consisting of the genera *Myrmecophaga*, or true Anteaters, *Dasypus* or Armadillos, and *Bradypus* or Sloths, are confined to South America.

GYRENCEPHALA.

In next proceeding to consider the subdivisions of the Gyrencephala, we seem at first to descend in the scale in meeting with a group of animals in that subclass, having the form of Fishes; but a high grade of mammalian organization is masked beneath this form. The Gyrencephala are primarily subdivided, according to modifications of the locomotive organs, into three series, for which the Linnean terms may well be retained; viz. *Mutilata*, *Ungulata* and *Unguiculata*, the maimed, the hoofed, and the clawed series.

These characters can only be applied to the Gyrencephalous subclass; *i. e.* they do not indicate natural groups, save in that section of the Mammalia. To associate the Lyencephala and Lissencephala with the unguiculate Gyrencephala into one great primary group, as in the Mammalian systems of Ray, Linnæus and Cuvier, is a misapplication of a solitary character akin to that which would have founded a primary division on the discoid placenta or the diphyodont dentition. No one has proposed to associate the unguiculate Bird or Lizard with the unguiculate Ape; and it is but a little less violation of natural affinities to associate the Monotremes with the Quadrumanes in the same primary (unguiculate) division of the Mammalian class.

The three primary divisions of the Gyrencephala are of higher value than the ordinal divisions of the Lissencephala; just as those orders are of higher value than the representative families of the Marsupials.

The *Mutilata*, or the maimed Mammals with folded brains, are so called because their hind-limbs seem, as it were, to have been amputated; they possess only the pectoral pair of limbs, and these in the form of fins: the hind end of the trunk expands into a broad, horizontally flattened, caudal fin. They have large brains with many and deep convolutions, are naked, and have neither neck, scrotum, nor external ears.

The first order, called CETACEA, in this divison are either edentulous or monophyodont, and with teeth of one kind and usually of simple form. They are testiconda and have no 'vesiculæ seminales.' The mammæ are pudendal; the placenta is diffused; the external nostrils—single or double—are on the top of the head, and called spiracles or "blow-holes." They are marine, and, for the most part, range the unfathomable ocean; though with certain geographical limits as respects species. They feed on fishes or marine animals.

The second order, called SIRENIA, have teeth of different kinds, incisors which are preceded by milk-teeth, and molars with flattened or ridged crowns, adapted for vegetable food. The nostrils are two, situated at the upper part of the snout; the lips are beset with stiff bristles; the mammæ are pectoral; the testes are abdominal, as in the Cetacea, but are associated with vesiculæ seminales. The Sirenia exist near coasts or ascend large rivers; browsing on fuci, water plants or the grass of the shore. There is much in the organization of this order that indicates its affinity to members of the succeeding division.

In the *Ungulata* the four limbs are present, but that portion of the toe which touches the ground is incased in a hoof, which blunts its sensibility and deprives the foot of prehensile power. With the limbs restricted to support and locomotion, the Ungulata have no clavicles; the fore-leg remains constantly in the state of pronation, and they feed on vegetables.

The third division of the *Gyrencephala* enjoy a higher degree of the sense of touch through the greater number and mobility of the digits, and the smaller extent to which they are covered by horny matter. This substance forms a single plate, in the shape of a claw or nail, which is applied to only one of the surfaces of the extremity of the digit, leaving the other, usually the lower, surface possessed of its tactile faculty; whence the name *Unguiculata*, applied to this group, however, is more restricted and natural than the group to which Linnæus extended the term. All the species are 'diphyodont,' and the teeth have a simple investment of enamel.

The first order, CARNIVORA, includes the beasts of prey, properly so called. With the exception of a few Seals, the incisors are $\frac{3-3}{3-3}$ in number; the canines $\frac{1-1}{1-1}$, always longer than the other teeth, and usually exhibiting a full and perfect development as lethal weapons; the molars graduate from a trenchant to a tuberculate form, in proportion as the diet deviates from one strictly of flesh to one of a more miscellaneous kind. The clavicle is rudimental or absent; the innermost digit is often rudimental or absent; they have no vesiculæ seminales; the teats are abdominal; the placenta is zonular. The Carnivora are divided, according to modifications of the limbs, into 'pinnigrades,' 'plantigrades' and 'digitigrades.' In the Pinnigrades (Walrus, Seal-tribe) both fore and hind feet are short, and expanded into broad, webbed paddles for swimming, the hinder ones being fettered by continuation of integument to the tail. In the Plantigrades (Bear-tribe) the whole or nearly the whole of the hind foot forms a sole, and rests on the ground. In the Digitigrades (Cat-tribe, Dog-tribe, &c.) only the toes touch the ground, the heel being much raised.

It has been usual to place the Plantigrades at the head of the Carnivora, apparently because the higher order, Quadrumana, is plantigrade; but the affinities of the Bear, as evidenced by internal structure, *e.g.* the renal and genital organs, are closer to the

Seal-tribe ; the broader and flatter pentadactyle foot of the plantigrade is nearer in form to the flipper of the Seal than is the more perfect digitigrade, retractile clawed, long and narrow hind foot of the feline quadruped, which is the highest and most typical of the Carnivora.

The next perfection which is superinduced upon the unguiculate limb is such a modification in the size, shape, position, and direction of the innermost digit, that it can be opposed, as a thumb, to the other digits, thus constituting what is properly termed a 'hand.' Those Unguiculates which have both fore and hind limbs so modified, or at least the hind limbs, form the order QUADRUMANA.

ARCHENCEPHALA.

The structural modifications in the genus *Homo*,—the sole representative of the *Archencephala*,—more especially of the lower limb, by which the erect stature and bipedal gait are maintained, are such as to claim for MAN ordinal distinction on merely external zoological characters. But as I have already argued, his psychological powers, in association with his extraordinarily developed brain, entitle the group which he represents to equivalent rank with the other primary divisions of the class *Mammalia* founded on cerebral characters. In this primary group Man forms but one genus, *Homo*, and that genus but one order, called BIMANA, on account of the opposable thumb being restricted to the upper pair of limbs. The testes are scrotal ; their serous sac does not communicate with the abdomen ; they are associated with vesicular and prostatic glands. The mammæ are pectoral. The placenta is a single, subcircular, cellulo-vascular, discoid body.

Man has only a partial covering of hair, which is not merely protective of the head, but is ornamental and distinctive of sex. The dentition of the genus *Homo* is reduced to thirty-two teeth by the suppression of the outer incisor and the first two premolars of the typical series on each side of both jaws, the dental formula being :

$$i. \frac{2-2}{2-2},\ c. \frac{1-1}{1-1},\ p. \frac{2-2}{2-2},\ m. \frac{3-3}{3-3} = 32.$$

All the teeth are of equal length, and there is no break in the series ; they are subservient in Man not only to alimentation, but to beauty and to speech.

The human foot is broad, plantigrade, with the sole not inverted as in *Quadrumana*, but applied flat to the ground; the leg bears vertically on the foot; the heel is expanded beneath; the toes are short, but with the innermost longer and much larger than the rest, forming a 'hallux' or great toe, which is placed on the same line with, and cannot be opposed to, the other toes; the pelvis is short, broad, and wide, keeping well apart the thighs; and the neck of the femur is long, and forms an open angle with the shaft, increasing the basis of support for the trunk. The whole vertebral column, with its slight alternate curves, and the well-poised, short, but capacious subglobular skull, are in like harmony with the requirements of the erect position. The widely-separated shoulders, with broad scapulæ and complete clavicles, give a favourable position to the upper limbs, now liberated from the service of locomotion, with complex joints for rotatory as well as flexile movements, and terminated by a hand of matchless perfection of structure, the fit instrument for executing the behests of a rational intelligence and a free will. Hereby, though naked, Man can clothe himself, and rival all native vestments in warmth and beauty; though defenceless, Man can arm himself with every variety of weapon, and become the most terribly destructive of animals. Thus he fulfils his destiny as the supreme master of this earth, and of the lower Creation.

In these endeavours to comprehend how Nature has associated together her mammalian forms, the weary student quits his task with a conviction that, after all, he has been rewarded with but an imperfect view of such natural association. The mammalian class has existed, probably from the triassic, certainly from the lower olitic period; and has changed its generic and specific forms more than once in the long lapse of ages, during which life-work has been transacted on this planet by animals of that high grade of organization. Not any of the mammalian genera of the secondary periods occur in the tertiary ones. No genus found in the older eocenes (plastic and septarial clays, &c.) has been discovered in the newer eocenes. Extremely few eocene genera occur in miocene strata, and none in the pliocene. Many miocene genera of Mammalia are peculiar to that division of the tertiary series. Species indistinguishable from existing ones begin to appear only in the newer pliocene beds. Whilst some groups, as *e. g.* the Perissodactyles and omnivorous Artiodactyles, have been gradually dying out, other groups, as *e. g.* the true Ruminants, have been augmenting in genera and species.

In many existing genera of different orders there is a more specialized structure, a greater deviation from the general type, than in the answering genera of the miocene and eocene periods; such later and less typical Mammalia do more effective work by their more adaptively modified structures. The Ruminants, *e. g.* more effectually digest and assimilate grass, and form out of it a more nutritive and sapid kind of meat, than did the antecedent more typical or less specialized non-ruminant Herbivora.

The monodactyle Horse is a better and swifter beast of draught and burthen than its tridactyle predecessor the miocene *Hipparion* could have been. The nearer to a Tapir or a Rhinoceros in structure, the further will an equine animal be left from the goal in contending with a modern Racer. The genera *Felis* and *Machairodus*, with their curtailed and otherwise modified dentition and short strong jaws, become, thereby, more powerfully and effectively destructive than the eocene *Hyænodon*, with its typical dentition and three carnassial teeth on each side of its concommitantly prolonged jaws could have been.

Much additional and much truer insight has, doubtless, been gained into the natural grouping of the Mammalia since palæontology has expanded our survey of the class; but our best-characterized groups do but reflect certain mental conceptions, which must necessarily relate to incomplete knowledge, and that as acquired at a given period of time. Thus the order which Cuvier deemed the most natural one in the class *Mammalia* becomes the debris of a group, known at a subsequent period to be a more natural order.

We cannot avoid recognizing, in the scheme which I now submit, the inequality which reigns amongst the groups, which our present anatomical knowledge leads us to place in one line or parallel series as orders. I do not mean mere inequality as respects the number and variety of families, genera, and species of such orders, because the paucity or multitude of instances manifesting a given modification or grade of structure in no essential degree affects the value of such grade or modification.

The order *Monotremata* is not the less ordinally distinct from the *Marsupialia*, because it consists of but two genera, nor is the order *Bimana* from that of *Quadrumana*, because it includes only a single genus. So likewise the anatomical peculiarities of the *Proboscidia*, *Sirenia*, and *Toxodontia* call, at least, for those general terms, to admit of the convenient expression of general propositions respecting them; and some of these general propositions are of a value as great as the organic characters of more expanded orders.

There are residuary or aberrant forms in some of the orders, which, to the systematist disagreeably, compel modifications of the characters that would apply to the majority of such orders. The flying Lemurs (*Galeopitheci*), the rodent Lemurs (*Cheiromys*), the slow Lemurs (*Loris*, *Otolicnus*), forbid any generalization as to teeth or nails in the *Quadrumana*, whilst they continue associated with that order by the character of the hinder thumb; which, by the way, they possess in common with the pedimanous Marsupials. The large, volant, frugivorous Bats (*Pteropus*) are equally opposed to the application of a common dental character to the *Cheiroptera*. They are associated with the insectivorous Bats on account of the common external form arising out of the modification of their locomotive organs for flight, just as the Dugongs and Manatees are associated with the *Cetacea* on account of their resemblance to Fishes arising out of the same modification of the locomotive system for an aquatic existence. The herbivorous *Cetacea* are now separated from the piscivorous *Cetacea* as a distinct order; and with almost as good reason we might separate the frugivorous from the insectivorous *Cheiroptera*; the cases are very nearly parallel.

Nature, in short, is not so rigid a systematist as Man. There are peculiar conditions of existence which she is pleased shall be enjoyed by peculiarly modified mammals; these peculiarities break through the rules of structure which govern the majority of species existing and subsisting under the more general conditions of existence, to which the larger groups of Mammalia are respectively adjusted.

One class of organs seems to govern one order, another class another order; the dental system, which is so diversified in the *Marsupialia* and *Bruta*, is as remarkable for its degree of constancy in the *Rodentia* and *Insectivora*. But, as a general rule, the characters from the dental, locomotive, and placental systems are more closely correlated in the Gyrencephalous orders than in those in the inferior subclasses of the Mammalia.—*Journal Linnean Society.*

ARTICLE VIII.—*On a method of Preparing and Mounting Hard Tissues for the Microscope;* by CHRISTOPHER JOHNSTON, M.D.*

Having for several years occupied my leisure moments with what are usually denominated "microscopical studies," I beg leave to offer, as the result of successful experience, a simple and certain method of preparing and mounting *hard tissues*, such as bone, teeth, shells, fossilized wood, &c.

I am aware that treatises upon the microscope give a few indications for making sections and embalming them in Canada balsam; but they are unsatisfactory either by reason of their brevity or their want of precision. Specimens may be procured ready-made from the hands of Topping, Bourgogne and others, but while they are expensive, persons in remote situations are obliged to purchase by catalogue without the opportunity of selection. Besides, it is oftentimes difficult or else impossible to obtain series of particular objects, so that the student must either limit his researches or "prepare" for himself: in the latter case he may increase his number of objects indefinitely, and supply himself with many such as are not attainable from abroad, and divided in any direction he may require.

A microscopic section should be as thin as the structure of the object will allow, of uniform thickness, and polished on both sides, whether it be mounted in the dry way or in balsam. To meet these requirements I proceed as follows :—

Being provided with

1. A coarse and a fine 'Kansas hone, kept dressed *flat* with fine emery;

2. A long fine Stub's dentist's file;

3. A thin dividing file and fine saw;

4. Some Russian isinglass boiled, strained, and mixed with alcohol sufficient to form a *tolerably* thick jelly when cold;

5. A small quantity of Canada balsam;

6. Slides: 7. Clover glass.

8. One ounce of chloroform; 9. One of F.F. aqua ammonia.

10. Some fragments of thick plate (mirror) glass 1 inch square or 1 by 2 inches; and finally,

11. An ounce of "dentist's silex," and

12. Thin French letter paper, of which 500 or more leaves are required to fill up the space of an inch: I examine the object and decide upon the plane of the proposed section.

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* From *Silliman's Journal.*

Coarse approximative sections may be obtained with the saw or dividing file (excepting silicified substances), but these instruments are not applicable to longitudinal sections of small human or other teeth, small bones, &c. Take now the object in the fingers if sufficiently large, and grind it upon the coarse hone with water, to which add "silex" if necessary, until the surface coincides with the intended plane. Wash carefully: finish upon the finer hone; and polish upon soft linen stretched upon a smooth block.

If the object be too small to admit of immediate manipulation it should be fastened upon a piece of glass with isinglass—or what is better, upon thin paper well glued with the same substance upon glass; and a piece of thick paper or visiting card, perforated with a free aperture for the object, must be attached to the first paper. This is the *guard*, down to which the specimen must be ground with oil: and its thickness and the disposal of the object require the exercise of good judgment. Hot water will release everything; and chloroform remove the grease from the specimen, which, like that ground with water, is ready for the second part of the process.

2d. Carefully cover the surface of a piece of the plate glass with thin French letter paper; next apply a paper *guard*, as before stated, but not thicker, for teeth and bone, than $\frac{1}{500}$th inch; then trace a few lines with a lead pencil upon the first paper in the little space left in the *guard* so that the increasing transparency of a specimen being prepared may be appreciated; and finally moisten the "space" with isinglass to the extent of the object, which must be delicately brushed over on the ground surface and at the *edges* with tolerably thin isinglass before it is cemented in its place. Gentle pressure should now be employed, and maintained with a wire spring, or thread wound round about.

In two or three hours the second side may be ground in oil; silex may be employed at first, or even a file; but these means must not be persevered in, and the operation must be completed upon the bare hone. When the second side shall have been wiped with chloroform it may be polished with a bit of silk upon the finger; and after *spontaneous* separation from the paper in hot water the specimen ought to be well washed on both sides with a camel's hair pencil and soap water, dropped into cold water, and thence extracted to dry. After immersion in chloroform for a moment, and examination for the removal of possibly adherent particles, the *section* may be declared suitable for mounting.

Before proceeding to this step, a few precautions are necessary about particular sections. Transverse sections of teeth or bone should be dried, after the preliminary washing, between glass, in order to avoid the disadvantage of warping. Very porous parts, such as cancellated bone, or fragile bodies, such as the poison fang of serpents, require that the whole structure, or the canals, be saturated with glue and dried. Sections may now be cut with a saw, ground in oil, and cemented to the holding-glass subsequent to immersion in chloroform.

Mounting.—Spread a sufficient quantity of old Canada balsam, or of that thickened by heat (not boiling), upon a slide, and, when cold, impose the section. Have ready a spatula bearing a quantity of equally inspissated balsam warmed until it flows, with which cover the specimen, and then immediately warm the slide, being careful to employ the least possible heat. Now carefully depress the section and withdraw every air bubble with a stout needle set in a handle towards the ends of the slide: put on the cover glass, slightly warmed, not flat, but allowing one edge to touch the balsam first, press out superfluous balsam, and the specimen is safe. The slide may now be cleaned with a warm knife, spirits of wine, and ammonia.

This communication would be incomplete without some very important hints concerning "cover glass." It is easy to clean small covers, but very thin glasses or large ones, one or two inches in length, are not so safely handled. All danger of breaking is, however, avoided by placing a cover upon a large clean slide, and wiping one side only with a bit of linen damp with aqua ammonia, and then with a dry piece. The other side may be cleaned after the mounting.

In the next place, all preparers are aware of the difficulty attending the use and application of large covers. I beg leave to assure the inexpert that the following method will insure success. Having prepared the cover glass, and superposed it, let it first be gently pressed downwards at many points, with the flat end of a lead pencil: it will be found, however, almost impossible to flatten it without breaking, consequently too much balsam will overlie and underlie the section. Let now a piece of thin paper be laid over the cover and upon this a thick slide; if a moderate heat be applied to both the slides, over and beneath the specimen, direct pressure evenly exerted with the finger (or spring clothespins) will force out all unnecessary balsam, and leave the section and the protecting cover perfectly flat and unbroken.

The reader will not deem me too prolix when he attempts his first preparation, or when, after having followed the plans so scantily given in the books, he feels the need of something precisely definite. It is certain that neither Canada balsam nor gum mastic will retain the first ground side of a specimen upon a slide long enough to enable the preparer to reduce it to the requisite thinness, and with both these substances *heat* must be employed, which is objectionable because most objects are thereby warped or cracked; and furthermore the paper *guard*, which I hold to be indispensable for limiting and equalizing the thinness of a section, is not mentioned in treatises, in which, if known to the author, such a measure should be noticed. But it is possible to fasten agate, fossil wood, &c. with hot gum shellac, so that they may be ground upon both sides with a water stone; but even in these instances invidious cracks may endanger or destroy the beauty of a choice preparation.

I am confident that my specimens are second to none in any respect: and the highly creditable performances of friends, to whom I have given the method forming the subject of this communication, lead me to believe that with the facilities it affords the observers of our country will need no Topping for objects within their reach, and I beg leave to add that the profitable pleasure I have enjoyed induces me, through the American Journal of Science, to invite participation.

ARTICLE IX.—*General Position and Results of Geology.* (From the Anniversary Address of the President of the Geological Society of London, 1857.)

Let me now close my address by a few observations necessarily occurring to my mind, as the result of these investigations. First, then, it appears to me, we are steadily progressing towards a knowledge of the material structure of the crust of the earth, and of the modifications it has undergone in the long course of ages; and such a knowledge seems essential to the right appreciation of many of the phenomena connected with the variations in the fauna and flora of the surface of the earth. In regard to the natural history of the earth, every day produces new genera and new species in every great section of geological formations; and yet this new evidence does not appear to approximate these sections together, or to bind them more into one great whole, so long as the test applied be identity of species, though unquestionably, if all the formations be taken together, every new discovery seems to supply a link, and to bring the organic elements of formations, widely apart as to time, into connection as parts of one great and harmonious organic system. How then are we to account for this separation in time of the elements of a creation? Are we still, with Cuvier, to suppose that it has resulted from successive destructions of a partially constructed creation and successive renewals, each new creation supplying deficiencies in the preceding one, but producing others by leaving out some of the elements of the last; the creations, therefore, remaining imperfect? Or are we to suppose, with Blainville, that the work of creation was originally complete, and that the gaps now visible are due to the gradual dropping-out of certain of the links in the course of countless ages? Or are we to consider, with Lamarck and many others, that the present is only the development, through various successive stages, of the past, and that the limits of possible variation and transmutation of species, either by imperceptible steps of gradation or by periodic and sudden changes, regulated by the original law of creation, have not yet been determined? To one or other of these theories we must necessarily recur, and so far as the wisdom and power of the Great Creator are concerned, neither can augment or diminish it; for, admitting that creative power must have been exercised, it is indifferent whether it acted in the mode of Cuvier, or in that of Blainville, or in that of Lamarck. In every case the image of the whole must have been in the creative mind, and the wisdom equal, whether the creation was formed as a whole, and members of it were allowed to perish at certain intervals, corresponding to the successive physical conditions of the earth; or, the whole creation being mentally determined by the Creator, those portions of it only which corresponded to the conditions of the earth's crust at each epoch were called successively into existence, various classes and genera attaining therefore the highest development under circumstances best suited to the requirements of their organization; or, the final result having been conceived by creative intelligence, and certain members only of the great whole called into existence, like points on the circumference of a circle, and imbued with such a power of vital development, as should cause them in successive ages to fill up the whole space with an infinite variety of organic beings. The great discovery of Von Baer, of the existence of lower forms in the embryo-state of higher animals, has been supposed by speculative philosophers to favour the theory of development; but it does no more than prove that, whilst the animal is obliged to live under conditions different from those of his complete organization, no new form of organization is adopted, but simply one of those belonging to animals who ordinarily live under such conditions; and, though the perfect animal has passed through such changes, the successive developments exhibited during the embryonic life of an animal, or during the period of a few weeks or months, or perhaps a year, can neither be taken as a proof of a separate individual existence, under either of the embryonic types, nor represent the changes which the same animal, as a species, may have really passed through in countless ages: on the contrary, it is more reasonable to suppose that this involved structure was adopted at the first creation of each of these species, and indicates only the simplicity and harmony of natural laws. If, however, the organic creation was effected as one great whole, and gradually diminished by the dropping-out of many of its links, either by generic or by specific death, how can we account for the total absence in the deposits of early times of any traces of the now living animals which were then co-existent with those of whom such abundant records have been preserved? To me it seems impossible to adopt such a theory without combining with it that of development. For not only must certain forms of organization have disappeared, but others must have so varied as no longer to be recognized as identical with those which have been revealed to us in the stony tablet of the earth.

I have already, more than once, alluded to the theory of colonies, proposed by M. Barrande, and I cannot deny myself the pleasure of once more recurring to it, and pointing out its great importance. Whilst then regretting, more than condemning, that ill-judged zeal, which, seeking to restrict the inquiries of man, by insisting that he shall take all his opinions of creation from that one book given unto man for a totally different object, I cannot but observe that the real history of the creation given in the Bible affords a wholesome caution to all those who endeavour to explain every act of the Creator as if He had been a man. Except as regards man, creation is not described as a work of manufacturing ingenuity, but as an act of infinite power: let the earth, let the sea, let the air bring forth things of their kind, was the fiat of the Almighty; and I cannot but think, that at each portion of the earth this fiat led to the production of genera and species suitable to the conditions of each, and to the appearance, therefore, in different localities, of species representative of, but rarely identical with, each other. On such a principle, how easy is it to understand that the colonies of M. Barrande should, although not identical with those species which had pre-existed in a locality, still have co-existed with them! Absolute identity would indeed be more opposed to the laws of creation than the slight variations we observe in closely allied species.

Let me too for a moment refer to that theory which would ascribe the destruction of species to the agency of man, and has sought to bestow upon the human race an antiquity far greater than that usually assigned to it. Doubtless the actual number of years of the existence of the human race might be multiplied ten, or a hundred-fold, and yet the problem left unsolved. Man, as a species, in a natural state, is restricted in his development by the hardships of life, and the difficulty of obtaining subsistence. So far from being an agent of destruction, beyond those limits which render the existence of the Carnivora compatible with the existence of the Ruminantia and other harmless animals, he, perhaps, of all animals, is the most feeble and defenceless; and it is only when he has become a civilized species that his race is capable of great development, and he becomes a really destroying agent. The ordinary history of the world is sufficient to prove this statement; and, if we compare the wide forest and prairie lands of America as they were 200 years ago, when the wild Indian tribes only killed for subsistence, and used for that purpose only the simple weapons which barbaric ingenuity had enabled them to form, with their present state, when civilized man has not only invaded their lands, but supplied the still uncivilized natives with the weapons of civilization, not merely to supply the wants of their own existence, but also to minister to the luxury of civilized man, —we shall see that the actual destruction of species, so far as the agency of man is concerned, could never have occurred, to any appreciable extent, had not that extraordinary phasis in man's existence—civilization—occurred; and I will add, that even civilized man would have required a vast extension of time to work out the destruction of species, had not the invention of gunpowder supplied him with an agent of almost unlimited power of destruction; and further, that, even provided with it, he has made but small progress indeed in the destruction of species. The Creation is, and must ever be, a mystery to man, and yet it is a speculation worthy of the exercise of the highest intelligence. Placed on the earth, it is our privilege to study everything connected with it, and we should be neglecting the highest endowments of our race were we not to do so; nor let us be tempted to scoff at or condemn those who, possessed perhaps of a higher intelligence than our own, see further than we do, and adopt theories which appear to us absurd, sometimes only from our own inferiority; and above all, let us avoid that fatal error of connecting the results of scientific inquiry with the articles of religious belief. In attempting to discuss two widely different subjects at the same time, we must necessarily stumble. The speculation of a plurality of inhabited worlds, for example, is to the philosopher a proper mental exercise, though incapable of any positive solution; for, even supposing organic life to be compatible with every possible variation of physical conditions—a postulate at variance with the conditions of existence present on the earth, where life is limited on the one hand by the increase of pressure under the water, and on the other by its decrease in the air,—what more can we do than guess or speculate in the dark? Why then should we rashly connect such a speculation with the creed of the philosopher and the faith of the Christian, or assume the dream of the philospher to be a proper measure of the Creator's wisdom? Let us then continue, as we have hitherto done, to pursue our investigations into the history of the earth, under all its various stages, unbiassed by any preconceived opinions, and unshackled by the dread of offending those who will not study the works of creation, but, remaining ignorant of them, consider that they are thereby the better fitted for discussing the Divine attributes. At all events, let us make truth, and truth alone, our aim, supporting our own appreciations of it when we have reason for so doing, but treating with calmness and forbearance the opinions of others who may differ from us: it is from such differences of opinion that we may expect ultimately to discover truth, sublimed from the dross of error which must ever be mingled with it in all those reasonings of man which cannot be actually based on mathematical principles, or reduced to positive demonstration.—*Journal of Geol. Society.*

A Premium Essay on Practical and Scientific Agriculture, by Prof. G. C. Swallow, State Geologist, Missouri.

This Essay has been published by the Missouri District Agricultural Society, and is prefixed to the Report of their Second Annual Fair. In looking over this report we are struck with the vigour and wisdom of our Western cousins. They have awarded $5466 in premiums to competitors for excellence in every conceivable department of agriculture and of arts which contribute to the comfort and elegance of civilized life. The Essay opens very appropriately with a few words in praise of a rural life, and its happy moral influences. The learned Professor then defines what scientific and practical agriculture is. He shows that geology and chemistry are the sciences, a knowledge of which is of most importance to the agriculturalist. The application of these sciences to the agriculture of the State of Missouri he also treats with brevity, point and skill. The following account of the geological formations upon which the soil of this State depends, may be interesting to many of our readers.

As the most essential properties of the soils of Missouri depend upon the Geological Formations on which they rest, this science is destined to give us material aid in understanding the nature and durability of our soils, and in determining the best method of developing their resources and preventing that deterioration so detrimental to agricultural pursuits.

The alluvial bottoms of our large rivers usually furnish a light sandy calcareous soil, which contains more or less of the clay and humus deposited in the beds of those ancient lakes and sloughs, now converted into rich savannas by the accumulated sediment and decayed vegetable matter. This soil possesses in an eminent degree all the properties essential to the highest degree of fertility. The fine sands and humus render it light and porous; the humus gives it the power to imbibe and retain moisture; its sand and dark color prepare it to receive the heat of the sun; while the clay and vegetable mould enable it to absorb carbonic acid and other fertilizing gases from the atmosphere.

These alluvial deposits have rendered this soil as durable as it is productive, by furnishing a loose subsoil, rich in all the elements of fertility. A soil thus productive and durable and so admirably adapted to the production of our great staples—hemp, corn and tobacco—and covering an area of more than four millions of acres, is destined to exert a vast influence over the future wealth and prosperity of our State.

But this variety of soil is surpassed in value and extent by that based upon the silicious marls of the bluff, where that formation is best developed, as in Platte, Lafayette, Jackson, Buchanan, Clay, Saline, Chariton, Howard and several other counties of the State,—The light porous character and composition of these marls, and the intermingled vegetable matter, constitute a soil unsurpassed in fertility and adaptation to many of our most important crops. It covers an area of, at least, six millions of acres.

In a still larger portion of the State the excess of clay in the Bluff formation renders the soil less pervious to water and atmospheric influences. While this variety is somewhat inferior in nature to that last described, still it may be rendered almost as productive by a judicious system of subsoiling and clovering.

The Magnesian Limestone, so abundant in the great basin of the Osage and its tributaries, on the Gasconade and in the mining region of the South east, together with the intercallated sandstones and chert beds and overlaying clays, form a soil at once light, warm and rich in lime, silex, potash and magnesia. These ingredients with its location on the sunny slopes and hill-sides of those dry, salubrious regions, give it a peculiar adaptation to the culture of the grape.

In treating of practical agriculture the essayist warns the farmer against the fatal mistake of exhausting the soil, and enforces by cogent reasons the necessity of " subsoiling, deep, thorough and frequent tilling, and the addition of vegetable matter by clovering or other means, as the best method of preparing the soil to sustain the frequent droughts incident to the climate, and to retain the moisture from the excessive rains which fall during certain seasons of the year. Altogether the Essay in a short compass, contains most valuable suggestions for the direction of the farmer in those parts, and for the emigrant who may settle in the magnificent lands of the West.

The late meeting of the American Association for the advancement of science in this city has brought us into hearty sympathy with many eminent students of natural science in the United States; and none more worthy of esteem than the author of this Essay. Having seen their faces in the flesh, and having had living evidence of the warmth of their hearts, the ardour of their zeal and the thoroughness of their attainments, we are now better prepared to appreciate their valuable labours and to follow with interest the course of their important researches and discoveries.

A. P. K.

Illustrative Scientific and Descriptive Catalogue of the Achromatic Microscopes manufactured by J. & W. Grunow & Co., New Haven, Conn., U. S. Price 30 cents. Pp. 104.

We have lately received a valuable pamphlet with the above very unassuming title. It is, in point of fact, a concise and well-written treatise on the theory of the microscope, its mechanical construction, its accessory apparatus, and its use, each section being copiously illustrated with good wood engravings, and having a price-list attached. From personal experience we can cordially recommend the Messrs. Grunow as careful and able workmen. Their instruments are superior to those of the French, and nearly equal to the best of English makers; indeed, nothing we have seen can surpass their rack-work and lever-stage movements.

We regret to see them advertising two grades of object-glasses —first and second class; the latter at little over half-price. Surely such artists ought to confine themselves to their best work. We note with some surprise the absence of a Micro-Photographic apparatus among the accessory instruments, in view of the attention which microscopists have lately been giving to that mode of illustrating their objects. We regret too that the Messrs. Grunow should have seen fit to give no credit to those English makers, the forms of whose stands they have copied. Their prices appear high, but good workmanship must always be expensive. The following comparison may be of use to intending purchasers in Canada. The instruments are nearly equal in point of excellence. Messrs. Grunow's stand is somewhat heavier, but Messrs. Powell & Lealand's Glasses are, in our opinion, superior :—

	Grunow & Co.'s prices in N. H.	Powell & Lealand's Sterling prices in London.
	STUDENT'S LARGER MICROSCOPE, NO. 4, A.	LEVER-STAGE MICROSCOPE.
Microscope Stand and Eye-pieces..	$70 00	£18 14 0
Mahogany Case..................	15 [illegible]	
¼-inch Object Glass..............	30 00	
1-inch " "	18 00	
Bull's-eye Condenser............	6 00	
Frog Plate......................	5 00	
Three Dark Wells..............	3 00	
Diaphragm Plate................	5 00	
Lieberkuhn's....................	6 00	
Polariscope......................	20 00	2 10 0
Animalcule Cage................	2 00	0 6 0
Steel Disc (Drawing)...........	4 00	0 12 0
Forceps..........................	3 00	0 10 0
Cobweb-Micrometer Eye-piece ...	30 00	4 4 0
	$217 00	£26 16 0

A few typographical errors have been overlooked, but as they are not likely to mislead any one we pass them by. D. A. P.

THE AQUAVIVARIUM.—We had it in view to write an article on the Aquavivarium before the advent of spring, giving short instructions for its formation and successful management, and indicating some Canadian plants and animals, that would form interesting objects of study. But in this both time and materials have failed us, and for the present we confine ourselves to the enumeration of a few of the numerous works which have lately appeared in Britain, to the best of which we refer those of our readers who may wish to study natural history, under its most charming form.

The Aquarium ; an unveiling of the wonders of the deep sea. With coloured plates and wood engravings. By PHILIP H. GOSSE, A.L.S., &c. 1 vol., post 8vo. London : John Van Voorst. Price 17s.

We give the first place to Mr. Gosse's beautiful volume, as we believe that gentleman in conjunction with Mr. Warrington, may fairly claim to be the discoverer of the Aquarium, and to his writings we chiefly attribute its great popularity, and the rapid improvement in its universal application which has lately taken place. We consider this work unnecessarily expensive, and as it treats only of the marine forms, it is not available for an inland latitude.

Common objects of the sea shore, including hints for an aquarium. By Rev. J. G. WOOD. London : Routledge & Co. 1857. 1 vol., 12 mo., pp. , with 13 plates. Colored 3s. 6d., plain 1s.

A marvel of cheapness, fluently written, and well illustrated. The author is a superficial observer, and adds nothing to what was previously known. As its name indicates, this book is also marine.

Handbook to the Aquarium. By F. S. MERTON. London: Whiteley & Co. Price 1s.

The *Athenæum* says, "This book is a very dear shilling's worth, and the highest compliment we can pay it is to say that it is less full of errors than most of the popular books on the Aquarium. It is to be regretted that so good an opportunity for cultivating natural history should be rendered almost useless, by a set of books written by persons who know nothing of natural history, and who cannot spell or write their own language." We have not ourselves seen the book, but have no doubt at all of the correctness of the above estimate of its merits.

Ocean and River Gardens; a history of the marine and fresh-water Aquaria. By H. NOEL HUMPHREYS. 1 vol., 12mo., with 18 colored plates. pp. 219. Price 10s. 6d. London: S. Low & Co.

The *Athenæum's* remarks above quoted, apply with even more force to this work, than to the one for which they were intended. It would be hard to find within any pair of boards devoted to natural history a greater number of erroneous views, unscientific descriptions, and errors of all sorts, than are perpetrated by our author under the cloak of a pretended scientific knowledge, and a grandiloquent style. Mr. Humphries had better return to his illuminated missals and his coins, and leave natural history to original observers; he may be a numismatologist and probably a colourist, but assuredly he is no naturalist.

Popular History of the Aquarium of marine and fresh-water Animals and Plants. By GEORGE BRETTINGHAM SOWERBY, F. L. S. 1 vol., 16 mo. pp. 327, with 20 colored plates. London: Lovell Reeve. Price half a guinea.

We anxiously waited more than a year for this book, with high expectations as to the value of the observations of an accomplished natural history draughtsman, upon the objects of his pencil. We regret to say that in it we have been grievously disappointed. A great part of the book is taken from the writings of other men. Gosse, Harvey and Forbes, being largely drawn upon, and even Hugh Miller occasionally quoted. And his original observations, meagre as they are, are so filled with errors, that were it not for the plates, which are for the most part excellent, we would feel bound to pronounce the book worthless. As it is we can recommend no one to invest so much money in so little science.

The Aquavivarium, fresh and marine. By E. LANKASTER, M.D. a small 12 mo. vol., pp. 71, with plates and wood engravings. London: Hardwick. Price 1s. 6d.

Exclusive of the writings of Mr. Gosse, this little book is to our mind worth more than all that has been published on the subject to which it relates, that has come under our observation. We cordially recommend it to our readers. It treats chiefly of the fresh-water tank, (therefore all the more valuable to us,) in five chapters.—I. First Principles. II. History of. III. How to form. IV. Plants for. V. Animals for. His VI. and last chapter is devoted to the marine department. We quote his preface in full; the whole treatise is equally pithy and to the point.

"Having taken considerable interest in the domestic culture of plants and animals in water, and written the article "Aquavivarium" for the English Cyclopædia, I was induced, at the request of the publisher, to put together the following remarks. I have done so in the hope that they will in some manner contribute to make the prevailing taste for establishing domestic Aquavivaria subservient to the teaching of Natural History, and the study of God's works."

Rustic Adornments for Homes of Taste. By SHIRLEY HIBBERD. 1 vol., 12 mo., with plates. London: Groombridge.

The Book of the Aquarium and water-cabinet; or instructions on the formation and management of collections of Fresh-water and Marine Life. By SHIRLEY HIBBERD. 1 vol., 12 mo., pp. 148, with plates. London: Groombridge.

Plain Instructions for the Management of the Aquarium. Edited by J. BISHOP, assisted by other gentlemen. London: Dean & Son.

We only give the titles of these works, the two former aim to be popular and practical, the latter we have not seen.

D. A. P.

A HINT TO AGRICULTURAL SOCIETIES.—If Agricultural Societies throughout the country would hold out annual prizes for exhibition of collections of insects possessing merit, it would be some inducement to young Canadian entomologists who are at present devoting much time to the study. Farmer's sons and others could then go to work in a practical manner, giving us yearly observations and discoveries in their respective branches of entomological study, therefore producing beneficial results, and more satisfactory to the country than paying large sums of money for a repetition of facts already known.—*U. C. Paper.*

DR. JOHN FORBES ROYLE.—Science has sustained a loss in the death of Dr. Royle, which took place at his residence, Heathfield Lodge, Acton, Middlesex, on the 2d of January. He had been for many weeks in ill-health, but his death was sudden at last. Dr. Royle was educated in London for the medical profession, and was a pupil of the late Dr. Anthony Todd Thomson, from whom he seems to have acquired that taste for the study of botany which afterwards distinguished him. Having passed his medical examinations, he entered into the service of the East India Company, and was for many years stationed in the Himalaya, where he had great opportunities afforded him of studying, not only the plants of that district, but of the whole empire. He was appointed superintendent of the East India Company's Botanic Garden at Saharempore,—a position which gave him the largest possible opportunity for studying the indigenous Flora of Hindústan. The result of his labours was given to the world in a magnificent work, entitled 'Illustrations of the Botany and other branches of Natural History of the Himalayan Mountains, and of the Flora of Cashmere.' This work was published, in folio, with plates, in 1833, and at once gave to the author a European reputation as a botanist. In this work Dr. Royle gave the result of his researches into the medical properties of a large number of plants, as well as the history of drugs used in Europe, whose origin was unknown. In 1857 he published an essay 'On the Antiquity of Hindoo Medicine,' a work displaying much learning and research. On the opening of King's College, London, as a medical school, the knowledge of drugs and plants possessed by Dr. Royle pointed him out as a fit person to hold the Chair of Materia Medica, a position which he filled till the year 1856. Whilst lecturing on this subject he published his 'Manual of Materia Medica,' a book which is now used as a text-book on the subject in medical schools. His extensive knowledge of the natural history of India made him a valuable contributor to the periodical scientific literature, and he was a contributor to 'The Penny cyclopædia,' and Kitto's 'Dictionary of the Bible,' and other works. He took an active interest in promoting a knowledge of the material resources of India, and in 1840 produced a work which perhaps will be read with more interest now than when it was published, 'On the Productive Resources of India.' During the period of the Russian War, Dr. Royle drew attention to India as a source of the various fibrous materials used in the manufacture of cordage, clothing, paper, &c., by a lecture delivered before the Society of Arts in 1854. This lecture was afterwards expanded into a valuable work 'On the Fibrous Plants of India,' which was published in 1855. In the Preface to this work he announced that he was employed in a general work on 'The Commercial Products of India,' which, we believe, has not yet appeared. Dr. Royle was a Member of the British Association for the Advancement of Science, at whose meetings he often read papers, two of which deserve especial mention, one 'On the Cultivation of Cotton,' and another 'On the Cultivation of Tea in the East Indies.' He took an active interest in the last subject, and his efforts have been attended with complete success, as tea, rivalling that from China, is now produced in abundance in the Himalaya. For a short time he held the office of Secretary to the British Association for the Advancement of Science. He took an active interest in the developement of the plan of the Great exhibition of 1851, and the success which attended the exhibition of the Department of Indian Products was due, in a great measure, to his efforts. He was a Fellow of the Royal Linnean and Geological Societies, and at the time of his death held an appointment in connexion with the East India Campany in London.—*Athanœum.*

CANADIAN INSTITUTE.—We see by the Toronto papers that a costly and very beautiful service of plate has been procured to be presented to Dr. Daniel Wilson, who has gratuitously edited the *Canadian Journal* for the past two years. The cost was $480. From the report of the Institute it appears that the journal is now sent to the scientific societies of Paris, Copenhagen, Stockholm, &c, and that several articles that have appeared in its pages have been translated and reprinted in some of the leading scientific journals of Europe. It is gratifying to mark the progress of Canada in science and literature.—*Athanœum.*

The University of St. Andrew has conferred its degree of LL.D. on Mr. James Scott Bowerbank. This is a graceful and well-earned compliment. As the founder of the Palæontographical Society, and a museum of unique fossil specimens, and a laborious investigator in many departments of Natural History and Geology, every one will recognise Mr. Bowerbank's claim for such an honour, and the judgment displayed by the University that has conferred it.—*Athanœum*

PERMIAN FOSSILS IN KANSAS, AND ELSEWHERE IN AMERICA.—We have received, nearly at the same time, published notices by Mr. Meek and Dr. Haydon of Albany, and by Professor Swallow of Missouri, on the discovery in a bed of limestone at Smoky Hill Fort, and other places in Kansas, of fossil shells, clearly indicating that this bed represents the Permian system of Sir R. I. Murchison, the newest member of the Palæozoic series, and one of the links heretofore wanting to give completeness to the chain of geological formations in Western America. We observe that a controversy exists between the gentlemen above named as to the priority of discovery or the right of announcing it. As both of the parties have sufficiently established reputations, independently of this discovery, we would recommend to them to leave the honor to Major Hawn and Dr. Cooper, who actually disinterred these interesting remains, and to co-operate in the description of the fossils and the prosecution of farther researches.

We observe in the November number of *Silliman's Journal*, that the fossils collected by Professor Emmons in North Carolina are leading to the conclusion, that the well-known red sandstones of Connecticut, New Jersey, etc., are of somewhat older date than geologists have recently supposed—that they may be Lower Triassic or even Permian. This is of some geological interest in British America, as it would bring these deposits into parallelism with the great areas of red sandstone in Prince Edward Island and Nova Scotia, known to be later than the coal period, and respecting which the writer several years since* stated his opinion, founded on fossil plants and reptilian remains, that they were probably Permian or Lower Triassic, a view which then seemed scarcely compatible with the received age of the similar sandstones in the United States.

The most interesting part of the discoveries of Prof. Emmons, rendered still more interesting by the probability that these rocks are older than the American geologists have hitherto supposed, is, that among these fossils appears a small mammal, probably the oldest known, the Dromatherium Sylvestre (Emmons). This is the first evidence of Mammalian life obtained from the Secondary rocks in America; and if the views above mentioned are correct, older than the Microlestes of the German Trias, the oldest fossil mammal heretofore found. J. W. D.

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* Journal Ac. Nat. Sci. Phila., vol. 2, and Proc. vol. vii; and Acadian Geology.

MONTHLY METEOROLOGICAL REGISTER, SAINT MARTIN'S, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF DECEMBER, 1857.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer corrected and reduced to 32° F. (English inches.)			Temperature of the Air. F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Mean Velocity in Miles per hour.			Amo'nt of Rain in inches.	Amo'nt of Snow in inches.	Weather, Clouds, Remarks, &c., &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	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	29·817	29·754	29·898	46·0	46·0	35·5	·215	·282	·210	·92	·86	·90	S. S. E.	W. S. W.	W. S. W.	7·92	5·60	10·00	0·160	....	Rain.	C. C. Str. 4.	C. Str. 10.
2	871	783	680	34·7	40·8	35·3	·203	·227	·203	·90	·85	·90	W. S. W.	S. W.	S. by E.	9·03	3·83	0·27	....	....	C. Str. 8.	C. C. S.	C. C. Str. 8.
3	623	814	902	33·0	30·4	22·4	·189	·160	·120	·89	·86	·82	W.	W. N. W.	W. N. W.	16·13	6·03	23·36	....	0·50	" 10.	C. Str. 10.	C. Str. 10.
4	890	901	30·014	21·0	24·0	13·0	·104	·097	·083	·78	·65	·82	N. W.	W.	N. W. by N.	33·12	1·10	9·30	....	....	C. C. Str. 6.	" 1.	Clear. Aurora Borealis.
5	30·031	30·111	177	6·5	20·0	5·0	·051	·083	·046	·87	·63	·84	N. W. by N.	N. E. by E.	S. E. by E.	1·63	0·93	1·63	....	....	Clear.	Clear	" " "
6	060	29·884	29·678	3·6	14·0	21·0	·044	·089	·092	·86	·84	·67	N. E. by E.	N. E. by E.	E.	5·23	2·97	8·67	Inapp.	0·93	"	C. C. Str. 10.	Sleet.
7	29·500	634	310	34·0	43·5	33·3	·178	·241	·187	·83	·79	·89	S. W.	W. by S.	S. W.	16·21	10·17	11·23	....	....	C Str. 6.	Cir. 2.	Clear.
8	713	754	987	33·5	43·3	32·9	·187	·233	·178	·89	·79	·86	S. W.	W. by N.	W. N. W.	4·51	3·02	3·36	....	....	Clear.	Clear.	Clear. Aurora Borealis.
9	831	643	378	26·0	31·0	37·7	·112	·171	·226	·70	·89	·91	N. E. by E.	N. E. by E.	S. S. E.	7·63	8·51	6·51	0·240	0·10	"	Sleet.	Rain.
10	370	375	604	35·5	37·5	23·0	·210	·207	·106	·90	·84	·73	S. W. by W.	S. W. by W.	W. N. W.	9·33	7·35	16·81	....	....	C. Str. 4.	C. Str. 6.	C. C. Str. 4.
11	990	30·030	30·279	11·1	12·3	9·2	·063	·068	·069	·67	·67	·77	W. by N.	N. W. by N.	W.	23·33	8·72	10·51	....	....	Clear.	C. C. Str. 4.	Clear.
12	30·326	262	232	9·0	20·8	21·6	·068	·098	·098	·70	·73	·74	W.	W.	W. S. W.	8·73	7·50	5·42	....	....	C. Cir. 4.	C. Str. 4.	"
13	187	29·914	29·818	27·0	39·0	34·6	·128	·214	·187	·76	·84	·85	W. S. W.	S. W.	S. W.	18·30	8·06	13·98	....	....	Clear.	Light Cirri. 2.	"
14	29·815	820	30·018	33·1	40·1	35·2	·187	·210	·186	·90	·79	·83	S. W. by W.	S. W. by W.	W. by N.	7·80	4·92	3·08	....	....	C. C. Str. 8.	C. Str. 10.	C. Str. 10.
15	30·198	30·260	185	19·1	24·1	20·2	·091	·091	·089	·73	·65	·68	N. E. by E.	N. E. by E.	N. E. by E.	14·22	3·93	2·47	....	....	C. Str. 10.	C. C. Str. 4.	Clear.
16	082	184	131	19·6	31·1	24·7	·091	·152	·135	·73	·78	·86	N. E. by E.	N. N. W.	N. E. by E.	5·42	0·82	0·01	....	1·10	Snow.	C. Str. 6.	C. Str. 10.
17	29·981	29·900	29·888	25·0	35·6	32·5	·107	·192	·192	·70	·83	·87	N. E. by E.	S. by W.	S. by W.	1·00	0·01	0·01	....	....	C. Str. 10.	" 6.	" 10.
18	650	350	340	32·2	34·4	34·0	·191	·203	·205	·90	·94	·95	N. E. by E.	N. E. by E.	N. W. by W	2·90	8·81	3·28	0·876	....	" 10.	Rain.	Rain.
19	810	950	30·147	22·5	18·8	12·0	·102	·103	·075	·80	·78	·74	W.	W.	W. N. W.	12·73	14·30	15·77	0·074	....	" 8.	C. Str. 10.	C. Str. 9.
20	30·272	30·254	346	9·1	11·3	7·7	·065	·066	·067	·73	·68	·71	N. W.	W.	W. S. W.	9·80	4·11	0·73	....	....	" 10.	" 8.	Clear. Aurora Borealis.
21	199	100	29·937	7·4	30·5	17·0	·051	·145	·096	·87	·78	·83	S. E.	S. E.	E. by N.	2·90	1·05	2·31	....	....	Clear.	Clear.	C. Str. 8.
22	29·479	29·275	357	20·3	27·0	22·1	·114	·137	·096	·87	·82	·70	N. E. by E.	N. by E.	W. by N.	7·42	6·08	9·10	....	3·74	Snow.	Snow.	" 10.
23	388	206	198	13·0	25·3	24·0	·083	·123	·135	·82	·79	·90	S. W.	S. E.	S. W.	17·55	2·22	3·13	....	1·04	C. Str. 8.	C. Str. 10.	Snow.
24	347	683	974	20·1	12·4	0·1	·114	·068	·038	·87	·67	·85	W.	N. W.	W. S. W.	19·51	15·70	13·99	....	0·10	" 4.	" 4.	Clear.
25	30·003	908	854	—10·7	8·2	— 0·4	·022	·065	·034	·78	·68	·74	W. by N.	S. by W.	N. E. by E.	0·01	0·00	0·00	....	....	Clear.	" 10.	Cir. Cum. 6. Lunar Halo.
26	29·820	809	984	— 3·5	3·0	1·4	·051	·038	·036	·83	·73	·86	N. E. by E.	N. E. by E.	N. E. by E.	0·23	2·32	0·00	....	....	C. Str. 8.	" 8.	C Str. 10.
27	30·098	30·138	30·002	—13·0	7·2	3·0	·018	·040	·031	·74	·70	·83	N. E. by E.	S. E.	E. N. E.	0·36	0·03	0·22	....	....	Clear.	C. C. Str. 4.	Cir. Cum. 6. Lunar Halo.
28	29·635	29·595	29·840	0·0	35·7	27·0	·050	·192	·146	·79	·83	·88	N. E. by E.	W. S. W.	W.	1·40	0·37	11·28	....	0·20	Snow.	Cirr. Str. 8.	" 4.
29	869	820	969	19·5	28·2	20·5	·107	·135	·086	·83	·78	·70	S. E. by S.	N. E. by E.	N. W. by N.	0·80	1·62	0·75	....	....	C. Str. 10.	" 10.	" 5.
30	800	680	656	12·5	26·0	28·0	·070	·129	·144	·73	·80	·83	N. E. by E.	N. E. by E.	E. by S.	0·31	2·06	3·15	....	2·10	" 10.	C. C. Str. 10.	Snow.
31	170	28·880	183	36·8	25·0	30·1	·178	·123	·160	·92	·79	·86	E. by N.	N. E. by E.	W. by S.	12·21	2·30	8·21	....	17·00	Snow.	Snow.	Snow.

REPORT FOR THE MONTH OF JANUARY, 1858.

	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	29·531	29·470	29·827	14·4	25·3	21·5	·075	·123	·034	·72	·76	·60	S. S. E.	E. by N.	S. W.	17·83	0·08	3·72	....	2·90	C. Str. 10.	Snow.	Clear.
2	916	741	700	10·7	21·9	25·5	·082	·138	·146	·88	·74	·88	S. by W.	S. W.	W. by S.	5·37	0·78	14·30	....	....	Clear.	Clear.	"
3	788	416	438	8·0	16·0	12·0	·056	·067	·070	·79	·78	·73	S. W. by S.	S. by E.	N. by E.	4·00	0·23	12·53	....	4·00	C. C. Str. 4.	Snow.	C. Str. 10.
4	225	070	211	10·9	42·0	38·0	·082	·225	·217	·88	·79	·86	S. by W.	W. by S.	W. by S.	2·00	12·82	20·62	....	....	C. Str. 8.	C. C. Str. 4.	Clear.
5	656	714	995	11·2	9·6	— 5·0	·072	·079	·031	·78	·88	·83	N.	N.	E.	23·11	0·76	7·07	....	....	Clear.	Clear.	" Aurora Borealis.
6	947	852	816	— 6·0	2·8	2·0	·029	·047	·044	·81	·84	·84	N. E. by E.	N. E. by E.	N. E. by E.	17·85	12·22	17·40	....	....	C. C. Str. 6.	C. Str. 10.	Snow.
7	954	30·057	30·338	3·2	14·6	— 1·6	·069	·038	·023	·79	·70	·85	W.	W.	N W. by W	13·72	4·00	5·70	....	0·38	C. Str. 10.	Clear.	Clear.
8	30·587	536	563	—10·2	8·9	— 0·3	·059	·039	·026	·78	·82	·83	W. by N.	W. S. W.	S. S. W.	9·26	3·08	4·73	....	....	Clear.	"	" Aurora Borealis.
9	29·963	29·916	29·803	— 8·0	2·0	13·0	·051	·093	·050	·79	·95	·92	E. by N.	W. N. W.	W. N. W.	2·73	1·82	1·45	....	....	"	"	"
10	30·147	30·213	30·289	3·7	20·1	0·0	·094	·050	·042	·85	·72	·84	N. W.	W. S. W.	E.	18·75	0·57	0·76	....	....	"	"	" Faint Aur. Borealis.
11	29·957	29·357	29·356	28·0	40·3	39·5	·153	·245	·226	·88	·92	·92	S. by E.	S. by E.	S. S. W.	20·66	10·87	10·12	0·381	....	Rain.	C. Str. 10.	Rain.
12	580	30·002	30·238	27·0	23·0	8·6	·140	·087	·058	·88	·60	·80	W.	W. by N.	S. W. by W.	18·03	23·63	7·36	....	....	C. C. Str. 8.	Cirr. 4.	Clear.
13	30·065	29·912	29·948	— 4·2	24·0	18·0	·031	·100	·087	·79	·74	·84	E. N. E.	W. by S.	W. by S.	3·60	7·46	3·65	....	0·90	Clear.	C. Str. 4.	" Aurora Borealis.
14	146	30·130	30·270	10·0	35·1	14·7	·062	·170	·070	·86	·81	·82	W. S. W.	W. S. W.	E. by N.	3·00	1·12	0·00	....	....	"	Clear.	"
15	292	151	034	4·7	13·9	15·0	·043	·070	·074	·75	·82	·81	E.	N. E. by E.	N. E. by E.	5·93	10·66	6·61	....	1·30	C. C. Str. 8.	C. Str. 10.	Snow.
16	29·412	29·215	29·480	31·2	31·0	30·1	·162	·162	·143	·89	·89	·79	N. E. by E.	N. E. by B.	N. W.	12·17	6·10	1·10	0·120	1·10	Rain.	Rain.	"
17	766	729	944	10·1	14·6	4·2	·057	·070	·046	·99	·82	·84	N. W.	W. S. W.	S. S. W.	16·03	9·07	4·57	....	1·20	Str. 2.	Clear.	Clear. Aurora Borealis.
18	966	854	967	—10·2	12·2	4·1	·022	·051	·041	·76	·63	·74	S. by W.	W. S. W.	S. by W.	0·03	0·00	0·27	....	....	Cir. Str. 4.	Cirr. Str. 4.	"
19	30·018	936	987	— 9·2	13·2	2·2	·054	·067	·042	·78	·80	·84	S. by W.	S. E. by E.	E.	0·92	0·05	0·00	....	....	" 6.	C. Str. 10.	C. Str. 10.
20	29·995	997	30·026	— 9·3	18·4	14·7	·022	·075	·064	·78	·70	·70	S. S. E.	S. S. E.	S. by W.	0·02	0·31	1·21	....	....	Str. 4.	" 4.	" 10.
21	932	880	100	15·6	37·1	19·3	·072	·193	·084	·75	·82	·71	S. W.	W. by N.	N. by E.	8·55	15·43	10·35	....	....	C. Str. 8.	" 8.	" 4.
22	30·601	30·617	697	— 9·7	9·2	—10·7	·020	·042	·017	·64	·59	·57	N. N. E.	S. E. by E.	S. E. by S.	10·27	0·96	0·35	....	....	Clear.	Clear.	Clear.
23	675	355	405	—18·7	1·0	— 5·5	·013	·030	·024	·69	·69	·64	N. E. by E.	N, E. by E.	N. E. by E.	0·02	0·02	7·11	....	....	"	"	"
24	405	254	313	— 9·0	22·4	14·0	·024	·084	·059	·74	·71	·65	N. E. by E.	N. E. by E.	N. E. by E.	0·50	0·10	0·00	....	....	"	Light Cirri.	Cum. 4.
25	154	057	035	21·4	40·0	33·2	·089	·212	·175	·72	·82	·84	N. by E.	S. S. E.	S. S. E.	0·03	0·11	1·17	0·076	....	C. Str. 10.	Rain.	Rain.
26	29·723	29·511	29·503	34·6	43·2	37·1	·185	·262	·208	·90	·84	·96	S. by E.	S. E. by E.	S. by E.	0·06	1·77	9·36	0·174	....	Rain. 0.	"	C. Str. 10.
27	570	614	751	32·4	38·7	21·5	·169	·212	·112	·84	·82	·93	S. by E.	S. S. E.	N. E. by E.	12·63	12·07	8·57	Inapp.	....	Str. 2.	"	" 10.
28	745	709	755	19·0	19·9	15·3	·090	·084	·070	·78	·71	·70	N. E. by E.	N. E. by E.	N. E. by E.	11·65	16·50	8·02	....	....	C. Str, 10.	C. Str. 10.	" 10.
29	301	664	705	13·4	22·0	18·6	·067	·098	·092	·81	·74	·90	N. E. by E.	N. E. by E.	N. W.	21·28	9·40	5·35	....	....	" 10.	" 10.	" 10.
30	643	579	796	18·0	21·9	6·4	·081	·082	·042	·77	·62	·66	N. N. W.	W. N. W.	W. N. W.	8·90	10·75	22·31	....	....	" 10.	" 10.	Cirr. 2.
31	917	9·3	30·080	—10·1	5·0	— 4·3	·017	·031	·029	·57	·56	·82	W. N. W.	W. S. W.	W. S. W.	32·12	10·20	5·95	....	....	Clear.	Clear.	Clear.

REMARKS FOR DECEMBER, 1857.

Barometer....... Highest, the 20th day, 30·346 inches.
Lowest, the 31st day, 28·880· "
Monthly Mean, 29·743 inches.
Monthly Range, 1·466 "

Thermometer... Highest, the 1st day, 46°0.
Lowest, the 27th day, —13°2.
Monthly Mean, 14°96.
Monthly Range, 59°2.

Greatest intensity of the Sun's rays, 59°0.
Lowest point of terrestrial radiation, —13°5.
Mean of humidity, ·806.

Rain fell on 5 days, amounting to 1·350 inches; it was raining 32 hours and 30 minutes.

Snow fell on 10 days, amounting to 26·81 inches; it was snowing 68 hours 50 minutes.

Most prevalent wind, N. E. by E. Least prevalent wind, E.

Most windy day, the 24th day; mean miles per hour, 16·40.

Least windy day, the 25th day, miles per hour, 0·00.

Aurora Borealis visible on 3 nights.

Lunar Haloes visible on 2 nights.

The Electrical state of the atmosphere has indicated moderate intensity.

Ozone was in rather large quantity.

REMARKS FOR JANUARY, 1858.

Barometer. ...... Highest, the 22nd day, 30·697 inches.
Lowest, the 4th day, 29·070 "
Monthly Mean, 29·907 inches.
Monthly Range, 1·627 "

Thermometer. Highest, the 26th day, 45°4.
Lowest, the 23rd day, —18°7.
Monthly Mean, 13°76.
Monthly Range, 62°1.

Greatest intensity of the Sun's rays, 51°9.
Lowest point of terrestrial radiation, —19°2.
Mean of humidity, ·786.

Rain fell on 5 days, amounting to 0·751 inches; it was raining 34 hours and 40 minutes.

Snow fell on 7 days, amounting to 11·78 inches; it was snowing 34 hours and 35 minutes.

Most prevalent wind, N. E. by E. Least prevalent wind, E.

Most windy day, the 12th day; mean miles per hour, 16·36.

Least windy day, the 18th day; mean miles per hour, 0·10.

Aurora Borealis visible 5 nights. Zodiacal Light very bright.

Parhelia and Mock Suns visible on 2 days.

The Electrical state of the atmosphere has indicated moderate intensity.

Ozone was in rather large quantity.

MONTHLY METEOROLOGICAL REGISTER, AT MONTREAL, (LATITUDE 45° 30′ N., LONGITUDE 73° 36′ W.) FOR THE MONTH OF DECEMBER, 1857.

HEIGHT ABOVE THE LEVEL OF THE SEA, 57·07 FEET.

BY A. HALL, M. D.

Day of Month.	Barometer, Corrected and reduced to Fah., 32°.			Temperature of the Air.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction and Force of the Wind, from 0, Calm, to 10, Violent Hurricane.			Amo'nt of Rain in Inches.	Amo'nt of Snow in Inches.	Clouds and their Proportion, in Numbers, from 0 Cloudless, to 10, perfectly Overcast.			Observations.
	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.			7 a. m.	2 p. m.	9 p. m.	
1	29·974	29·907	29·914	40·5	43·0	37·8	·225	·209	·157	·91	·75	·71	S 2	S W 2	S W 4	0·29	....	Nim. 10	Cu. St. 7	Cu. St. 9	
2	969	948	798	36·5	41·0	38·0	·170	,212	·165	·80	·82	·72	S W 2	W 1	S W 1	....	....	Nim. 10	Cu. St. 8	Cu. St. 8	
3	749	850	30·016	36·0	29·9	24·0	·120	·123	·094	61	77	73	W S W 2	W S W 1	W S W 1	....	Inap.	Nim. 10	Cu. St. 10	Cu. St. 10	
4	30·057	30·054	106	23·0	24·0	15·0	·073	·077	·040	59	60	46	N W 1	W N W 1	N N W 2	....	Inap.	Cu. St. 10	Strat. 0	0 0	Bright Zodiacal Light. Diffused Auroral Light.
5	170	212	258	9·0	12·0	12·0	·051	·045	·045	65	60	60	N E 1	N E 1	N E 1	....	....	Strat. 1	Cir. 1	0 0	" " " " " "
6	249	344	29·723	7·0	17·0	30·3	·045	·047	·148	64	50	89	N E 1	N N E 1	N N E 2	....	....	0 0	Cu. St. 10	Nim. 10	
7	29·632	29·803	946	39·0	42·0	37·2	·195	·199	·157	82	74	71	S W 4	W 2	W 4	Inap.	Inap.	Cu. 4	0 0	0 0	Bright Zodiacal Light.
8	829	919	30·156	36·0	43·0	32·0	·191	·186	·143	90	67	79	W S W 2	W 2	S 1	....	....	Cu. St. 10	Strat. 1	0 0	Zodiacal Light.
9	30·111	773	29·495	29·4	33·8	39·0	·123	·168	·216	77	89	91	W 3	S 1	S 1	....	....	Cu. St. 10	Nim. 10	Nim. 10	
10	29·521	510	678	39·0	37·0	27·0	·216	·136	·093	91	62	63	W 2	W 2	W 2	Inap.	1·20	Nim. 10	Cu. St. 10	Nim. 10	
11	30·096	30·247	30·389	15·0	15·5	11·0	·063	·031	·028	67	37	39	N N W 2	N W 2	N W 2	....	....	Cu. St. 9	Cu. 0	0 0	Zodiacal Light.
12	441	471	388	12·0	23·0	25·5	·015	·098	·100	60	72	74	W 2	W 2	W 4	....	....	Cir. St. 8	Cu. 9	0 0	Faint Zodiacal Light. High Wind at its maximum between 5 & 6 A. M. [of the 13th.
13	219	091	29·938	28·6	37·0	36·0	·123	·178	·136	77	91	75	S W 7	S W 6	S W 4	....	....	Cu. 9	Cir. Cu. 8	Cu. St. 3	
14	29·925	29·966	30·134	39·0	40·5	37·5	·173	·197	·171	73	78	76	W 2	W 1	W 3	....	....	Cu. St. 10	Cu. St. 10	Cu. St. 9	
15	30·397	30·478	342	23·0	25·2	23·0	·106	·100	·106	86	74	86	N E 2	N E 2	N N E, 3	....	....	Cu. St. 10	Cir Stra [illegible]	Cu. St. 10	
16	227	238	274	23·5	30·5	27·5	·123	·142	·141	100	84	93	N 2	N 2	N 2	....	1·20	Nim. 10	Nim. 10	Cu. St. 10	
17	119	034	104	28·2	38·0	35·0	·153	208	·183	100	91	90	Calm.	Calm.	Calm.	....	....	Nim. 10	Nim. 10	Nim. 10	
18	29·794	29·413	29·418	34·0	37·0	37·5	·196	·221	·221	100	100	100	N 2	N N E 2	N N E 2	0·31	....	Nim. 10	Nim. 10	Nim. 10	
19	909	30·128	30·300	22·5	19·5	15·8	·118	·097	·059	100	92	65	W N W 2	W 2	W 2	1·30	Inap.	Nim. 10	Nim. 10	Nim 10	
20	30·421	462	491	12·5	14·6	12·0	060	·046	·015	80	55	60	N W 2	W 3	W 2	....	Inap.	Cu. St. 10	Cu. 7	0 0	Faint Zodiacal Light. Aurora, with streamers.
21	412	216	062	17·4	27·2	20·0	·072	·093	·091	75	63	85	S 1	S 1	S 1	....	....	Cu. St. 10	Cir. 5	Nim 10	
22	29·646	29·469	29·434	24·2	29·0	28·0	·129	·160	·117	100	100	76	N N E 1	N N E 1	N N E 1	....	4·00	Nim. 10	Nim. 7	Cu. St. 10	
23	502	311	30·268	14·0	25·0	28·0	·051	·082	·117	63	61	76	W 2	S 3	S 2	....	1·50	Strat. 3	Nim. 10	Nim. 10	
24	541	866	127	24·7	15·0	9·0	·105	·040	·022	80	46	35	N W 3	N N W 3	N N W 3	....	3·50	Nim. 10	Cu. St. 8	0 0	Auroral Light.
25	30·120	30·057	29·958	4·5	11·5	7·0	·005	·036	·017	9	49	29	W N W 1	W N W 3	W N W 1	....	....	Strat. 0·5	Nim. 10	Nim. 10	
26	29·929	29·920	30·059	0·6	6·0	6·0	·020	·029	·029	43	51	51	N E 3	N N E 2	N N E 2	....	....	Cu. St. 19	Cu. St. 10	Cu. St. 10	
27	30·267	30·194	144	— 2·0	5·0	4·9	·006	·013	·013	12	23	23	N E 3	N E 3	N E 2	....	....	0 0	Cu. St. 9	Cu. St. 10	Lunar Halo.
28	29·433	29·728	29·955	+ 20·0	35·0	30·6	·091	·183	·124	85	90	73	S W 1	W S W 1	W 1	....	4·50	Nim. 10	Cu. St. 9	0 0	Lunar Corona.
29	[illegible]6	941	30·009	26·4	28·9	23·4	·099	·117	·051	69	76	40	W S W 1	W N W 1	N W 7	....	Inap.	Cu. St. 10	Cu. St. 10	Cu. St. 8	
30	978	808	29·742	21·2	28·0	32·0	·096	·153	·181	85	100	100	N 1	N W 1	N W 1	....	....	Cu. St. 10	Nim. 10	Nim. 10	
31	271	28·994	292	31·3	27·0	31·0	·174	·147	·155	100	100	89	E N E 2	N N E 2	W 3	....	15·00	Nim. 10	Nim. 10	Nim. 10	

REPORT FOR THE MONTH OF JANUARY, 1858.

	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.			7 a. m.	2 p. m.	9 p. m.	
1	29·727	29·612	29·983	18·0	28·0	25·0	·067	·153	·117	·68	·100	·87	S W 2	S W 2	W N W 1	....	5·00	Strat. 4	Nim. 1	0 0	Lunar Corona.
2	30·123	879	796	15·0	28·0	30·0	·055	·099	·130	·64	·64	·78	W S W 2	W S W 2	S W 2	....	2·00	Cu. St. 3	0 0	Strat. 1	Zodiacal Light.
3	29·933	448	492	12·5	20·9	16·3	·030	·080	·074	41	71	83	N W 2	N W 3	S W 2	....	0·50	Cu. St. 10	Nim. 1	Cu. St. 5	
4	380	160	311	26·0	40·0	39·0	·111	·203	·173	81	82	73	S W 4	W S W 4	W S W 4	....	1·75	Cu. St. 10	Strat. 5	Cu. St. 4	
5	882	897	30 106	20 0	10 0	5·0	·091	·045	·013	85	68	23	N 2	N E 2	N E 4	....	....	0 0	0 0	0 0	Faint Zodiacal and Auroral Lights.
6	30·053	938	29·893	— 0 2	6·0	5·0	·038	·029	·041	85	51	74	N E 3	N N E 4	N N E 4	....	....	Cu. St. 10	Nim. 10	Nim. 10	
7	040	30·214	30·486	+ 6 3	11·0	6·4	·043	·028	·029	75	39	51	W 2	N W 2	N W 2	....	5 75	Nim. 10	Strat. 4	Strat. 2	
8	687	703	579	1·0	7·0	2·3	·022	·038	·020	45	85	43	W N W 1	W N W 1	W S W 1	....	....	Cu. St. 9	Cir. 5	0 0	Brilliant Aurora. Faint Zodiacal Light.
9	181	29·914	29·993	16·0	25·0	31·0	·059	·082	·155	65	61	89	S 3	S S W 3	N W 1	....	....	Cu. St. 10	Nim. 10	0 0	Faint Zodiacal Light. Meteor perpendicularly from Auryga at 11·45 p.m.
10	254	30·394	30·346	19·0	19·4	18·8	·055	·065	·087	53	62	84	N W 1	W 1	W 6	....	Inap.	0 0	0 0	0 0	
11	29·914	29·318	29·362	33·0	39·8	40·0	·188	·216	·248	100	91	100	S 6	S 4	S W 4	Inap.	Inap.	Nim. 10	Nim. 10	Nim. 10	Auroral Bank.
12	558	30·094	30·352	35·0	24·2	17·0	·162	·094	·0[illegible]3	80	73	67	S W 6	W 1	W 1	0·11	....	Nim. 10	0 0	0 0	Faint Zodiacal Light.
13	30·255	29·954	052	5·0	18·0	26·0	·013	·036	·105	23	36	75	N 4	N E 3	W S W 2	....	....	Cu. St. 7	Cir. 8	Cu. St. 4	Faint Zodiacal Light.
14	217	30·292	396	24·6	30·0	23·4	·088	·111	·088	67	67	67	W 2	W 1	W 1	....	Inap.	Cu. St. 4	0 0	0 0	Faint Zodiacal Light.
15	456	222	29·995	11·0	16·0	17·8	·042	·059	·098	59	65	100	W 1	N E 1	E 1	....	....	Cu. St. 9	Nim. 10	Nim. 10	
16	29·584	29·419	540	35·0	20·0	32·5	·204	·167	·181	100	100	100	E 1	N E 2	N E 2	Inap.	2·50	Nim. 8	Nim. 10	Nim. 10	
17	835	969	30·0[illegible]3	17·8	14·0	10·0	·078	·051	·025	83	63	37	N E 1	N E 3	N E 2	0·11	0·50	Cu. St. 10	Cu. 3	0 0	Auroral Bank.
18	30·039	998	054	3·8	11·3	9·7	·024	·036	·039	47	49	57	N N E 1	N E 1	N N E 1	....	....	0 0	Strat. 2	0 0	Faint Auroral Light.
19	139	30·117	111	3·0	11·2	10·6	·022	·042	·039	45	59	57	N E 1	N E 1	N E 1	....	....	Fog	Cu St. 10	Cu. St. 10	
20	102	114	161	6·0	16·9	21·0	·029	·047	·074	51	50	64	N E 2	N E 2	N E 1	....	Inap.	Cu. St. 10	Cu. St. 8	Cu. St. 10	
21	051	29·855	231	25·5	37·0	20·0	·111	·154	·043	81	71	40	N 1	N E 3	N E 2	....	....	Cu. St. 8	Cir. 6	Cu. St. 2	Faint Auroral Light.
22	715	30·776	797	— 1·4	1·9	— 0·3	·028	·014	·023	68	34	53	N 3	N 3	N 3	....	....	0 0	0 0	0 0	Faint Auroral Bank.
23	731	580	531	—13·0	4·0	+ 5·8	·018	·024	·029	42	47	51	N 2	N 2	N 1	....	....	0 0	0 0	0 0	Imperfect Lunar Halo, with Central Corona.
24	512	416	345	+ 0·3	34·0	23·0	·017	·077	·106	39	60	86	N 1	N 1	S 1	....	....	Strat. 1	Cir. St. 8	Cir. St. 8	Faint Solar Halo at 2 p. m.
25	279	201	101	32·2	38·0	37·0	·175	·229	·221	94	100	100	S 1	S 1	S 1	....	....	Nim. 10	Nim. 10	Nim. 10	
26	29·851	29·525	29·583	39·5	43·4	39·0	·235	·254	·238	97	92	100	S S W 1	S S W 1	S W 1	0·27	....	Nim. 10	Nim. 10	Nim. 6	
27	637	713	830	35 5	34·0	25·0	·177	·135	·100	85	79	74	W S W 1	N 1	N 1	0·03	....	Cu. St. 6	Nim. 10	Nim. 10	
28	868	829	873	20·8	21·9	17 0	·085	·070	·063	78	64	67	N E 4	N E 3	N E 3	0·02	....	Cu. St. 10	Cu. St. 10	Cu. St. 10	
29	853	774	757	16 0	24·0	22·0	·059	·077	·101	65	60	86	E N E 2	E N E 2	E N E 2	....	Inap.	Nim. 10	Nim. 10	Cu. St. 10	
30	734	701	835	20·9	25·0	13·0	·080	·100	·048	71	74	62	W N W 1	W N W 2	N W [illegible]	....	....	Cu. St. 10	Cu. St. 10	Cu. St. 9	
31	30·049	30·098	30·219	— 3 0	1 2	2·0	·012	·017	·020	32	39	43	W 7	W 3	W 1	....	....	0 0	0 0	Cir. 1	

REMARKS FOR DECEMBER, 1857.

Barometer. ...... Highest, the 20th day: 30·491 inches
Lowest, " 31st " 28·994 "
Monthly mean, 29·9703 inches.
Monthly range, 1·497 "

Thermometer. . Highest, 1st day: 47°0.
Lowest. 27th " —5°0.
Monthly mean, 25°05.
Monthly range, 52°0.

Greatest intensity of the sun's rays, 86°7.
Warmest day was the 1st, its mean temperature being 40°43.
Coldest " " 27th, " " " 2°63.
Mean of humidity, ·719.

Rain fell on 5 days during 47 hours 30 minutes, amounting to 1·90 inches. Snow fell on 13 days during 81 hours 30 minutes, amounting to 30·9 inches in depth. The latter melted and added to the rain afforded a total of the former equivalent to 8·86 inches.

The most prevalent wind was the W.
The least prevalent wind was E. N. E. and E.
No record of wind from the E. S. E., S. E., S.S. E., and S. S. W.
The most windy day was the 13th.
The most windy hour between 5 and 6 A. M. of the 13th.
There was one calm day, the 17th.
There was no cloudless day.
Ozone was in moderate proportion.

N. B.—The rain and snow guages are noticed each morning at 10 a.

REMARKS FOR JANUARY, 1858.

Barometer. ...... Highest, the 22nd day, 30·797 inches.
Lowest, " 4th " 29·160 "
Monthly mean, 30·0226 inches.
Monthly range, 1·497 "

Thermometer. . Highest on the 26th day, 49°0.
Lowest " 23rd " —14°0.
Monthly mean, 18°83.
Monthly range, 63°.

Greatest intensity of the sun's rays, 79°.
Warmest day was 26th; its mean temperature, 40°63.
Coldest day was 23rd; " " —1·06.
Mean of humidity, ·6786.

Rain fell on 6 days during 56 hours 50 minutes. It snowed on 12 days during 52 hours 15 minutes. Of the former there fell 0·54 inches in depth; of the latter 17·95 inches. This melted and added to the former yielded a total of 3·81 inches rain in depth.

The most prevalent wind was the N. E.
The least " E.
No record of wind from N. N. W., E. S. E., S. E., and S. S. E.
The most windy day was the 11th.
The most windy hour between 4 and 5 a. m. of same.
There was no calm day.
Cloudless days occurred on 5th, 10th, 22nd, 23rd and 31st.
Ozone was in moderate proportion.

N B.—The rain and snow guages are noted each morning at 10 a. m.