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THE

CANADIAN NATURALIST.

SECOND SERIES.

ELEMENTARY VIEWS OF THE CLASSIFICATION OF ANIMALS.

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[The matter of the following pages has been prepared principally for the benefit of students, who are in general much more apt to learn names and details than to attain to general views. It is introductory to the printed synopsis of lectures which I annually prepare for my classes, and is now published under the impression that, though but elementary and general, the views which it contains may prove interesting to naturalists, and useful to some of those who may be struggling with the difficulties incident to the study of zoölogy under the heterogeneous methods of classification which are found in most elementary books. Should time permit, it may be followed by illustrations of the details of some of the classes and orders of animals. The writer acknowledges his obligations, as sources of recent information, to Agassiz's Essay on Classification, Dana's Remarks on the Classification of Animals based on Cephalisation, and Huxley's Lectures on Classification, though he cannot follow throughout the systems of any of these authors.]

1. Introductory Remarks.

No subject is at present more perplexing to the practical zoölogist or geologist, and to the educator, than that of zoölogical classification. The subject in itself is very intricate, and the views given as to certain groups by the most eminent naturalists so conflicting, that the student is tempted to abandon it in despair, as incapable of being satisfactorily comprehended.

The reasons of this, it seems to the writer, are twofold. First, zoölogy is so extensive, that it has become divided into a number of subordinate branches, the cultivators of which attach an exag-

gerated value to their own specialties, and are unable to appreciate those of others. Thus we find naturalists subdividing one group more minutely than others, or raising one group to a position of equivalency with others, to which, in the opinion of the students of these others, it is quite subordinate. So also we have some zoölogists basing classification wholly on embryology or on mere anatomical structure, or even on the functions of some one class of organs. Secondly, there is a failure to perceive that, if there is any order in the animal kingdom, some one principle of arrangement must pervade the whole; and that our arrangement must not be one merely of convenience, or of a desultory and uncertain character, but uniform and homogeneous.

The writer of these pages does not profess to be in a position to escape from these causes of failure; but as a teacher of some experience, and as a student of certain portions of the animal kingdom, he has endeavoured carefully to eliminate from his own views the prejudices incident to his specialties, and to take a general view of the subject; and is therefore not without hope that the results at which he has arrived may be found useful to the young naturalist.

Classification in any department of Natural History is the arranging of the objects which we study in such a manner as to express their natural relationship. In other words, we endeavour in classification to present to our minds such a notion of the resemblances and differences of objects as may enable us to understand them, not merely as isolated units, but as parts of the system of nature. Without such arrangement there could be no scientific knowledge of nature, and our natural history would be merely a mass of undigested facts.

At first sight, and to a person knowing only a few objects, such arrangement may appear easy; but in reality it is encompassed with difficulties, some of which have not been appreciated by the framers of systems. The more important of these difficulties we may shortly consider.

1. There are in the animal kingdom a vast number of kinds or species. To form a perfect classification it would be necessary to know the characters or distinctive marks of all these species. To make even a tolerable approximation to a good system, requires an amount of preparatory labour which can be estimated only by those who have carefully worked up at least a few species in these respects.

2. So soon as we have ascertained the characters of a considerable number of species, we find that in their nearest resemblances these do not constitute a linear series, but arrange themselves in groups more or less separated from each other like constellations in the heavens, and having relationships tending with more or less force in different directions. This not only introduces complexity into our systems, but renders it impossible to represent them adequately in written or spoken discourse, or even by tables or diagrams. We think and speak of things in series, but nature's objects are not so arranged, but in groups radiating from each other like the branches of a tree; and our imperfect modes of thought and expression are severely tested in the attempt to understand nature, or to convey ideas of classification to the minds of others.

3. The considerations above stated oblige us to enquire what leading characters we may take as the principal thread of our arrangement, so as to make this as natural as possible and at the same time intelligible. It is simplest to take only one obvious character, as if for example we were to arrange all animals according to their colour or to the number of their limbs; but the greater the number of characters we can use, or the more completely we can represent the aggregate of resemblances and differences, the more natural will our arrangement be, and consequently also the more scientific and useful.

In attempting to weigh the several characters presented by any object, we find some that are of leading importance, others that are comparatively unimportant, though still not to be neglected; and we find that some indicate grades of complexity, others are connected with adaptations to certain uses, and others indicate plan of construction. Due weight must be given to all these kinds and degrees of characters. It is perhaps in the proper estimation and value of their relative importance and different modes of application that the greatest failures have been made.

Keeping in view these difficulties of the subject, we may now proceed to the consideration of the more elementary of the groups in which we arrange animals.

2. The Species in Zoology.

We cannot consider the animals with which we are familiar without perceiving that they constitute kinds or *Species*, which do not appear to graduate into each other, and which can be distin-

guished by certain *characters*. Yet simple though this at first sight appears, we shall find that many intricate questions are connected with it. Our idea of the species is based on the resemblance of the individuals composing it in all the characters which we consider essential. If, for instance, a number of sheep and goats are placed before us, we readily select the individuals of each species. In doing this we give no regard to differences of sex or age, but put the young and old, the male and female, of each species together. Nor do we pay attention to merely accidental differences: a mutilated or deformed specimen is not on that account separated from its species. Nor do we attach value to characters which experience has proved to vary according to circumstances, and in the same line of descent. Such, for example, are differences of colour, or fineness of the hair or wool. The remaining resemblances and differences are those on which we rely for our determination of the species, and which we term essential. We shall find that these essential characters of the species are points of structure, proportion of parts, ornamentation, and habits.

These characters constitute our idea of the species, which we can readily separate from the *Individuals* composing it. The individuals are temporary, but the species is permanent, being continued through the succession of individuals. If all the adult individuals are alike and indistinguishable from each other, then any one may serve as a specimen of the species. If there are differences of sex or *Varieties* subordinate to the species, then a suite of specimens showing these will represent the species. The species is thus an assemblage of powers and properties manifested in certain portions of matter called individuals, and which are its temporary representatives. It follows that the species is the true unit of our classification, and that the indefinite multiplication of individuals leaves this unchanged.

Our idea of the species will however be imperfect if we do not distinctly place before our minds its continued existence in time. This depends on the power of reproduction, whereby the individuals now existing have descended from similar progenitors, and will give birth to successors like themselves. A moment's thought will suffice to show that, independently of this, species could have no real existence in nature. If animals were not reproductive, the species would become extinct after the lapse of a generation. If their reproduction followed no certain law, and

the progeny might be different from the parents, then the characters of the species would speedily become changed, and it would practically cease to be the same. Again, it is necessary that the reproduction of species should be pure or unmixed; for an indiscriminate hybridity would soon obliterate the boundaries of species. It is impossible, therefore, to separate the idea of species from the power of continuous unchanged reproduction, without depriving it of its essential characters.

In like manner it is obvious that we must assume a separate origin for each species, and that we need not assume more than one origin. Practically, species remain unchanged, and do not originate from one another; and if all the individuals of a species were destroyed except one pair, this would, under favourable circumstances, be sufficient to restore the species in its original abundance.

The questions which have been raised as to the origin of species by descent with indefinite variation, and as to the possible creation of individuals of the same species in different places or at different times, are not of a practical character, at least in zoology proper, and the whole burden of proof may be thrown on those who assert such views.

We are thus brought to the definition of species, long ago proposed by Cuvier and De Candolle, and may practically unite in one species all those individuals which so resemble each other that we may reasonably infer that they have descended from a common ancestry. All our practical tests for the determination of species resolve themselves into this general consideration. The only modification of this statement on which even a Darwinian can insist, is, that a sufficient time and great geological changes being given, one species may possibly split into two or more; and since this is an unproved hypothesis, we may practically neglect it, except as a warning to be very sure that we do not separate as distinct species any forms which may be merely varieties of a single species, an error exceedingly prevalent, and which vitiates not a little of our reasoning on such subjects.

The origin of the first individuals of a species may be, and probably is, a problem not within the province of natural history. In the case of vital force it is the same as in the case of gravitation and other forces. We can observe its operation and ascertain the laws of its action, but of the force itself we know nothing. It is to us merely an expression of the power and will of the

Creator. With regard to the creative force or power, we are still more ignorant. We do not witness its operation. We know nothing, except by inference, of its laws; and whatever we may succeed in ascertaining as to these, we may be sure that in the last resort we shall, as in the case of all other natural effects, be obliged to pause at that line where what we call force resolves itself into the will of the supreme spiritual Power. The "miracle" of enactment must necessarily precede law; the "miracle" of creation, the existence of matter or force. Those who deny this have no refuge but in a bald scepticism, discreditable to a scientific mind, or in metaphysical subtilties, into which the zoologist need not enter.

We must not suppose, however, that the species is absolutely invariable. Variability, in some species to a greater extent than in others, is a law of specific existence. It is the measure of the influence of disturbing forces from without in their action on the specific unity In some cases it is difficult to distinguish varieties from true species, and with many naturalists there has been a tendency to introduce new species on insufficient grounds. Such errors can he detected ordinarily by comparing large suites of specimens and ascertaining the gradations between them, which always occur in the case of varieties, but are absent in the case of species truly distinct. Such comparisons require much time and labour, and must be pursued with much greater diligence than heretofore, in order to settle finally the question whether the varietal perturbations always tend to return to a state of equilibrium, or whether in any case they are capable of indefinite divergence from the specific unity.

The species is the only group which nature furnishes to us ready made. It is the only group in which the individuals must be bound together by a reproductive connection. There might or might not be affinities which would enable us to group species in larger aggregates, as *genera* and *families;* and the tie which binds these together is merely our perception of greater or less resemblance, not a genetic connection. We say for example, that all the individuals of the common Crow constitute one species. and we know that if all these birds were destroyed except one pair, the species would really exist, and might be renewed in all its previous numbers. We can make the same assertion with reference to the Raven or to the Blue Jay, considered as species. But if, because of resemblances between these species, we group them in

the genus *Corvus* or in the family *Corvidæ*, we express merely our belief in a certain structural resemblance, not in any genetic connection. Nor need we suppose that if any of the species of a genus were destroyed they would be reproduced from the others. Further, while all the individuals of any of the species may be precisely similar to each other and still be distinct individuals, all the species of the genus cannot be similar in all their characters, otherwise they would constitute but one species.

In other words, the species and the genus, considered as groups, differ not in degree but in kind. To make this very plain, let us take a familiar illustration. I have a number of maps, all uniform in size and in style of execution; but in the whole there are only two kinds,—maps of the eastern hemisphere, and maps of the western hemisphere. Now all of the maps of *one* kind constitute a species; those of *both* kinds, a genus. The individuals of one species, say of the eastern hemisphere, are all alike. They have all been struck from one plate, from which many similar maps may be produced. But the other map, though necessary to make up the set or genus, may be quite dissimilar in all its details from the first, and could not be produced from its plate. We have no difficulty here in understanding that the specific unity is of a different kind from the generic unity, and that the distinction is by no means one of mere grade of resemblance. A very little thought must convince any one that this applies to species and genera in zoology; and that those naturalists who affirm that species have no more real existence in nature than genera, have overlooked one of the essential elements of classification. Nor would this distinction be invalidated by the assumption of a descent with modification, unless it could be shown that in actual nature species shade into each other; and this is certainly not the case in those which are reckoned as good species.

I have been thus careful to insist on the nature of the species in natural history; because I believe that loose views on this subject have caused a large proportion of the errors in classification.

Though the groups higher than species do not exist in nature in the same sense in which species exist, they are not arbitrary, but depend on our conception of resemblances and differences which actually exist. We go out into the forest and perceive different species of trees; but, at the same time, we find that these species can be grouped in genera, as Oaks, Birches, Maples, &c., under

each of which generic names there may be several species. It is evidently not an arbitrary arrangement of ours thus to group species: they naturally arrange themselves in such groups, under the action of our comparing powers.

3. Genera and Higher Groups.

In comparing species with each other for purposes of classification, there are four distinct grounds on which such comparison can be made. These are:—1st. intimate structural or anatomical resemblance; 2nd. Grade or rank; 3rd. Use or function; 4th. Plan or type. All of these may be, indeed must be, used in classification, though in very different ways.

1. *Intimate structural relationship* is the ground on which we frame *Genera.* Two or more species resemble each other structurally to such an extent that the same definition will in many important points apply to both. Such species we group in a genus. It is most important to observe, as Agassiz has well pointed out, that this close resemblance in structure is really our main ground for the formation of genera. But for this very reason it is not to be expected in our higher groups. It is the mistaken application of this criterion to classes, which constitutes the leading defect of a work otherwise very valuable, and which I cordially recommend to students,—Huxley's "Lectures on Classification."

2. *Grade or rank* refers to degree of complexity of structure, or to the degree of development of those functions that are the highest in the animal nature. A coral polyp is more simple in structure than a fish, and is therefore lower in rank. A fish is less highly endowed in brain, sensation, and intelligence, than a mammal, and is therefore of lower rank. An egg or an embryo is simpler than the adult of the species to which it belongs; and when one animal resembles the embryo of another, it ranks lower in the scale. A worm ranks lower than an insect whose larva it resembles.

We use this difference of grade or rank in grouping genera in *Orders;* but it occupies a very subordinate place in the construction of other groups. Many grave errors have arisen from its indiscriminate application; most heterogeneous assemblages being formed when we construct groups larger than orders merely on the ground of lower grade: and when, on the other hand, we separate the lower members of natural groups on the ground of simplicity of structure, we fall into an equal mistake of another

kind. Of errors of these kinds still current, I may instance the attempt of some naturalists to establish a province or sub-kingdom of *Protozoa*, to include all the simplest members of the Animal Kingdom, and the separation of the Entozoa or intestinal worms from the other worms as a distinct class. The classification in Owen's "Lectures on the Invertebrate Animals," which I have long used with advantage as a text-book, is defective in some parts in this respect.

There are two kinds of investigation much used in classification, which more especially develope the idea of grade or rank among animals. One is that of embryology, or the development of animals from the ovum. Another is that of cephalisation, or the development of the head and organs connected therewith. Both of these are of great importance, but, on the principles above stated, they aid us chiefly in referring animals to their *Orders*. Other limitations of the criterion of grade or rank will appear when we arrive at the consideration of *Classes*.

3. *Function or Use.*—In different animals we often find the same use served by different kinds of organs, as, for instance, the wing of a bird and the wing of an insect, which, though both used for flying, are constructed in very different ways. It would lead us astray were we to arrange animals primarily on this ground: for instance, if we were to group together fishes and crustacea because both swim; or birds and insects, because both fly. Again, in different groups of animals, certain functions and the organs which subserve them are greatly developed in comparison with others. For example, the enormous reproductive power of fishes, or the remarkable development of the locomotive organs in birds, as compared with other vertebrates. This consideration is not applicable in our primary division of animals, but it constitutes the principal ground on which naturalists have based the secondary divisions or *Classes*; and it serves also to indicate the *analogies* between the corresponding members of different primary groups, as, for instance, of the birds in one group to the insects in another.

4. *Plan or Type.*—Under this head we consider the similarity of construction in different animals or organs, without regard to uses. We say, for example, that the wing of the bird and the bat, the paddle of the whale, and the fore-leg of the dog, are similar in type or *homologous* to each other, because they are made up of similar sets of bones. They are modifications of one general plan

of structure. Animals thus constructed on similar plans are said to have an *affinity* to each other.

It is evident that this consideration of homology or affinity, if we can really detect it in nature, should be a primary ground in our arrangement; because, if we regard nature as an orderly system, and still more if we regard it as the expression of an intelligent mind, this must be the aspect in which we can best comprehend its scheme or plan of construction.

As a simple illustration of this and the preceding heads, we may suppose that we are writing a treatise on architecture, or the art of building. We observe 1st, that there are differences of material employed, as stone, brick, or wood; 2nd, that there are various grades of buildings, from the simplest hut to the most elaborate palace or temple; 3rd, we find a great variety of uses for which building are constructed, and to which they are adapted; 4th, there are different orders of architecture or styles, which indicate the various plans of construction adopted. It will, in studying such a subject, be the most logical order to consider, 1st, the several orders of architecture or plans or types adopted; 2nd, under each of these to classify the various kinds of buildings according to their uses; 3rdly, under each of these secondary heads, to treat of buildings more or less elaborate or complex; and 4thly, to consider the materials of which the structures may be composed. This is precisely what the most successful formers of systems have done in natural history, in dividing the animal kingdom into provinces or branches, classes, orders, and genera. On the other hand, classifications produced by mere anatomists who content themselves with a close adherence to similarity of structure and rigid definitions based on these, may be compared to a system of architecture produced by a mere bricklayer, who regards only the materials used and the manner of putting them together.

4. The General Nature of the Animal.

Having settled the more important of the general principles of classification, we now proceed to their practical application; and first, as a necessary preliminary, to ascertain what we understand by the term *Animal*, and what are the *precise limits of the Animal Kingdom*.

In answer to the question, What is an animal? we may say in the first place that the animal is a being possessing organisation based on cell-structures, and vital force. This suffices to distin-

guish it from mineral substances, but not from the plant, which is also organised and living, though in a mode somewhat different.

To distinguish the animal from the plant, we may affirm, 1st, that it is reproductive by eggs and not by seeds; 2nd, that in its processes of nutrition it digests organic food in an internal cavity, subsequently consuming a part of this food at the expense of the oxygen of the atmosphere; and that it builds up its tissues principally of nitrogenised matter; 3rd, that the animal possesses the power of voluntary motion, and, to subserve this, muscular tissue; 4th, that it possesses sensation, and, to subserve this and motion as well, a nervous system and external senses.

We thus find four general characteristics of the animal:

1. *Sensation*—by means of a nervous system and special senses.
2. *Voluntary motion*—by means of the muscular and nervous systems.
3. *Nutrition*—by means of a stomach and intestines, with absorptive, circulatory, and respiratory apparatus.
4. *Reproduction*—by ova and sperm-cells.

In every animal, even the simplest, these functions are in greater or less perfection performed; and it is the presence of the aggregate of these functions or the organs proper to them, that enables us to call any organism an animal. It is important to carry with us this definition of the animal; first, as indicating the limits of the creatures which the zoologist has to classify; and secondly, as pointing out to us the nature of the characters on which we must rely, in our classification. For the student I hold it to be necessary, before proceeding further, to understand well these functions and structures, as they exist in some one of the higher animals.

5. Primary Division of Animals into Provinces or Branches.

This, on the principles already stated, must be made solely on the ground of type or plan, and this taken in its most general aspects.

If we bring before us mentally the several members of the animal kingdom, we shall probably be struck in the first instance with the general prevalence of bilateral symmetry, or the arrangement of parts equally on the right and left sides. We may observe, however, that there is a large group of animals to which

this general style of construction does not apply, and which have, in the words of Agassiz, a "vertical axis around which the primary elements of their structure are symmetrically arranged," conforming in this respect, and also often in other points, to the symmetry of the plant, rather than to that of the more perfect animals. We would thus obtain what is perhaps the most obvious of all primary divisions of animals,—that into those with bilateral symmetry and those that are radiated, or the *Artiozoaria* and the *Actinozoaria* of Blainville. We shall soon find, however, on more detailed examination, that this division is very unequal, since the first group includes by far the greater part of the animal kingdom, and its members are nearly as dissimilar among themselves as any of them are from the radiates.

Penetrating a little deeper into structural character, we find that one large group of the bilateral animals possesses an internal skeleton, arranged in such a way as to divide the body into an upper chamber holding the brain and nervous system, and an under chamber for holding the ordinary viscera; whereas in the greater number of the bilateral animals and all the radiates, there is but one chamber for containing the whole of the organs. The first of these groups, from the vertebræ or joints of the backbone, peculiar to its members, we name *Vertebrata*, and all the other animals *Invertebrata*, as proposed by Lamarck: this division corresponds to the *enaima* and *anaima* of Aristotle. Here also however we have a very unequal division,—the invertebrata being a vast and heterogeneous assemblage.

If, however, after separating the vertebrata on the one hand, and the radiata on the other, we study the remainder of the animal kingdom, we find that it readily resolves itself into two groups, known as the *Articulata* and the *Mollusca*. We thus reach the fourfold division of Cuvier; which is by much the most natural and philosophical yet proposed, however much it may be carped at by some merely anatomical systematists. This system may be summarised as follows:

Provinces or Branches of the Animal Kingdom.

1. VERTEBRATA, including Mammals, Birds, Reptiles, and Fishes. All these animals are bilateral and symmetrical, have an internal vertebrated skeleton, a brain and a dorsal nerve-cord lodged in a special cavity of the skeleton. With reference to the general

form, they may be termed doubly symmetrical animals; with reference to their nervous system, *Myelencephalous.*

2. ARTICULATA,* including Arachnida, or spiders and scorpions; Insects; Crustaceans, and Worms. These animals are bilateral and symmetrical, have an external annulose skeleton, a nervous system, consisting of a ring and ganglion around the gullet, connected with a double abdominal nerve-cord. They are otherwise named *Annulosa*, longitudinal animals, or *Homogangliata.*

3. MOLLUSCA, including Cuttle-fish and their allies; Gasteropods or univalve shell-fishes and their allies; Lamellibranchiates or bivalve shell-fishes, &c.; Brachiopods and their allies. They are bilateral but not always symmetrical, have no skeleton, and an œsophageal nervous ring with nerve-fibres and ganglia not symmetrically disposed. They are otherwise named massive animals, or *Heterogangliata.*

4. RADIATA, including Sea-urchins and starfishes; Sea-nettles and hydras; Polyps and coral-animals; and Sponges and their allies. These have the parts arranged radially around a central axis, and the nerve-system when discernible consisting of a central ring with radiating fibres. They may be otherwise named peripheric animals, or *Nematoneura.*

This fourfold division includes the whole animal kingdom, and is the only rational one which can be based on type or plan of structure. Since the time of Cuvier, though modifications in detail have become necessary, it has been strengthened by the progress of discovery; and more especially Von Baer has shown that the study of embryology establishes Cuvier's branches, by showing that in their development, animals pass through a series of forms belonging to their own branch and to that only.

The attempts which have been made to introduce additional branches or provinces, I regard as retrograde steps. Such for example is the province *Cœlenterata* of Leuckart, including the Polyps and the Acalephs, both of them good classes, but not together constituting a group equivalent to a Province; the Province *Protozoa* of Siebold, which to resume our architectural figure, includes merely the huts and cabins which it is difficult to refer to any style of architecture, but which do not, on that

* I prefer this term to "Annulosa," as being Cuvier's original name—a fact which should overrule merely verbal objections.

account, themselves constitute a new style; and the Provinces *Molluscoida* and *Annuloida* of Huxley, which, as their names indeed import, are in the main merely simple forms of Mollusca and Articulata.

6. Division of Provinces into Classes.

Having formed our Primary divisions or Provinces on the ground of type or plan, we must, in dividing these into classes, have regard either to subordinate details of plan, or to some other ground. In point of fact, naturalists seem to have tacitly agreed to form classes, on what Agassiz terms the "manner in which the plan of their respective great types is executed, and the means employed in their execution." In other words, they have in forming classes adopted, perhaps unconsciously, a *functional* system, similar to that employed by Oken in forming his primary groups. They have taken the relative development of the four great functional systems of the animal,—the sensative, the locomotive, the digestive, and the reproductive. This is very manifest in the ordinary and certainly very natural sub-division of the vertebrates into the four classes of Mammals, Birds, Reptiles,* and Fishes. The Mammals are the nerve or sensuous animals, representing the highest development of sensation and intelligence. The Birds are eminently the locomotive class. The Reptiles represent merely the alimentary or vegetative life. The Fishes are the eminently reproductive or embryonic class.

If this is a natural division of vertebrates into classes, and if the other three Provinces are of equivalent value, then there should be but four classes in each, one corresponding to each of the great functional systems. We may name the first of these the nervous class; the second, the motive class; the third the nutritive class; the fourth, the reproductive or embryonic class. Let us then endeavour, as a test of the truth of this system, to make such an arrangement of the classes of the animal kingdom.

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* The *Amphibia*, as Dana well argues on the principle of cephalisation, are clearly Reptiles, because we arrange animals in their mature and not in their embryonic condition, and because the points of reproduction in which Amphibia differ from ordinary reptiles, have relation to an aquatic habitat, and are ordinal or rank characters merely.

TABLE OF CLASSES OF ANIMALS.

Provinces or Branches.	Vertebrata.	Articulata.	Mollusca.	Radiata.
1. Nervous class.	*Mammalia*..	*Arachnida* .	*Cephalopoda*.....	*Echinoder-*
2. Motive class...	*Aves*.....	*Insecta*	*Gasteropoda* (including *Pteropoda*)	[*mata*. *Acalephæ*.
3. Nutritive class	*Reptilia*....	*Crustacea*...	*Lamellibranchiata*.	*Anthozoa*.
4. Embryonic or Reproductive clas .	*Pisces*.....	*Annulata*..	*Molluscoida* (including *Tunicata, Brachiopoda, Bryozoa*,.....	*Protozoa*.

All of the above groups are recognized by common consent as classes, except a few which have been already incidentally adverted to, and to which it is not necessary again to refer here.*

It will be observed that the order in descending the columns is that of *affinity;* that in reading across the columns is the order of *analogy*. The affinities no naturalist will seriously doubt. The analogies may be less familiar. In examining them, it will be seen that the first class in each province includes animals remarkable for condensation of the head and body, where the former exists; for high nervous energy, sensation, and intelligence; for prehensile apparatus, and for absence or simplicity of metamorphosis. The classes in the second line are characterized by the greatest locomotive powers in their respective provinces; those in the third line by the development of the nutritive apparatus and of vegetative growth; those in the fourth line by embryonic characters when mature, and by abundant reproductive energy.

It will be observed also as a necessary consequence of the system we have pursued, that each of our classes includes animals of very various rank or grade. Indeed, most of them have at their bases forms so simple or imperfect that it is almost impossible to include them in the class-characters. This is no objection to our arrangement, but a proof of its correctness; for we have now arrived at the point where we must form *Orders* based solely on

* The rank given to the *Arachnida* will be disputed by some naturalists; but a consideration of the structures of these animals will show that their relations to the insects and the crustacea are similar to those of the mammals to the birds and the reptiles; and that it is no more reasonable to say that the arachnidans are nearer to the crustaceans than to the insects, on the ground of general structure, than it would be to do the same in the case of the mammals and the reptiles as compared with the birds.

this consideration of rank. Of these humbler members of our classes we may mention the *Marsupials* and the *Monotremes* among the mammals, the *Amphibia* among the reptiles, the *Mites* among the arachnidans, the *Myriapods* among the insects, the *Entozoa* among the worms. Indeed it is quite possible on this ground to divide each of our classes into two or more *Sub-classes*. This is sometimes convenient for the sake of more accurate definition; but it is not necessary, since the division into orders sufficiently expresses these grades of complexity or elevation.

7. Division of Classes into Orders and Families.

Orders, as already stated, are based principally on rank or grade, to be ascertained by relative complexity or by the development of the higher nature of the animal. The last section, however, obliges us to take this with some limitation; for since we have four descriptions or sorts of classes, each of these must have the grade within it ascertained on special grounds. For example, the orders of birds, insects, gasteropods, and acalephæ, should be ascertained chiefly by reference to the locomotive organs, as being the system of organs most eminently represented in the class. If we glance for a moment at the systems which have been proposed, we shall see that this view has unconsciously commended itself to naturalists. The orders of insects, for example, are very plainly based on such characters, being founded mainly on the wings. This is nearly equally manifest in the ordinarily received orders of birds. It appears in the division into Pteropods, Heteropods, and Gasteropods proper among the Gasteropoda. It is also seen in the orders *Ctenophora*, *Discophora*, *Siphonophora*, among Acalephæ. It would be easy to show by a detailed review of the orders in the animal kingdom, that, in so far as they have been distinctly defined, they have in most cases been framed with a reference to the prevailing characteristics of the class; and also with the idea of grade or rank as a leading ground of arrangement. As previously observed, also, it is in the construction of orders, and in ascertaining rank in other divisions, that embryology and the doctrine of cephalisation are chiefly useful. For the present, however, we must leave this subject until we shall have an opportunity to enter into descriptive zoology.

In Botany, orders and families are identical. In Zoology we use the term *Family* for a group inferior to an order, and equivalent to the sub-order or tribe in botany. The family con-

sists of an assemblage of genera resembling each other in general aspect. Most large orders are readily divisible into such assemblages, which, though in themselves somewhat vague, have the advantage of being formed on grounds which, being conspicuous and obvious at first sight, much aid the naturalist in the preliminary parts of his work. For example, among the carnivorous mammalia such groups as the *Mustelidæ* or weasels, the *Canidæ* or dogs, the *Felidæ* or cats, are so obvious that any member of one of these groups can be referred to that to which it belongs almost at first sight. Still I do not regard families as necessary divisions of the order. Some small orders may not admit of division into families; and even where such division is admissible, the genera may be studied as members of the order, without being grouped in families, though this grouping is often very useful and convenient.

It is important to observe, before leaving this part of the subject, that, in consequence of the great multiplication of species in some groups, and the close scrutiny of their structures, it is the tendency of specialists to form many small genera. This leads to the construction of numerous families, many of which would more properly remain as genera. A still worse consequence is, that, instead of forming sub-orders and sub-classes, such specialists often call sub-orders or even families orders, and raise sub-classes or orders to the rank of nominal classes, thus introducing a confusion which leads the student to suppose that these terms have no definite meaning. I would further observe here, that I do not so much insist on the use of one name for a group rather than another, as on the constant use of each term for groups truly equivalent in the system.

It may be necessary here to state that the formation of orders on the ground of rank, and of families on the ground of general aspect, does not exclude the ideas of rank and general aspect from the province or class. On the contrary, as a secondary ground, general aspect is a good character in the province and class, and a gradation of rank can be perceived in provinces and classes. In the provinces, the *Vertebrata* stand highest, and the *Radiata* lowest, the *Articulata* and the *Mollusca* being nearly equal, and their lower members not so high as the highest *Radiata*; so that they would stand in a diagram thus:

Vertebrates

Articulates *Mollusks*

Radiates.

So among classes, the nerve class in each province is the highest and the embryonic class the lowest, and the other two intermediate; but the idea of rank is not here the primary one, as it is in forming the orders. It is also true that from the province downward the idea of type or plan is constantly before us.

We have now in descending from provinces reached the genera and species, with the consideration of which we commenced; and if the preceding views have been understood, we shall be prepared to commence the study of Descriptive Zoology, or to enter upon the details which fill up the outline which has been sketched. In doing this we must take specimens of known species and study them in their structural and physiological peculiarities, and in their relations to the other species congeneric and co-ordinate with them.

ON THE OCCURRENCE OF PIERIS RAPÆ IN CANADA.

By G. J. Bowles, Sec. Ent. Soc. of Canada, Quebec Branch.

During the summer of 1863—my first collecting season—I captured in the vicinity of Quebec numerous specimens of a butterfly of which no description could be found in any work on American entomology. Mr. Couper, to whom I applied for assistance, was equally at a loss to determine the species, considering it, as I did, to be indigenous to Canada. In order to solve the problem, however, he forwarded some specimens of the imago to Mr. William Saunders, of London, C. W., who pronounced them to be identical with *Pieris rapœ*, the small white butterfly of England, one of the most common and injurious lepidopterous insects of that country. In the meantime I had enclosed a drawing of the butterfly, together with the wings, to Mr. S. H. Scudder, of Boston, Mass., from whom I received a reply, stating that after comparing the drawing and wings with specimens of *P. rapœ* in the Museum of Comparative Zoology at Cambridge, he saw no reason to consider them distinct: at the same time he desired further investigation to be made respecting the larva and pupa states of the insect. This investigation has been successfully carried out, and places beyond doubt the identity of the butterfly with the English *P. rapœ*, thus establishing another instance of the transportation of a lepidopterous insect across a wide expanse of ocean, and its naturalization in

a new country,—an instance which, when the evidence is considered, must be regarded as the most conclusive on record.

The identity of the English and Canadian species is thus proved by the exact similarity of the two insects in all their stages. That the imagines are alike, in both sexes, I have on the authority of the gentlemen above named; for in Quebec I could have no opportunity of comparing specimens taken in both countries. It is singular, too, that a curious variety of the male is common to both: in Canada, however, (perhaps from the effect of a different climate) it is more frequently met with than in England. Two males of a bright canary color, but with the usual markings of the species, were captured here last summer—one by Mr. Couper, the other by me; and this season I have already seen several similar individuals. On referring to a valuable work in the library of Parliament, (Curtis's Farm Insects,) I was gratified to find that the author mentions having in his collection a male *P. rapæ*, "taken near Oldham, in Lancashire, which has all the wings of a bright yellow color." As to the pupa, in size, color and markings, it exactly agrees with engravings and descriptions of the English chrysalis, and also in its usual place of deposition, &c. The last link in the chain is furnished by the similarity of the caterpillar, which also agrees with the best English descriptions. I took several of these larvæ from cabbage-plants in hotbeds on the 8th of June, and have reared four of them to maturity. When about half-grown, they began to exhibit the characteristic markings of the species,—these markings becoming more decided as they increased in size.

That this insect is not native to Canada, is certain from two interesting circumstances connected with its history. A limit can be set to its existence in Canada; and the place where it first appeared can be specified. Until within a few years, the butterfly was unknown in this country. No description of it is found in Kirby's "Fauna Boreali Americana"; nor in the "Canadian Naturalist," by Gosse, who visited Quebec, and collected here about 1839. The "Synopsis" of the Smithsonian Institution is also wanting in this respect; and I have carefully examined the volumes of our magazine of natural history, (the "Canadian Naturalist," Montreal) without finding any notice of the species. This periodical contains two lists of lepidoptera collected in Lower Canada; one by Mr. R. Bell, Jun., of butterflies taken on the Lower St. Lawrence; the other by Mr. D'Urban, of those found in the vicinity of Montreal in 1857-8-9. The only *Pieris*

mentioned in these lists is *P. oleracea*, a species which may be distinguished at a glance from *P. rapæ*, the markings being altogether different. Mr. Couper captured a specimen of *P. rapæ* within the city limits of Quebec, about five years ago, but did not investigate the subject, though considering the insect a rare one, his special study being coleoptera. This is the earliest notice of the butterfly in Canada; and it evidently points out Quebec as the *locality* of introduction, and fixes the *period* at about seven or eight years ago.

With respect to the means by which it has been brought into the country, some plausible conjectures may be advanced. Of course the introduction took place during the season of navigation. The turnip, cabbage, and other kindred vegetables, constitute the principal food plants of the insect; and, adhering to one of these, it must have been carried across the ocean, either in the egg, larva, or chrysalis,—the last being the most unlikely, as the larva always forsakes its food-plant, and becomes a pupa in some sheltered situation, usually under the coping of a wall, &c. The eggs are laid on the under side of cabbage and turnip leaves, where the larva, on emerging, find themselves in close proximity to their food. Perhaps the vegetable refuse thrown from one of our ocean steamers on her arrival, has contained a few eggs or larvæ, which under these unfavourable circumstances, have retained their vitality; and from these have sprung the imagines destined to become the parents of the species in Canada.

The habitat of the insect is still very limited. After making enquiry, I do not think that it has extended more than forty miles from Quebec as a centre, so that a circle of eighty miles diameter would include the present habitat. This may seem great progress during the short period of its naturalization, but, considering the fecundity and habits of the species, it is not surprising.

There is some importance connected with the introduction of this butterfly, apart from the scientific interest of the subject to entomologists. Hitherto, Lower Canada has possessed but one species of the genus *Pieris* (*P. oleracea*, Harris; *Pontia casta*, Kirby,) and this species so insignificant in numbers, at least in the Quebec region, that its depredations have passed unnoticed. The new importation, however, must be regarded in a different light. As the insect is now permanently settled in the country, is very prolific, and the larvæ extremely voracious, we may anticipate its becoming a great pest to farmers and gardeners, not only where it is now found, but ultimately in the whole of Canada, and

parts of the United States. And that it will in the course of time spread over these regions, admits of no doubt. The food-plants of the species are cultivated in every part of the country, and besides, the insect has the power of accommodating itself to altered circumstances. Mr. Curtis, in the work before mentioned, states that the caterpillars have been found feeding on the willow, and on mignionette, nasturtiums, &c. It is therefore probable that its progress westward will not be impeded by the scarcity of its favorite food in certain localities, but that it will overcome all difficulties of this nature by resorting to other plants, not confining itself to the cruciferæ.

Last autumn, in the vicinity of Quebec, the ravages of these larvæ were very great. Large plots, and even fields of cabbages, cauliflowers, &c., were completely destroyed; the caterpillars only rejecting the strong supporting ribs of the leaves. Serious loss was thus occasioned to market gardeners and others. One informed me that he had sustained a loss of more than two hundred dollars by their depredations; another that nearly the whole of his crop of cabbages was destroyed, the small portion saved requiring to be carefully washed before being sent to market. A gentleman also told me that they had not only eaten up his garden produce, but had demolished a bed of mignionette, even to the stalks.

Nature has provided more than one means of checking the increase of the species. The chrysalis is attacked by a parasite, (probably one of the Ichneumonidæ) as several collected by me this spring gave evidence. Large numbers of the pupæ are also killed by the frost, where they have been placed in exposed situations, and thus the spring brood of butterflies is materially lessened. I noticed a singular circumstance connected with these winter pupæ. Living chrysalids, brought into the warm house from the cold outside, invariably shrivelled and dried in a few days. Out of many that I gathered during last winter, not one produced a butterfly.

Last year the species was exceedingly abundant in the neighborhood of Quebec, flying by hundreds over the fields and gardens, and even in the most crowded parts of the city; and this season it promises to be equally numerous. Early in March, the butterflies began to appear in houses, from pupa which had been suspended on the walls during the previous autumn. On the 6th April, at Laval, about fifteen miles from Quebec, several specimens were taken in the open air; and on the 26th May, I counted more

than fifty individuals, met with on about a mile of road within a short distance of the city.

Considering their great abundance within their present habitat, and their prospective dissemination over the Province, it is desirable that information respecting the appearance and habits of these insects should be given to the public, and means devised for their destruction. Farmers and gardeners should kill every caterpillar on their turnips, cabbages, &c., and be provided with nets to capture the perfect insects. The chrysalids should also be sought for on the fences during the fall and winter, and destroyed. Unless these precautions be taken, the injury caused by this butterfly to the green crops in Canada may become very serious.

The following is a description of the insect:

Male—wings white, (or light yellow) with one blackish spot on the fore wings above, and two beneath, a black band on the apex on the upper side, extending a short distance along the adjacent margins, a black dash on the fore edge of the hind wings, which are beneath of a pale yellow sprinkled with black. Body black, antennæ annulated with black and white. Female has *two* blackish spots on upper side of anterior wings. Expands about two inches.

Chrysalis—Pale green, speckled with black, suspended horizontally by the tail and a thread across the middle.

Caterpillar—About 1½ inches long when full grown, green finely dotted with black, a yellow stripe along the back, and a row of yellow spots along each side in a line with the spiracles.

The caterpillars reared by me were about one-twelfth of an inch long when I procured them, and attained their full size in eleven days. On the 19th June they became pupæ, and seven days after the perfect insects appeared. The butterfly therefore passes through all its changes in less than a month. Three or four broods are produced during the season.

(Read before the Quebec Branch, Entomological Society of Canada. 7th July, 1864.)

SYNOPSIS OF CANADIAN FERNS AND FILICOID PLANTS.

By George Lawson, Ph.D., LL.D.

The following Synopsis embraces a concise statement of what is known respecting Canadian ferns and filicoid plants. Imperfect as it is, I trust that it will prove useful to botanists and fern

fanciers, and stimulate to renewed diligence in investigation. The whole number of species enumerated is seventy-four. Of these eleven are doubtful. Farther investigation will probably lead to the elimination of several of the doubtful species, which are retained for the present with a view to promote inquiry; but a few additional species, as yet unknown within the boundaries of Canada, may be discovered. The above number may be regarded, then, as a fair estimate—perhaps slightly in excess—of the actual number of ferns and filicoid plants existing in Canada. The number certainly known to exist, after deducting the species of doubtful occurrence, is sixty-three.

The number of species described in Professor Asa Gray's exhaustive Manual, as actually known to inhabit the northern United States, that is to say, the country lying to the south of the St. Lawrence River and Great Lakes, stretching to and including Virginia and Kentucky in the south, and extending westward to the Mississippi River, is seventy-five. This number does not include any doubtful species.

The number described in Dr. Chapman's Flora, as inhabiting the Southern States, that is, all the states south of Virginia and Kentucky and east of the Mississippi, is sixty-nine.*

From these statements it will be seen that we have our due share of ferns in Canada.

The whole number of ferns in all the American States, and the British North American Provinces, is estimated, in a recent letter from Mr. Eaton, as probably over 100.

In the British Islands there are about 60 ferns and filicoid plants. In islands of warmer regions the number is greatly increased. Thus Mr. Eaton's enumeration of the true ferns collected by Wright, Scott, and Hayes, in Cuba, embraces 357 species. The proportions of ferns to phanerogamous plants in the floras of different countries are thus indicated by Professor Balfour, in the Class-Book of Botany, page 998, §1604:—"In the low plains of the great continents, within the tropics, ferns are to phanerogamous plants as 1 to 20; on the mountainous parts of the great continents, in the same latitudes, as 1 to 8, or 1 to 6; in Congo as 1 to 27; in New Holland as 1 to 26. In small islands, dispersed over a wide ocean, the proportion of ferns increases; thus while in

* Mr. D. C. Eaton, M.A., is author of that portion of Dr. Chapman's Flora which relates to the ferns.

Jamica the proportion is 1 to 8, in Otaheite it is 1 to 4, and in St. Helena and Ascension nearly 1 to 2. In the temperate zone, Humboldt gives the proportion of ferns to phanerogamous plants as 1 to 70. In North America the proportion is 1 to 35; in France 1 to 58; in Germany 1 to 52; in the dry parts of southern Italy as 1 to 74; and in Greece 1 to 84. In colder regions the proportion increases; that is to say, ferns decrease more slowly in number than phanerogamous plants. Thus in Lapland the proportion is 1 to 25; in Iceland 1 to 18; and in Greenland 1 to 12. The proportion is least in the middle temperate zone, and it increases both towards the equator and towards the poles; at the same time it must be remarked, that ferns reach their absolute maximum in the torrid zone, and their absolute minimum in the arctic zone."

Canada consists of a belt of land, lying to the north of the St. Lawrence River and the Great Lakes. By these it is separated, along nearly the whole extent of its south-eastern and western boundaries, from the northern United States, which thus enclose Canada on two sides. A striking resemblance, amounting almost to identity, is therefore to be looked for in the floras of the two countries. Yet species appear in each that are absent in the other.

The species of ferns and filicoid plants which are certainly Canadian, amount to.....63
Of these there inhabit the Northern States, ...58
Do. do. Southern States, ...38
Do. do. Europe, ...36

The following table is designed to show some of the geographical relations of our Canadian ferns. The first column (I.) refers exclusively to the occurrence of the species within the Canadian boundary. The plus sign (+) indicates that the species is general, or at least does not show any decided tendency towards the extreme eastern or western, or northern or southern parts of the Province. The letters N, S, E, W, &c., variously combined, indicate that the species is so limited to the corresponding northern, southern, eastern or western parts of the province, or at least has a well-defined tendency to such limitation. The mark of interrogation (?) signifies doubt as to the occurrence of the species. The second column (II.) shows what Canadian species occur also in the Northern States, that is the region embraced by Gray's Manual; and the third column (III.) those that extend down south into Chapman's territory. The fourth column (IV.) shows the occurrence of our species in

Europe; C in this column indicating Continental Europe, and B the British Islands. The fifth or last column (V.) shows the species that extend northwards into the Arctic circle—35 in all, of which however, only 14, or perhaps 15, are known to be Arctic in America. Am., As., Eu., and G., indicate respectively Arctic America, Arctic Asia, Arctic Europe, and Arctic Greenland. The information contained in the last column has been chiefly derived from Dr. Hooker's able Memoir in the Linnæan Transactions (vol. xxiii., p. 251).

Hitherto no attention whatever has been paid, in Canada, to the study of those remarkable variations in form to which the species of ferns are so peculiarly liable. In Britain, the study of varieties has now been pursued by botanists so fully as to show that the phenomena which they present have a most important bearing upon many physiological and taxological questions of the greatest scientific interest. The varieties are studied in a systematic manner, and the laws of variation have been to a certain extent ascertained. And as the astronomer can point out the existence of a planet before it has been seen, and the chemist can construct formulæ for organic compounds—members of homologous series—in anticipation of their actual discovery, so in like manner the pteridologist now studies the variations of species by a comparative system, which enables him to look for equivalent forms in the corresponding species of different groups. Studies so pursued are calculated to evolve more accurate and definite notions as to the real nature of species, and the laws of divergence in form of which they are capable. I would therefore earnestly invite Canadian botanists to a more careful study of the *varieties* of the Canadian ferns, after the manner of Moore and other European leaders in this comparatively new path. The elasticity, or proneness to variation, of the species in certain groups of animals and plants has been somewhat rashly used to account for the origin of species, by what is called the process of variation. It seems to tell all the other way. Innumerable as are the grotesque variations of ferns, in forkings and frillings, and tasselings, and abnormal veinings, &c. (see the figures in Moore's works), we do not know of a single species in which such peculiarities have become permanent or general, that is *specific*, so that the species can be traced back to such an origin. Surely something of the kind would have happened had all species originated by a process of variation.

*Tabular View of the Distribution of Canadian Ferns and Allied Plants over Certain Parts of the Northern Hemisphere.**

Name.	I. Canada.	II. Northern States.	III. Southern States.	IV. Europe.	V. Arctic Circle.
POLYPODIACEÆ.					
1. Polypodium vulgare, . .	+	+	+	C.B.	Eu.
2. P. hexagonopterum, . .	+	+	+	...	...
3. P. Phegopteris, ...	+	+	...	C.B.	Eu. G.
4. P. Dryopteris, ...	+	+	...	C.B.	Eu.Am.G
5. P. Robertianum, . . .	+	+	..	C.B.	...
6. Adiantum pedatum, . .	+	+	+	...	...
7. Pteris aquilina, ...	+	+	+	C.B.	Eu.
8. Pellæa atropurpurea, . .	S.	+	+	...	...
9. Allosorus Stelleri, . . .	+	+	...	...	...
10. Cryptogramma acrostichoides	W W	...	..	?	Am.
11. Struthiopteris Germanica .	+	+	...	C	Eu.
12. Onoclea sensibilis, . . .	+	+	+	...	...
13. Asplenium Trichomanes, .	+	+	+	C.B.	...
14. A. viride, ...	N.E.	...	...	C.B.	Eu. G.
15. A. angustifolium, . . .	S.W.	+	+	...	...
16. A. ebeneum, ...	+	+	+	...	...
17. A. marinum, ...	E.?	...	..	C.B.	...
18. A. thelypteroides, . . .	+	+	+	...	...
19. A. montanum, ...	?	+	+	...	...
20. A. Ruta muraria, . . .	?	+	+	C.B.	Eu.
21. Athyrium Filix fœmina, .	+	+	+	C.B.	Eu.
22. Woodwardia Virginica, .	S. W.	+	+	..	...
23. Scolopendrium vulgare, .	W W	+	...	C.B.	...
24. Camptosorus rhizophyllus, .	W.	+	+	...	...
25. Lastrea dilatata, ...	+	+	÷	C.B.	Eu. Am.
26. L. marginalis, ...	+	+	+	...	...
27. L. Filix-mas, ...	??	...	...	C.B.	Eu. G.
28. L. cristata, ...	+	+	...	C.B.	...
29. L. Goldieana, ...	W.	+	...	...	...
30. L. fragrans, ...	N W?	+	...	...	As.Am.G.
31. L. Thelypteris, ...	+	+	+	C.B.	...
32. L. Nov-Eboracensis, . .	+	+	+	...	...
33. Polystichum angulare, . .	+	+	..	C.B.	Eu.
34. P. Lonchitis, ...	N.W.	+	...	C.B.	Eu.Am.G
35. P. acrostichoides, . . .	+	+	+	...	..
36. Cystopteris fragilis, . . .	+	+	+	C.B.	Eu.Am.G
37. C. bulbifera, ...	+	+	+	..	...
38. Dennstædtia punctilobula, .	+	+	+	...	...

* In the above Table, the doubtful species are included, but all reference to varieties is omitted.

Name.	I. Canada.	II. Northern States.	III. Southern States.	IV. Europe.	V. Arctic Circle.
39. Woodsia Ilvensis,	+	+	+	C. B.	Eu. As. Am. G.
40. W. alpina,	+	...	...	C. B.	Eu. G.
41. W. glabella,	+	+	...	...	Am.
42. W. obtusa,	?	+	+	...	...
43. Osmunda regalis,	+	+	+	C. B.	...
44. O. cinnamomea,	+	+	+	...	...
45. O. Claytoniana,	+	+	+	...	...
46. Schizæa pusilla,	?	+	...	...	...
OPHIOGLOSSACEÆ.					
47. Botrychium Virginicum,	+	+	+	...	Eu. G.
48. B. lunarioides,	+	+	+	?	...
49. B. lunaria,	N.	...	...	C. B.	Eu. G.
50. Ophioglossum vulgatum,	?	+	+	C. B.	Eu.
LYCOPODIACEÆ.					
51. Plananthus Selago,	N. ?	+	+	C. B.	Eu. As. Am. G.
52. P. lucidulus,	+	+	+	C.	...
53. P. alopecuroides,	? ?	+	+	...	...
54. P. inundatus,	+	+	+	C. B.	...
55. Lycopodium clavatum,	+	+	+	C. B.	Eu. G.
56. L. annotinum,	+	+	+	C. B.	Eu. Am. G
57. L. dendroideum,	+	+	+	...	...
58. L. complanatum,	+	+	+	C.	Eu. As.
59. Selaginella spinulosa,	N. E.	+	+	C. B.	Eu. G.
60. Stachygynandrum rupestre,	+	+	+	...	...
61. Diplostachyum apodum,	+	+	+	...	...
MARSILEACEÆ.					
62. Azolla Caroliniana,	S.	+	+	...	...
63. Salvinia natans,	? ?	...	+	C.	...
64. Isoëtes lacustris,	+	+	+	C. B.	Eu. G.
EQUISETACEÆ.					
65. Equisetum sylvaticum,	+	+	...	C. B.	Eu. Am. G
66. E. umbrosum,	+	+	...	C. B.	Eu.
67. E. arvense,	+	+	...	C. B.	Eu. As. Am. G.
68. E. Telmateja,	W.	+	...	C. B.	...
69. E. limosum,	+	+	...	C. B.	Eu.
70. E hyemale,	+	+	...	C. B.	Eu.
71. E. robustum,	+	+	...	...	...
72. E. variegatum,	N. E.	+	...	C. B.	Eu. Am G.
73. E. scirpoides,	+	+	...	C.	Eu. As. Am. G.
74. E. palustre,	N.	...	...	C. B.	Eu. Am.

Nat. Ord. POLYPODIACEÆ.

POLYPODIUM.

P. vulgare, Linn.—Frond linear-oblong or somewhat lanceolate, more or less acuminate, deeply pinnatifid, in some forms almost pinnate; lobes (or pinnæ) linear-oblong, obtuse, often acute, rarely acuminate, entire or crenate or serrate; sori large; very variable as regards outline of the frond, form, &c., of the lobes, and serrature. *P. vulgare*, Linn., A. Gray, Moore, &c. *P. Virginianum* of English gardens. *P. vulgare*, var. *Americanum*, Hook., Torrey, Fl. N. Y., ii, 480.—On rocks in the woods, not rare around the city of Kingston; abundant on the rocky banks of the St. Lawrence, in Pittsburg; in the woods at Collins's Bay; and on Judge Malloch's farm, a mile west from Brockville; Gananoque lakes and rivers; Farmersville; Newboro on the Rideau; Toronto; on the great boulder of the Trent Valley, near Trenton; on rocks west from Brockville, outcrop of Potsdam sandstone at Oxford, and Hull, mountains near Chelsea, C. E., B. Billings, jun.; near Gatineau Mills, D. M'Gillivray, M.D.; Mount Johnson, C. E., and Niagara River, P. W. Maclagan, M.D.; Brighton, in the crevice of a rock in a field, and abundant on rocky banks right bank of the Moira, above Belleville, J. Macoun; Ramsay, Rev. J. K. McMorine, M.A.; north-west from Granite Point, Lake Superior, R. Bell, jun.; mountain top, near Mr. Brydge's house, Hamilton, C. W., Judge Logie; River Rouge and lower end of Gut Lake, W. S. M. D'Urban; Cape Haldimand, Gaspé, John Bell, B A.; Red River Settlement, Governor M'Tavish; foot of Cape Tourmente, Abbé Provancher; L'Orignal and Grenville, C. E., J. Bell, B.A. The habitats above cited show that although this fern is not so common in Canada as in Britain, it is nevertheless widely distributed. It is common in New York State, according to Professor Torrey, and in the Northern States generally according to Professor Asa Gray; rarer in the South, according to Dr. Chapman.

P. hexagonopterum, Mich.—Frond triangular in outline, acuminate, pinnate, hairy throughout; pinnæ broadly lanceolate, pinnatifid; lowest pair of pinnæ larger than the others, not deflexed; lobes of the pinnæ linear-oblong or lanceolate, strongly toothed, or almost pinnatifid. The decurrent pinnæ have a tendency to form conspicuous irregular-angled wings along the rachis. Stipe not scaly except at the base. Rhizome long, slender, ramifying. Whole plant much larger than *P. Phegopteris*, and quite a different species.

P. hexagonopteram, Michx., A. Gray, &c. The figure in Lowe's Ferns, vol. i, p. 143, tab. 49, is a little too much like Phegopteris, *P. Phegopteris*, *γ majus*, Hook. Fl. Bor. Amer.. ii,p. 258. Hooker's *β. intermedia*, of Phegopteris is *connectile*, Willd., which A. Gray refers to *P. Phegopteris*, *L. Phegopteris hexagonoptera*, J. Sm. Cat., p. 17.—Canada, Goldie in Hook. Fl. B. Amer.; Chippawa, C. W., P. W. Maclagan, M.D.; Mirwin's Woods, near Prescott, rare, B. Billings, jun.; near Westminster Pond, London, W. Saunders. Not by any means so general in Canada as in New York State, where Professor Torrey states it is common.

P. Phegopteris, Linn.—Frond acutely triangular in outline, acuminate, pinnate; the pinnæ linear-lanceolate, pinnatifid, lowest pair deflexed; lobes of the pinnæ oblong, scythe-shaped, obtuse approximate, entire; rachis hairy and minutely scaly to the apex of the frond, as well as the mid-ribs of the pinnæ. *P. Phegopteris*, Linn., A. Gray, Moore, &c. *Phegopteris vulgaris*, J. Sm., *P. connectile*, Michx, Pursh Fl. Am. Sept., 2nd ed., vol. ii, p. 659.—Canada, Hooker, Black-Lead Falls and DeSalaberry, west line, W. S. M. D'Urban; Ramsay, Rev. J. K. McMorine, M.A.; Nicolet, P. W. Maclagan, M.D.; Prescott, damp woods, not common; Osgood Station of the Ottawa and Prescott Railway; also Gloucester, near Ottawa, growing on the side of a ravine, and Chelsea, C. E., B. Billings, jun; opposite Grand Island, Lake Superior, R. Bell, jun.; L'Orignal and Harrington, J. Bell, B.A.

P. Dryopteris, Linn.—Frond thin, light-green, pentangular in outline, consisting of three divaricate triangular subdivisions. each of which is pinnate, with its pinnæ more or less deeply pinnatifid; pinnules oblong, obtuse, nearly entire; stipe slender and weak, not glandulose. *P. Dryopteris*. Linn. A. Gray, Moore, &c. *Phegopteris Dryopteris*, J. Sm.—Abundant in the woods around Kingston; Ramsay, Rev. J. K. M'Morine, M.A.; very common in woods about Prescott. B. Billings, jun.; Montreal and Nicolet Rivers, C.E., P. W. Maclagan, M.D.; Belleville, common in the woods, J. Macoun; opposite Grand Island, Lake Superior, R. Bell. jun.; River Rouge, Round Lake, Montreal, De Salaberry, west line, and Black Lead Falls, W. S. M. D'Urban; Newfoundland, Labrador, Somerset, and St. Joachim, Abbé Provancher; L'Orignal, J. Bell, B.A.

Var. β. erectum.—Frond erect, rigid, with a very stout and very long glabrous stipe (18 inches long); beech woods at Collins's Bay,

near Kingston, with the normal form. This variety resembles *P. Robertianum* in general aspect, but is not at all glandulose.

P. Robertianum, Hoffman.—A stouter plant than *P. Dryopteris*; fronds more rigid and erect; rachis, &c., closely beset with minute-stalked glands. *P. Robertianum*, Hoffman, Moore. &c. *P. calcareum*, Sm., *P. Dryopteris*, var. *calcareum*, A. Gray. Canada, Moore and other authors; United States, Gray and others. This species is commonly spoken and written of as a Canadian fern. Not having had an opportunity of seeing Canadians specimens, I cannot cite special habitats. The minutely glandulose rachis serves at once to distinguish it.

ADIANTUM.

A. pedatum, Linn.—Stipe black and shining, erect, forked at top, the forks secundly branched, the branches being oblique triangular oblong pinnules. *A. pedatum*, Linn., A. Gray, &c., Low's Ferns, vol. iii, pl. 14. Abundant in vegetable soil in the woods around Kingston; woods around the iron-mines at Newboro-on-the-Rideau; Farmersville; Toronto; Montreal, Chippawa, Wolfe Island, and Malden, P. W. Maclagan, M.D.; Belleville, in rich woods, abundant, J. Macoun; Ramsay, Rev. J. K. McMorine, M.A.; Ke-we-naw Point, R. Bell, jun; at the Sulphur Spring, and common everywhere about Hamilton, Judge Logie; Lake Huron, Hook. Fl. B. A.; De Salaberry, west line, W. S. M. D'Urban; on the Gatineau near Gilmour's rafting-ground, D. M Gillivray, M.D.; London, W. Saunders; St. Joachim and Isle St. Paul, Montreal, Abbé Provancher; West Hawkesbury and Grenville, C. E., J. Bell, B. A. Apparently common everywhere in Upper Canada. I cannot speak so definitely of the Lower Province. This is one of our finest Canadian ferns; "the most graceful and delicate of North American ferns," says Torrey. It is easily cultivated. Fine as it is in the Canadian woods, I have specimens even more handsome from Schooley's Mountains (A. O. Brodie, Ceylon Civil Service); their fan-like fronds spread out in a semicircle, with a radius of 2½ feet. It is not a variable species in Canada. T. Moore, in "Index Filicum," gives its distribution as N. and N. W. America, California to Sitka, North India, Sikkim, Neapal, Gurwhal, Simla, Kumaon, Japan. There is a var. *β. Aleuticum*, Rupr., in the Aleutian Islands.

PTERIS.

P. aquilina, Linn.—Stipe stout, 1 to 3 feet high, frond ternate, branches bipinnate, pinnules oblong lanceolate, sori continu-

ous under their recurved margins. *Pt. aquilina*, Linn., A. Gray, Moore, &c.—Abundant on Dr. Yates's farm in Pittsburg, and elsewhere about Kingston; Waterdown Road, Hamilton, common, Judge Logie; Chippawa and Malden, C. W., P. W. Maclagan, M.D.; Ramsay, Rev. J. K. M'Morine, M.A.; Prescott, common, B. Billings, jun., Belleville, very common on barren ridges, J. Macoun; Grand Island, Lake Superior, R. Bell, jun.; Red Lake River, also between Wild Rice and Red Lake Rivers, and Otter Tail Lake and River, between Snake Hill River and Pembina, &c., J. C. Schultz, M.D.; Black Lead Falls, and Portage to Bark Lake, W. S. M. D'Urban; Gatineau Mills, very common, D. M'Gillivray, M.D.; Lakefield, North Douro, Mrs. Traill; New Brunswick, Hook. Fl. Bor. Amer.; L'Orignal, J. Bell, B.A.; London, W. Saunders.

a. vera.—Pinnules pinnatifid (the normal or typical form of Moore), Dr Yates's farm, Kingston.

β. integerrima.—Pinnules entire (a sub-variety), common in Canada and westward. There are various other sub-varieties; differing in size, pubescence, &c.

γ. decipiens.—Frond bipinnate, thin and membranous, lanuginose, pinnules pinnatifidly toothed, or in small forms, entire, barren; L'Anse à Cabielle, Gaspé, John Bell, B.A. This is a very remarkable fern, resembling a Lastrea, and in the absence of fructification, it is doubtfully referred to *Pteris aquilina*, yet the venation seems to indicate that it belongs to that species, which is remarkable for its puzzling forms. Being at a loss what to make of this fern, I sent it to Mr. D. C. Eaton, M.A., who is justly looked up to by American botanists as our best authority on American ferns, and he likewise failed to recognise it. I hope some visitor to Gaspé will endeavor to obtain it in a fertile state, and thus relieve the doubt.*

[Var. δ. *caudata* appears occasionally in lists. I have as yet no satisfactory evidence of its occurrence in Canada proper. The nearest approach to it is a specimen from the Hudson Bay territories, probably from the Red River District (Governor M'Tavish). In the South it is a very distinct form, of which there are beautiful specimens in Wright's Cuban Plants (No. 872), and is very close to the *Pteris esculenta* of Australia.]

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* Since the above was written, I have had an opportunity of studying the forms and development of *Pteris aquilina* and am quite satisfied that the doubtful plant is a state of that species, not old enough to be fertile.

PELLÆA.

P. atropurpurea, Link.—Stipe and rachis almost black, shining, 6 to 12 inches high, frond coriaceous, pinnate, divisions opposite, linear-oblong or somewhat oval. *Pteris atropurpurea*, Linn. *Platyloma atrop.*, J. Sm., Torr. N. Y., ii. p. 488. *Allosorus atropurpureas*, A. Gray. *Pellæa atropurpurea*, Link., Fée, J. Sm. in Cat., Eaton.—Niagara River, at the Whirlpool, three miles below the Falls. This fern seems to retain its fronds all winter, for I have fertile specimens, in a fine state collected at the Whirlpool at the end of February, 1859, by A. O. Brodie. Dr. P. W. Maclagan has also collected it there. It is not common anywhere on the American continent so far as I can learn. Mr. Lowe speaks of it as in cultivation in Britain, "an evergreen frame or greenhouse species, not sufficiently hardy to stand over winter's cold." There must be some other reason for want of success in its cultivation in Britain.

ALLOSORUS.

A. Stelleri, Ruprecht.—Fronds pale green, thin and papery, 3 to 9 inches long, bipinnate and tripinnate, some of the smaller barren fronds scarcely more than pinnate; pinnæ five or six pairs; lobes of the barren frond, rounded, oval, veiny; of the fertile frond, much narrower, linear-lanceolate, firmer; sori at the tips of the forked veins along the margins, stipe red, whole plant glabrous. A beautiful and delicate fern, growing in the crevices of rocks, rare. *Allosorus Stelleri*, Ledeb, Fl. Rossica. *Allosorus gracilis*, Presl., A. Gray, Torrey Fl. N. Y. ii. p. 487. In a letter from Mr. T. Moore (1857), he mentioned to me that he had learned from specimens from Dr. Regel, St. Petersburg, that "the North American *Allosorus gracilis* is the old *Pteris Stelleri* of Amman, so that it spreads from North America through Siberia to India, whence Dr. Hooker has it." *Allosorus minutus*, Turcz. Pl. Exs. *Cheilanthes gracilis*, Klf. *Cryptogramma gracilis*, Torrey. *Pteris Stelleri*, Gmelin, *Pteris minuta*, Turcz. Cat. Pl. Baik. Dah. *Pt. gracilis*, Michaux. —Near Lakefield, North Douro, C. W., on rocks, Mrs Traill; abundant in crevices of limestone rocks, on the rocky banks of the Moira, Belleville, Co. Hastings, J. Macoun; Lake of Three Mountains, W. S. M. D'Urban; Canada to the Saskatchewan, Hook. Fl. Bor. Am.; Dartmouth, Gaspé, John Bell, B.A. This is a Northern species, and rare in the United States.

Cryptogramma.

C. acrostichoides, R. Br.—"Remarkable for its sporangia extending far down on the oblique veins, so as to form linear lines of fruit." I have not seen the plant It is referred by Sir William Hooker to *Allosorus crispus* (A. Gr. in Enum. of Dr. Parry's Rocky Mt. Plants). *Cryptogramma acrostichoides*, R.Br., Moore. *Allosorus acrostichoides*, A. Gr.—Isle Royale, Lake Superior. Placed in Dr. Hooker's Table as a Canadian species that does not extend into the United States. It has recently been found on the Rocky Mountains. *Allosorus crispus* is general throughout Europe, and occurs at Sitka, in North-West America. Mr. Moore observes that the Eastern (Indian) species, A. *Brunoniana*, is very doubtfully distinct from the European plant.

Struthiopteris.

S. Germanica var. *β Pennsylvanica*.—Rhizome stout, erect; fronds tufted; sterile ones large pinnate, erect-spreading, deeply pinnatifid; the fertile ones erect, rigid, with revolute contracted divisions, wholly covered on the back by sporangia. A very graceful fern, well-suited for cultivation in gardens. *Strupthiopteris Pennsylvanica*, Willd., Pursh, J. Sm. Cat. *S. Germanica*, Hooker, Torrey Fl. N. Y., ii, p. 486, Gray. *Osmunda Struthiopteris*, Linn.; *Onoclea Struthiopteris*, Schkr.; *Onoclea nodulosa*, Schkr., according to Hooker. Torrey refers *O. nodulosa*, Michx., to *Woodwardia angustifolia*.—Frankville, Kitley; Longpoint; Lansdowne; Hardwood Creek; usually found along the margins of creeks, &c.; common in rich, wet woods near Prescott, and abundant around Ottawa, B. Billings, jun.; low rich grounds, Belleville, abundant along Cold Creek, J. Macoun; Ke-we-naw Point, Lake Superior, in low ground, at times under water, R. Bell, jun.; Ramsay, Rev. J. K. M'Morine, M.A.; near Lakefield, North Douro, Mrs. Trail; field beyond Waterdown, Hamilton, Judge Logie; Osnabruck and Prescott Junction, Rev. E. M. Epstein; near Montreal, W. S. M. D'Urban; Assiniboine River, John C. Schultz, M.D.; Canada, to the Saskatchewan. Hook. Fl. Bor. A.; foot of Cape Tourmente, Abbé Provancher. This is the commonest plant in the Bedford swamps; Gaspé and L'Original, J. Bell, B.A.; London, W. Saunders. Found in the western part of New York State, but rare, according to Torrey.

ONOCLEA.

O. sensibilis, Linn.—Rhizome creeping; barren frond broad, leafy, deeply pinnatifid; fertile ones erect, spicate, contracted, doubly pinnate, with small revolute pinnules, enclosing the sporangia, not at all leafy. *Onoclea sensibilis*, Linn., Gray, J. Sm., &c. Lowe's Ferns, vol. vi. pl. 1.—In woods along the banks of the Little Cataraqui Creek in great abundance, and in moist swampy places in the woods in various other places about Kingston; west end of Loughborough Lake; Becancour, Abbé Provancher; London, W. Saunders; common in marshy ground at Hamilton, Judge Logie; Lakefield, North Douro, Mrs. Traill; St. John's, C. E., Niagara and Malden, P. W. Maclagan, M.D.; Belleville, in low marshy places, abundant, J. Macoun; Ramsay, Rev. J. K. M'Morine, M.A.; Amagos Creek, Lake Superior, R. Bell, jun.; Prescott, common, B. Billings, jun.; on the river shore, Gatineau Mills, D. M'Gillivray, M.D.; L'Anse au Cousin, Gaspé and L'Orignal, J. Bell; Nova Scotia. This curious fern has been cultivated in England since 1699; at Kew, since 1793. It is very variable as regards the outline and subdivision of the barren frond.

Var. *β. bipinnata.*—Fronds bipinnate; perhaps not a constant form. Fertile fronds of this variety originated the *O. obtusilobata*, Schkr. Pêche River, and near Cantley, Hull, D. M'Gillivray, M.D.

ASPLENIUM.

A. Trichomanes, Linn.—Frond small, narrow, linear, pinnate; pinnæ roundish-oblong or oval, oblique, almost sensile, crenate: rachis blackish brown, shining, margined; sori distant from the midrib. *Asplenium Trichomanes*, Linn., Moore, Gray, &c., Lowe's Ferns, vol. v. pl. 22. *Asp. melanocaulon*, Willd., Pursh. Fl. Sept. Americ., ii., p. 666. *Asp. anceps*, Lowe.—Inhabits rocky river banks, &c., but is not common in Canada. On rocky banks, at Marble Rock, on the Gananoque River; Mamainse, dry ground on the top of a mountain, R. Bell, jun.; rocky woodlands west from Brockville, rare, B. Billings, jun.; Montreal, Jones's Falls and Niagara, P. W. Maclagan, M.D.; Lake Medad, Hamilton, Judge Logie; Pittsburg, near Kingston, John Bell, B.A.; foot of Cape Tourmente, Abbé Provancher; near Belleville, J. Macoun.

β. delicatulum.—Frond narrower, pinnæ much smaller, thinner, and wider apart than in the normal form. This is a sub

variety, passing by intermediate states into the typical plant, which is the common form of northern Europe. The variety is the prevalent form in Canada, but also occurs farther south in the United States, for I have specimens from Catskill (A. O. Brodie); and is not confined to the American continent, for Professor Caruel, the acute author of "Flora Italiana," sends specimens of a similar form from Florence. There is an *A. Trich.* var. *majus*, in Cuba (according to Mr. Eaton's enumeration of Wright's Cuban ferns). *A. anceps* is a Madeiran form, not distinguishable, so far as I can see, from common European states of *A. Trichomanes.*

A. viride, Hudson.—Frond small, linear, pinnate; pinnæ roundish-oblong or oval, more or less cuneate at base, slightly stalked, crenate or slightly lobed; rachis bright green; sori approximate to the midrib; in outline of frond and general aspect resembles the preceding species. *A. viride*, Hudson, Flora Anglica, 385; Sm., Bab., Moore, &c. *A. Trichomanes, β ramosum*, Linn.—This beautiful alpine fern was found in Canada for the first time last summer, having been collected in considerable quantity at Gaspé, C.E., by John Bell, B.A., who formed one of a party of the Provincial Geological Survey. It was previously known to occur sparingly in N. W. America, at one spot on the Rocky Mountains, and in Greenland. Mr. Bell's discovery of its occurrence in Gaspé is therefore extremely interesting in a geographical point of view. The Gaspé specimens, although young, agree perfectly with the typical European form of *A. viride*, of which I have a full series of Scotch examples, as well as others collected in Norway by T. Anderson, M.D. In young specimens the pinnæ are usually large, thin, and more cuneate and lobed than in the mature plant, in which they are roundish-ovate.

A. angustifolium, Michx.—Frond large (1 to 3 feet high), annual, lanceolate, pinnate; pinnæ long, linear-lanceolate, acute; fertile fronds more contracted than the barren ones, "bearing sixty to eighty curved fruit-dots on the upper branches of the pinnate forking veins," (Eaton). *A. angustifolium*, Michaux, A. Gray, Eaton, J. Smith, Lowe's Ferns, vol. v, pl. 24.—In Canada this fern appears to be confined to the extreme south-western point of the province;* Malden, P. W. Maclagan, M.D.; at the Oil Wells, township of Enniskillen, Lady Alexander Russell. For

* Subsequently found in the Belleville district by Mr. Macoun.

information of the latter station I am indebted to the kindness of Judge Logie of Hamilton. This fern appears to be still rare in cultivation among the fern-fanciers of Europe. It was introduced to Britain in 1812 by Mr. John Lyon of Dundee.

A. ebeneum, Aiton.—Frond erect, lance-linear, pinnate; pinnæ numerous, lanceolate (the lower oblong), sessile, slightly auricled at base and finely serrate; rachis blackish-brown, shining. *Asplenium ebeneum*, Aiton, Hortus Kewensis, ed. 2, vol. v, p. 516, Gray, Eaton, J. Smith, Lowe's Ferns, vol. v, pl. 2. *A. polypodioides*, Schkr.—Rocky woods, Brockville, B. Billings, jun.; the only locality in Canada from which I have seen specimens.* Although so rare with us, this species appears to be not uncommon in the United States. Gray speaks of it as "rather common;" I have specimens from Schooley's Mountains, West point, N. Y., Providence, Philadelphia, &c. Judging from Mr. Eaton's indication in Chapman's Flora, it again seems to decrease in the south, so that its present headquarters are in the Nothern States.

[*A. marinum*, Linn.—Frond broad and leafy, linear-lanceolate, tapered above, pinnate; pinnæ ovate-oblong or linear, oblique, shortly stalked, rarely pinnatifid, the upper ones confluent, stipe brownish, rachis brown below, green and winged above, sori large, linear, oblique; grows on rocks. *Asplenium marinum*, Linn., Moore, J. Smith, &c. *A. lœtum*, Hort.—New Brunswick, E. N. Kendal, in Hook. Fl. Bor. Am. I cannot learn that this fern has been subsequently found in North America, and hope, therefore, that botanists will look for it on the rocky shores of New Brunswick. It usually grows out of the crevices of shore-cliffs, and is very limited in its geographical range, growing, according to Moore, only in the western part of Europe, crossing from Spain to Tangiers on the African coast, and being again met with in Madeira, the Azores, and Canary Isles.]

A. thelypteroides, Michaux.—Fronds large oblong-ovate, pinnate; pinnæ lancelolate, acuminate, from a broad sessile base, and deeply pinnatifid, the lobes oblong, minutely toothed. *Asplenium thelypteroides*, Michaux, Pursh, Bigelow, Torrey, Beck, Darlington, Gray, Eaton. *Diplazium thelypteroides*, Presl, J. Sm.—In rich woods, DeSalaberry, west line, W. S. M. D'Urban; Minvin's woods, &c., Prescott, B. Billings, jr.; Belœil Mountain, P. W. Maclagan, M.D.; moist woods near the Hop Garden, Belleville, rare, J. Macoun (a deeply serrated, leafy form); Ramsay, Rev.

* Subsequently found near Belleville by Mr. Macoun.

J. K. M'Morine, M.A.; St. Joachim, Abbé Provancher; London, W. Saunders. Not a common fern in Canada; perhaps more plentiful in the United States. I have a fine series of specimens from Schooley's Mountains (A. O. Brodie), and others from Providence.

β. serratum.—Lobes of the pinnæ ovate-oblong, approximate, strongly and incisely serrate. This may be regarded as a sub-variety.—Belleville, J. Macoun.

[*A. montanum*, Willd., which extends along the Alleghanies, has not yet been found in Canada, but may possibly occur. It grows on cliffs.]

[*A. Ruta-muraria*, Linn.—The wall-rue, a small species, which grows in the crevices of limestone cliffs in the Northern States, and is common on stone walls and old buildings in Britain, is to be looked for in Canada.]

ATHYRIUM.

A. Filix-fœmina, R. Br.—Frond ample (1–3 feet long), broadly oblong-lanceolate, bipinnate; pinnæ also lanceolate, pinnules ovate-lanceolate or oblong, incisely toothed. Grows in large tufts, the fronds delicate, of a bright green hue. Lady Fern of the poets. *Athyrium Filix fœmina*, R. Br., Spreng., Roth., Hook., Moore, &c. *Aspidium Filix-fœmina*, Swartz, Pursh, Beck. *Aspidium asplenioides*, Swartz, Willd., Pursh. *Asplenium Athyrium*, Schkr. *Asplenium Michauxii*, Spreng. *Asplenium Filix-fœmina*, A. Gray, Man., p. 595. *Nephrodium asplenioides* and *Filix-fœmina*, Michx. *Asplenium angustum*, Willd., Pursh.—Common in the woods near Kingston, Toronto, Trenton, &c.; Pêche River, Ottawa, Dr. M'Gillivray; Temiscouata, Chippawa and Malden, P. W. Maclagan, M.D.; Bell[illegible]e, moist woods, very common, several varieties, J. Macoun; Ramsay, Rev. J. K. M'Morine, M.A.; mouth of the Awaganissis Brook, Gulf of St. Lawrence, C. E., and Schibwah River, Lake Superior, R. Bell, jun.; Cemetery grounds, Hamilton, and on Prince's Island, Judge Logie; Hamilton's farm and base of Silver Mt., W. S. M. D'Urban; Mountain Fall, H. B. T., Governor M'Tavish; Snake Hill River, John C. Schultz, M.D.; L'Anse à la Barbe, Gaspé and L'Orignal, John Bell, B.A.; St. Tite, Abbé Provancher; London, W. Saunders.

β. angustum.—Frond narrow, linear-lanceolate; pinnæ rather crowded; pinnules not pinnatifid, but incisely toothed, with recurved margins; sori short, curved (*Aspidium angustum*, Willd. ?)—Farmersville; Delta; Belleville, J. Macoun.

γ. *rhœticum*.—Frond rather small, firm, narrowly lanceolate in outline; pinæ more or less distant and narrowly lanceolate; pinnules incisely toothed or deeply pinnatifid, linear, or more frequently lanceolate-acute, and acquiring a linear aspect from the reflection of the lobes, often crowded with confluent sori.—Dr. Yates's farm, on the banks of the St. Lawrence, near Kingston; near Montreal, Rev. E. M. Epstein, M.D.; near Lakefield, North Douro, Mrs Traill.

δ. *rigidum*.—Frond small, rigid; pinnules approximate, connected at the base by a broad decurrent membrane, sori confined to the lower part of each pinnule.—Lakefield, North Douro, Mrs. Traill.

There are other forms of this species, dependent in many cases, no doubt, upon situation; some with thin veiny fronds of great size, bearing few scattered sori. One form, very like the British var. *molle*, was gathered at Belleville by Mr. Macoun. I know no fern more variable than this. Our Canadian forms require careful examination.

Woodwardia.

W. Virginica, Willd.—Frond pinnate; pinnæ lanceolate, pinnatifid; sori arranged in line on either side of the midribs of pinnæ and pinnules. *Woodwardia Virginica*, Willd.; Gray Man., p. 593. (*Doodia*, R. Br.)—Millgrove Marsh, C. W., Judge Logie; sphagnous swamp near Heck's mills, ten miles from Prescott, Augusta, C. W., B. Billings, jun.; Pelham, C. W., P. W. Maclagan, M.D.; Belleville, J. Macoun.

Scolopendrium.

S. vulgare, Smith.—Fronds (in tufts) strap-shaped, with a cordate base undivided, margin entire, stipe scaly. *Scolopendrium vulgare*, J. E. Smith, Bab., J. Sm., Moore, &c. *S. officinarum*, Swartz, Schkr., Gray, Man., p. 593; Torr. Fl. N. Y. ii, p. 490. *S. Phyllitis*, Roth. *S. officinale*, DC. *S. lingua*, Cavanilles. *Asplenium Scolopendrium*, Linn. Sp. Plantarum, &c. *A. elongatum*, Salisb. *Blechnum linguifolium*, Stokes. *Phyllitis Scolopendrium*. Newman.—Owen Sound, Georgian Bay, Lake Huron, on soft springy ground, amongst large stones, growing in tufts, abundant, 1861; Robert Bell, jun. This interesting addition to our list of Canadian ferns has been collected in the same place by the Rev. Prof. William Hincks, F.L.S. Mr. Bell's

specimens agree, in every respect, with the typical European form of the species, which is exceedingly variable. Only one station was previously known for this fern in all North America, viz., limestone rocks along Chittenango Creek, near the Falls, respecting which Professor Torrey observed:—"This fern is undoubtedly indigenous in the locality here given, which is the only place where it has hitherto been found in North America." It was first detected by Pursh, who found it in shady woods, among loose rocks in the western parts of New York, near Onondago, on the plantations of J. Geddis, Esq. This species (he said) I have seen in no other place but that here mentioned, neither have I had any information of its having been found in any other part of North America. (*Pursh.*) Nuttall states that he found it in the western part of the state, without giving the locality; but according to Dr. Pickering, the specimens of Mr. Nuttall, in the herbarium of the Academy of Sciences in Philadelphia, are marked, "near Canandaigua, at Geddis's farm, in a shady wood, with *Taxus Canadensis*," Torrey Fl. N. Y., ii, p. 490. This fern occurs throughout Europe, and also in Northern Asia. Mr. Moore considers the Mexican *S. Lindeni* as a mere veriety of this species. In Europe there are many remarkable varieties, of which Mr. Moore has figured and described more than fifty that occur in Britain. The great beauty and remarkable character of many of these render them very suitable for cultivation. None of the abnormal forms have as yet been found in America, probably merely because they have not been looked for.

Camptosorus.

C. rhizophyllus Presl.—Frond lanceolate, broad and hastate, or cordate at base, attenuated towards the tip, which strikes root and gives rise to a new plant; hence this fern is called the Walking Leaf; fronds evergreen. *Camptosorus rhizophyllus*, Link, Presl, A. Gray, Eaton, Hooker. *Asplenium rhizophyllum*, Linn. in part (Linnæus's name included *Fadyena prolifera*, a totally different plant), Michaux, Pursh, Fl. Am. Sept. ii, p. 666, Bigelow, Torrey, Beck, Darlington, Lowe's Ferns, vol. v, pl. 14 *a*. *Antigramma rhizophila*, J. Sm., Torrey, Fl. N. Y. ii. p. 494. *Camptosorus rumicifolius*, Link.—On the flat perpendicular face of a rock in the woods, on the Spike's Corners side of the mills at High Falls, township of Portland, C. W., July 1862. In a rocky wood, a mile north-west from the Oxford station of the

Ottawa and Prescott Railway, upon a rock slightly covered with mould, B. Billings, jun.; mountain-side west from Hamilton, also at Ancaster and at Lake Medad, Judge Logie; Wolfe Island, E. J. Fox; not rare about Owen Sound, Rev. Prof. W. Hincks; Montreal Mountain, Abbé Provancher; rather northern in its range in North America, but not common anywhere in Canada. This curious fern has been long in cultivation in the botanic gardens of Europe.

LASTREA.

L. dilatata, Presl.—Fronds spreading, broadly lanceolate, rather pale but vivid green, bipinnate; the pinnules pinnate or pinnatifid with pointed lobes; on the lower pinnæ the posterior pinnules are longer than the anterior ones; stipe with rather distant pale unicolorus scales; sori small. This description refers only to the commonest form in Canada. It is a very variable species. *Aspidium spinulosum*, Gray.—Abundant in the woods about Kingston, as Collins's Bay, &c., Smith's Falls, Odessa, woods near the Falls of Niagara, Hinchinbrook, Gananoque lakes, Farmersville, Hardwood Creek, Delta, Upper Rideau Lake, Newboro-on-the-Rideau, Longpoint; Mouth of the Awaganissis Brook, Gulf of St. Lawrence, Goulais River, also Grand Island, and at Ke-we-naw Point, Lake Superior, R. Bell, jun.; Ramsay, Rev. J. K. M'Morine, M.A.; Prescott, very common. B. Billings, jun.; St. John's, St. Valentine, and Belœil, P. W. Maclagan, M.D.; Belleville, very common, J. Macoun; St. Foy Woods, W. S. M. D'Urban; Daniel's Harbor, Newfoundland, James Richardson (a peculiar form); Pêche River, Chelsea and Cantley, Hull, D. M'Gillivray, M. D. Of varieties referable to var. *Boottii*, Gray, var. *dumetorum*, Gray, or others, differing from the common (which, however, is perhaps not the typical) form, I have seen specimens from, or obtained information of their having been collected in, the following localities:—Malden, Brighton, Point Rich, Newfoundland, Hamilton's Farm, Murray, Hamilton, &c. These varieties still require careful study, with a view to their identification with European forms, which are now well understood.

β. tanacetifolia.—Frond large and very broad, triangular, tripinnate, with the pinnules pinnatifid or deeply incised, lobed. *P. tanacetifolium*, DC. ?—Pointe des Morts, Gaspé, John Bell, Mr. Bell's specimen seems to agree well with Mr. Moore's description of var. *tanacetifolia*. The typical *L. dilatata*, with

dark-centred scales, so common in Scotland, I have not yet seen growing in the Canadian woods; but a fragment, the upper portion of a frond, from Point Rich, Newfoundland, James Richardson, looks like it.

L. marginalis, J. Smith.—Frond ovate oblong, a foot, more or less, in length, bipinnate, pale green, somewhat coriaceous, lasting the winter; pinnæ linear-lanceolate, broad at base; pinnules oblong, very obtuse, obsoletely incised; sori marginal; stipe of a pale cinnamon color when old, with large thin pale scales profuse below. *L. marginalis*, J. Sm., *Aspidium marginale*, Swartz, Pursh, Bigelow, Beck, Darlington, Gray, Eaton, Lowe's Ferns, vol. vi, pl. 6 (a bad figure), Torrey Fl. N. Y. ii, p. 495. *Polypodium marginale*, Linn. *Nephrodium marginale*, Michaux.—This species is as common in the Canadian woods as *Lastrea Filix-mas* is in those of Britain; woods around Kingston, abundant; near Odessa; Newboro-on-the Rideau; along the course of the Gananoque River and lakes, in various places; very fine at Marble Rock; Farmersville; Hardwood Creek; Valley of the Trent, found on the great boulder, &c.; on Judge Malloch's farm and elsewhere about Brockville; on limestone rocks above the Rapids at Shaw's Mill, Lakefield, North Douro, Mrs. Traill; Sulphur Spring, Hamilton, Judge Logie; Cedar Island, A. T. Drummond, jun., B.A.; Smith's Falls, and Chippawa, P. W. Maclagan, M.D.; Ramsay, Rev. J. K. M'Morine, M.A.; Prescott, common, B. Billings, jun.; Belleville, in rich low moist woods, common, J. Macoun; above Blacklead Falls, W. S. M. D'Urban; Gatineau Mills, D. M'Gillivray, M.D.; Cape Tourmente, Abbé Provancher; Harrington, J. Bell, B.A.; London, W. Saunders. This is exclusively an American fern. It varies in size and appearance; in some specimens the pinnæ are wide apart, their divisions small and narrow; in others, the pinnæ overlap each other, and their divisions are broad and leafy, also overlapping, and in such forms they are usually toothed into rounded lobes. Mr. Macoun sends a form from Belleville, more deeply serrate than usual.

β. Traillæ.—Fronds very large (3½ feet long), bipinnate, all the pinnules pinnatifid.—Lakefield, North Douro, Mrs. Traill. This is a very handsome variety, and would form an attractive plant in cultivation. It has the same relation to the type of *L. marginalis* which *L. incisa (erosa)* has to typical *Filix-mas*.

Lastrea Filix-mas is erreneously referred to in some American works on Materia Medica as a common North American and Canadian fern. It has recently, however, been found on the Rocky Mountains by Dr. Parry. Professor Gray says that Dr. Parry's specimens are apparently identical with the European plant. Nothing like it occurs in Canada, so far as I can ascertain. Varieties of *L. marginalis* have been sent to me under the name of *L. Filix-mas.*

L. cristata, Presl.—Fronds erect, rigid, linear-oblong in outline, vivid green, pinnate or slightly bipinnate; pinnæ triangular-lanceolate; pinnules large, oblong, approximate, decurrent; sori large, in a single series on each side of, and near to, the vein; stipe with few pale scales. *Lastrea cristàta,* Presl, Moore, &c. *Polypodium cristatum,* Linn. *Aspidium cristatum,* Swartz, Willd., Pursh, E. B., Beck, Torrey Fl. N. Y., ii, p. 496. Gray. *Aspidium cristatum, β. Lancastriense,* Torrey; *A. Lancastriense,* Spreng., Bigelow, Beck, Darlington, Hooker.—Woods around Kingston; near the Pêche River, Gatineau, a tributary of the Ottawa, D. M'Gillivray, M.D.; Three Rivers, St. John's and Chippawa, P. W. Maclagan, M.D.; Sproule's Swamp, east from Belleville (a cedar swamp), not common, J. Macoun; Ramsay, Rev. J. K. M'Morine, M.A.; Prescott, common, B. Billings, jun.; Lake of Three Mountains, W. S. M. D'Urban; Silver Brook, Gaspé, John Bell, B.A.; St. Fereol, Abbé Provancher; L'Orignal, J. Bell; London, W. Saunders.

L. Goldieana, J. Smith.—Frond very large (3 or 4 feet or more in length), dark green, bipinnate; pinnæ 6 to 8 inches long, narrow, linear-lanceolate, not much attenuated towards the tips; pinnules (12–20 pairs), linear-oblong, approximate, uniformly curved forwards, scythe-shaped, sometimes with an extra lobe at base; sori small, near the midrib; stipe with pale shaggy scales above and larger dark-centred ones below; our largest Canadian fern, usually barren. *Lastrea Goldieana,* J. Smith. *Aspidium Goldianum,* Hooker, Edin. New Phil. Jour. vi, p. 333, and Fl. Bor. Am., ii, p. 260, Gray. *Nephrodium Goldieanum,* Hook. and Grev. *Aspidium Filix-mas,* Pursh, not of Willd., &c.—Farmersville, in woods near the village, abundant and very fine, forming immense tufts; near Hamilton's farm and De Salaberry, town-line, W. S. M. D'Urban; Belœil Mountain, Montreal and Malden, P. W. Maclagan, M.D; Belleville Woods, near Castleton; woods below Heely's Falls, west side, and in Simon Terrill's

Woods, Brighton, J. Macoun; Augusta, Robert Jardine, B.A.; about Montreal, Mr. Goldie in Hook. Fl. Bor. Amer. London, W. Saunders. This fine fern was appropriately named by Sir William Hooker in honor of its discoverer, a successful investigator of Canadian botany, now resident at Paris, C. W. The species belongs exclusively to the American continent. In Canada we have two sub-varieties:—

a. serrata, in which the divisions of the pinnæ are coarsely serrate. Montreal.

β. integerrima, in which the divisions of the pinnæ are almost or quite entire. Farmersville.

L. fragrans, Moore.—Frond 8 to 12 inches long, coriaceous, bipinnate, pinnæ triangular, of few (4 or 5 pairs) of pinnules, which are crowded and covered beneath by the large rusty membranous indusia, which conceal the sori. Rachis with profuse, large, palish scales, especially near the base. *Aspidium fragrans*, Swartz, A. Gray.—Rocks, Penokee Iron Ridge, Lake Superior, Mr. Lapham, and north-west—Professor Wood, in Class-Book; shaded trap rocks, Falls of the St. Croix, Wisconsin, Dr. Parry, and high northward, Gray's Manual. I have not yet seen Canadian specimens of this species, which is quite a northern fern, stretching along the northern shores of the Russian Artic dominions. I have specimens from Repulse Bay, collected by Captain Rae's party while wintering there in 1855. This plant does not appear to be in cultivation in any European garden.

L. Thelypteris, Presl.—Frond erect, lanceolate, mostly broad at base, and narrowed upwards, thin, and herbaceous, or slightly coriaceous, glabrous or downy, pinnate; pinnæ linear, rather distant, deeply pinnatifid; pinnules with revolute margins, veins forked, sori near their middle, becoming confluent. Stipe as long as, or longer than, the frond, and naked. *Lastrea Thelypteris*. Presl, Moore, J. Sm. *Aspidium Thelypteris*, Swartz, E. B. Willd., Pursh, Bigelow, Beck, Darlington, Torr. y Fl. N. Y. ii, p. 596, A. Gray, Man. *Polypodium Thelypteris*, Linn. *Dryopteris Thelypteris*, Gray.—Swamps in the woods, townships of Hinchinbrook, Portland, Ernestown, &c.; Millgrove Marsh, Hamilton, Judge Logie; Gatineau Mills on the Ottawa, D. M'Gillivray, M.D.; Prescott, common, B. Billings, jun.; Temiscouata, Thorold and Malden, P. W. Maclagan, M.D.; Belleville, very common in swamps, J. Macoun; Ramsay, Rev. J. K. M'Morine, M.A.; portage to Bark Lake, and on lumber-road through

the woods east from Hamilton's farm, W. S. M. D'Urban; Montreal, Drs. Maclagan and Epstein; Hudson Bay Territories near Red River Settlement, Governor M'Tavish; St. Joachim, Abbé Provancher; L'Orignal, J. Bell, B.A.; London, W. Saunders. In the State of New York the species is common in swamps and wet thickets (Torrey). I have it from West Point, N. Y. In the south, Eaton indicates Florida and northward. Very seldom found with fructification (Pursh). Fertile specimens are not rare with us. The forked veins of the pinnules distinguish this species from the next. In the Canadian plant, the outline of the frond is a little different from Scotch and Irish specimens, being less narrowed at the base. There are three forms of this species in Canada. The first (α) seems to be the plant of Gray's Manual, the second (β) is more like the *L. Thelypteris* of Europe, and the third (γ) is intermediate between this species and the next.

α. *pubescens.*—Frond somewhat coriaceous densely pubescent or downy throughout. Odessa, Hudson Bay.

β. *glabra.*—Frond thin, herbaceous, glabrous. Montreal, Chelsea, Hichinbrook, &c.

γ. *intermedia.*—Frond narrowed below, glabrous; stipe slightly elongated (veins forked). Gaspé, J. Bell, B. A.

L. *Nov-Eboracensis.*—Frond lanceolate, narrow at the base, thin and herbaceous, pinnate; pinnæ linear-lanceolate, more or less approximate, deeply pinnatifid; pinnules oblong, usually flat; veins simple (not forked), sori never confluent; stipe short, rachis, &c., downy, pinnules more or less distinctly ciliate. *Lastrea Noveboracensis*, Presl. *Polypodium Noveboracense*, Linn., Schk. *Aspidium thelypteroides*, Swartz. *Aspinium Noveboracense*, Willd., A. Gray, Eaton—Pittsburg near Kingston; Lakefield, North Douro, Mrs. Traill; Mountain side, Hamilton, Judge Logie; Prescott, common, B. Billings, jun., Mounts Johnson, Montreal, and Belœil, P. W. Maclagan, M. D.; Ramsay, Rev. J. K. M'Morine, M.A.; near Chelsea, D. M'Gillivray, M.D.; London, but not common, W. Saunders; L'Orignal, J. Bell. This fern belongs exclusively to the American continent. It seems to be more abundant and more distinct in the United States than with us. In *Flora Boreali-Americana*, Sir William Hooker observed: "The *Aspidium Noveboracense* is quite identical with *A. Thelypteris.*" In the recently-published volume of *Species Filicum* (which at present I can only quote at second hand), doubts are still expressed as to it being a species really distinct from L. *Thelypteris*. Mr. Eaton

and other American pteridologists think it quite distinct. Its most obvious characters are—(1.) The tapering form of the lower part of the frond (although there is also a form of *L. Thelypteris* having this peculiarity; (2.) sori few, mostly near the base of the pinnules, and not confluent, not overlapped by a recurved margin; (3.) veins of the pinnules simple, not forked. The outline of the frond must not be depended upon, as the Scotch and Irish *L. Thelypteris* is narrowed at the base like *L. Nov-Eboracensis*, This species is allied to *L. montana*, Moore (*Oreopteris*, Bory.)

POLYSTICHUM.

P. angulare, β. Braunii.—Frond soft, herbaceous, lanceolate, bipinnate; pinnules stalked, serrate; the small teeth tipped by soft bristles; stipe and rachis scaly throughout; In the Canadian plant the scales of the rachis are larger than in the typical *P. angulare* of England, from which it may be specifically distinct: *Aspidium Braunii*, Spenner. *Aspidium aculeatum* var. *Braunii*, A. Gray, Man. Bot., p. 599, A. *aculeatum*, Abbé Provancher; Harrington, Cape Bon-Ami and Dartmouth, N. fork, Gaspé, John Bell, B. A.; base of Silver Mountain, W. S. M. D'Urban.

P. Lonchitis, Roth.—Frond rigid and shining, linear-lanceolate, simply pinnate; pinnæ scythe-shaped, auricled, spinose. *Polystichum Lonchitis*, Roth, Moore, J. Sm., &c. *Polypodium Lonchitis*, Linn. *Lapidium Lonchitis*, Swartz, Schk.—Limestone rocks, Owen Sound, C. W., 1859, Rev. Professor Hincks. Professor Hincks has also kindly furnished me with specimens from the above locality. Woods, southern shore of Lake Superior and north-westward, Professor Asa Gray, in Man.; British America, Professor Wood in Class Book. It will be observed that Professor Hincks's station is the only definite Canadian one with which we are acquainted. Mr. T. Drummond found this fern on the Rocky Mountains many years ago.

P. acrostichoides, Schott.—Frond pale green shining, long and narrow, linear-lanceolate, simply pinnate; pinnæ long and narrow, linear-lanceolate, shortly stalked, auricled anteriorly at the base, more or less distinctly serrate, with hair-tipped teeth; fertile (upper) pinnæ slightly contracted, covered beneath by the large confluent sori stipe profusely chaffy, with pale scales. *Polystichum acrostichoides*. Schott, J. Sm. *Aspidium acrostichoides*, Swartz, A. Gray, Eaton. *Aspid. auriculatum*, Schk. *Nephrodium acrostichoides*, Michx.—Abundant in the woods a few miles from

Kingston; also not rare in the woods of the Midland District of Canada generally; Upper Rideau Lake; woods around Toronto, Rev. Dr. Barclay; Stanfold, Abbé Provancher; L'Orignal, J. Bell; London, W. Saunders; Sulphur Spring, Hamilton, Judge Logie, Prescott, common, B. Billings, jun; Nicolet and St. Valentine, C. E., and Chippawa, C. W., P. W. Maclagan, M.D.; Belleville very common in rocky woods, as in Hop Garden, J. Macoun; Ramsay, Rev. J. K. M'Morine, M.A.; hills and woods, portage to Bark Lake, W. S. M. D'Urban; Gilmour's Farm, Chelsea, D. M'Gillivray, M.D,; Osnabruck and Prescott Junction, Rev. E. M. Epstein. This species is exclusively American.

[*β. incisum*, pinnæ strongly serrate or incised into lobes. *Aspidium Schweinitzii*, Beck. This form, which I have from Schooley's Mountains, &c. (A. O. Brodie), will no doubt be found in Canada.]

Cystopteris.

C. fragilis, Bernhardi—Fronds delicate, green, lanceolate in outline, glabrous, bipinnate; pinnæ and pinnules ovate-lanceolate or oblong; the latter obtuse, incisely toothed, thin and veiny; sori large; stipe dark purple at the base. *Cystopteris fragilis*, Bernhardi, Hook., Bab., Moore, Newm., A. Gray. *Polypodium fragile*, Linn. *Cystopteris orientalis*, Desvaux. *Polypod. viridulum*, Desv. *Athyrium fragile*, Sadler. *Cyathea fragilis*, Sm. *C. cynapifolia* and *C. anthriscifolia*, Roth. *Cystea fragilis*, Sm. *Cyclopteris*, S. F. Gray.—Rocky woods and cliffs about Kingston, in various places but not abundant; Farmersville; Mountain side, Hamilton, on moist rocks, Judge Logie; rocks by the bay-shore, L'Anse au Cousin and Dartmouth River, Gaspé, John Bell, B.A.; Mirwin's woods, Prescott, common, B. Billings, jun.; Montreal and Jones's Falls, P. W. Maclagan, M.D.; rocky bank of the Moira, rather rare, J. Macoun; Ramsay, Rev. J. K. M'Morine, M.A.; camp at base of Silver Mount, on rocks, also River Rouge, abundant; De Salaberry, west line, and at Black Lead Falls, W. S. M. D'Urban; St. Joachim, Abbé Provancher; Grenville, C. E. John Bell, B. A.; London, W. Saunders. In Dr Hooker's valuable Table of Arctic Distribution this plant is indicated as a Canadian species that does not enter the United States, which, I presume, arises from a misprint, as the species is not uncommon in the Northern States, and extends south to the mountains of Carolina. The delicate *C. tenuis* is the form known in the south, but in Canada we have the stout typical European form of *C. fragilis*.

β. angustata.—Pinnules incised, with longish and spreading teeth. *Cyst. frag.* var. *cynapifolia*, J. Lowe.—Gaspé, John Bell, B.A. Specimens referable to this form were likewise gathered at Lake of Three Mountains by Mr. D'Urban. Mr. Bell's specimens agree perfectly with English specimens from Dr. John Lowe (*C. f. cynapifolia*). Italian specimens from Professor Caruel of Pisa, labelled "*Cyst. fragilis*," belong to this variety. Mr. Bell has a fertile frond from Gaspé with very broad veiny pinnæ, deeply incised, but not pinnate.

C. bulbifera, Bernhardi.—Frond thin, green, lanceolate or linear-lanceolate, bipinnate, bulbiferous towards the apex on the under surface; pinnæ oblong-lanceolate, narrowed at the tips; pinnules oblong-obtuse, incisely toothed; sori small, not very numerous; indusium short. Very variable in the size and form of the frond. *C. bulbifera*, Bernhardi, A.Gr., J. Sm.; *Aspidium bulbiferum*, Swartz, Schk., Pursh. *Aspidium atomarium*, Muhl.—Moist, swampy woods about Kingston, as Collins's Bay, Kingston Mills, &c.; abundant on Judge Malloch's farm, a mile west from Brockville; Petit Portage, &c., Gaspé, John Bell, B.A.; Wolfe Island, A. T. Drummond, B.A.; Mirwin's woods, Prescott, common, B. Billings, jun. (short form); Belœil Mountain, P. W. Maclagan, M.D.; rocky banks of the Moira, Belleville, and in cedar swamps and wet woods, very common, J. Macoun; Ramsay, Rev. J. K. M'Morine, M.A.; Mountain side, Hamilton, common, Judge Logie; Black Lead Falls, on limestone rock, W. S. M. D'Urban; Foot of Cape Tourmente, Abbé Provancher; Grenville, C. E., J. Bell; London, W. Saunders. There are two distinct forms or varieties of this species.

α. horizontalis.—Frond triangular-lanceolate, broad at base, not more than three or four times longer than broad; pinnæ horizontal. Niagara Falls, within the spray, Collins's Bay, &c.

β. flagelliformis.—Frond linear, attenuated upwards, very long and narrow, six or seven times longer than broad; pinnæ less horizontal. Frankville, Montreal, Gaspé, &c.

Dennstædtia.

D. punctilobula, Moore.—Frond broadly lanceolate, pale green, thin, with a stout rachis, bipinnate; the pinnules pinnatifid; sori minute, usually one on the anterior basal tooth of each lobe of the pinnule, which is reflexed over the sorus; the proper indusium is pale, cup-shaped, opening at top. Rhizome slender, creeping

through the soil; whole plant glandular-downy. *Dennstœdtia* (Bernhardi, 1800) *punctilobula*, Moore, Index Filicum, p. xcvii. *Dicksonia punctilobula*, Hooker, A. Gray, J. Sm. *D. pilosiuscula*, Willd., Hook. Fl. Bor. Amer. *Nephrodium punctilobulum*, Michx. *Aspidium punctilobulum*, Swartz. *Patania*, Presl. *Dicksonia pubescens*, Schkr. *Sitolobium pilosiusculum*, Desv., J. Sm. Gen. Fil.—Pittsburg near Kingston, John Bell, B.A.; River Rouge, W. S. M. D'Urban; Montreal, P. W. Maclagan, M. D.; Prescott, on Dr. Jessup's moist pasture-land, B. Billings, jun.; New Brunswick, E. N. Kendal, in Hook. Fl. Bor. Amer.; Ramsay, Rev. J. K. M'Morine. Mr. Eaton has mentioned to me that the drying fronds have the odor of new hay.

Woodsia.

W. Ilvensis, R. Br.—Frond lanceolate, usually four or five inches long, bipinnate, or nearly so, pinnæ approximate, pinnules oblong, obtuse, stipe (red), rachis and whole lower surface of the frond clothed with chaffy scales, which are rusty at maturity. Sori usually confluent around the margins of the pinnules. First observed in the Isle of Elba (Ilva), hence named, after Dalechamp, *Acrostichum Ilvense* by Linnæus, whose Phœnix was very wroth thereat; see English Flora, vol. iv, p. 323. *Woodsia Ilvensis*, R. Br., Hook., Moore, J. Sm., Gray, &c. *Nephrodium lanosum*, Michx.—Abundant on the ridge of Laurentian rocks at Kingston Mills; Rocks west from Brockville and at Chelsea, B. Billings, jun.; Mount Johnson and Belœil Mountain, P. W. Maclagan, M.D.; mountain gneiss rocks, opposite Rouge River, W. S. M. D'Urban. I have likewise specimens from the Hudson Bay territories (Governor M'Tavish), but without special locality. On rocks, Canada, Pursh; Canada to Hudson Bay, Hook. Fl. B. A.; foot of Cape Tourmente, Abbé Provancher. I think our plant must be much larger and more scaly than the European one. A tuft which I have from Catskill Mountains (A. O. Brodie) has richly fruited fronds a foot long and two inches wide. (I find that large American forms of this species have been mistaken for *W. obtusa*. The involucre, which is large and *not* split into hairs in the latter species, serves readily to distinguish it.) Much of the *W. Ilvensis* in cultivation in Europe is probably the American form.

β. gracilis.—Frond more slender, more hairy and less scaly than the type; pinnæ rather distant, deeply pinnatifid, or par-

tially pinnate. Dartmouth River, Gaspé, John Bell, B.A. In technical characters, this form agrees better with *W. alpina* (*hyperborea*), but it has quite a different aspect.

W. alpina, S. F. Gray.—Frond small (from one to two or three inches long), broadly linear, pinnate, somewhat hairy without distinct scales; pinnæ ovate, somewhat triangular, obtuse, pinnatifidly divided into roundish lobes *Woodsia alpina*, S. F. Gray, Brit. Pl., Moore. *Woodsia hyperborea*, R. Br. in Linn. Trans., vol. xi; Pursh, Fl. Am. Sept. ii, 660.—In the clefts of rocks, Canada, Pursh; Canada to the Saskatchewan, Hooker. Noticed in Dr. Hooker's Table of Arctic Plants as a Canadian species that does not extend into the American States.

W. glabella, R. Br.—Frond a few (2–4) inches long, linear, bright green and glabrous on both sides, simply pinnate; the pinnæ short, rounded or rhombic, cut into rounded or wedged lobes. Stipe with a few scales at the base only. *Woodsia glabella*, R. Br., Hook. Fl. Bor. Amer., tab. 237; Gray. Canada, Prof. Wood in Class Book. Sir W. Hooker, in the Fl. Bor. Amer., gave Great Bear Lake as the only station then known for *W. glabella*. Mr. D. C. Heaton has kindly furnished me with specimens from Willoughby Lake, Vermont (Goodale leg.), and Professor Gray notices its occurrence on rocks at Little Falls, New York (Vasey), and "high northward."

3. *Belli.*—Frond larger (6–7 inches long); pinnæ more elongated, pinnatifidly incised in rounded lobes (bright green, glabrous). Gaspé, on the Dartmouth River, twenty miles from its mouth, John Bell, B.A.

W. obtusa, Torrey.—Frond nearly a foot long, linear-lanceolate-glandulose, bipinnate; pinnules slightly decurrent, oblong, obtuse, crenate, or somewhat pinnatifid; indusium large, enveloping the sorus, torn into a few marginal lobes; stipe with few scattered, pale, chaffy scales. *Woodsia obtusa*, Torrey, A. Gray, J. Sm. *Aspidium obtusum*, Willd. *Physematium obtusum*, Hook, Fl. Bor. Amer. *Woodsia Perrineana*, Hook. and Grev. Ic. Fl. *Polypodium obtusum*, Swartz.—An impression prevails that this plant, which is said to be common in the Northern States, especially towards the west, grows also in Canada. Mr. D. C. Eaton, in the kindest manner, cut out of his own herbarium a specimen for me, from near High Bridge, New York city, in an excellent state for examination, which has enabled me to understand the species, and to ascertain that we have as yet no satisfactory evidence of its

occurrence in Canada. Large forms of *W. Ilvensis* have in some cases passed for it. (I introduce this notice of the plant with a view to promote further inquiry.)

OSMUNDA.

O. regalis β. spectabilis.—Fronds erect, pale green, glabrous, bipinnate; pinnules oblong-lanceolate, oblique, shortly stalked, very slightly dilated at the base, nearly entire; fertile pinnules forming a racemose panicle at the summit of the frond. *Osmunda spectabilis*, Willd., J. Smith. Farmersville; Hardwood Creek, Hinchinbrook, and other places in rear of Kingston, usually in thickety swamps, by corduroy roads, &c.; Millgrove Marsh, Hamilton, Judge Logie; Ramsay, Rev. J. K. M'Morine, M.A.; woods near the Hop Garden, Belleville, not common, J. Macoun; Prescott, common, B. Billings, jun.; around Metis Lake, &c.; opposite Gros Cap; also Sou-sou-wa-ga-mi Creek and Schibwah River, R. Bell, jun.; near Montreal, Rev. E. M. Epstein and W. S. M. D'Urban; mountain, Bonne Bay, Newfoundland, on rocks 1000 feet above the sea, James Richardson (a small form); Welland, J. A. Kemp, M.D.; Osnabruck and Prescott Junction, Rev. E. M. Epstein, Nicolet, Wolfe Island and Navy Island, P. W. Maclagan, M.D.; Lake St. Charles, Abbé Provancher; Caledonia Springs and L'Orignal, J. Bell; Portland, Thos. R. Dupuis, M.D.; Bedford; London, W. Saunders. The fronds of our plant are a little more drawn out than those of the European one; the pinnules are often distinctly stalked, and the overlapping auricles either altogether absent or only slightly developed. This is *O. spectabilis*, Willd.; *O. regalis, β.* Linn. Sp. Pl. Some botanists distinguish two American forms, one agreeing with the typical *O. regalis* of Europe; but it is difficult to do so. The typical *O. regalis* is a larger, more robust, and more leafy plant, with more widely spreading or divergent pinnæ, and more leafy auricled sessile pinnules, more or less pinnatifid at the base; in our Canadian plant they are quite entire. The divisions of the fertile portion of the pinnæ are also more widely divergent in *a regalis*. The frond, moreover, is of a darker color.

O. cinnamomea, Linn.—Sterile and fertile fronds distinct, the former ample, broadly lanceolate, pinnate; the pinnæ rather deeply pinnatifid; lobes regular, entire; fertile frond contracted, erect, in the centre of the tuft of sterile fronds, and not at all foliaceous. Sporangia ferruginous. Fertile frond decaying early in the sum-

mer. *Osmunda cinnamomea*, Linn., Gray, J. Sm. *O. Claytoniana*, Conrad, not of Linn.—Fairfield farm and elsewhere about Kingston, not uncommon; Millgrove Marsh, Hamilton, Judge Logie; Sandwich and Montreal, P. W. Maclagan, M.D.; opposite Gros Cap; also Two-Heart River, Lake Superior, R. Bell, jun., C.E.; Belleville, swamps and low grounds, common, J. Macoun; Ramsay, Rev. J. K. M'Morine, M.A.; St. Joy Woods, on the river shore, near Gatineau Mills, D. M'Gillivray, M.D.; Newfoundland, Miss Brenton, in Hook. Fl. Bor. Am.; Prescott, common, B. Billings, jun.; Nicolet, Abbé Provancher; L'Orignal, J. Bell; near London, W. Saunders.

O. Claytoniana, Linn.—Frond narrowly lanceolate, pinnate; pinnæ lanceolate, about three pairs of pinnæ near or below the middle of the frond contracted and fertile; sporangia brown, with green spores. This species, when fresh, has a strong odor, resembling that of rhubarb (Pie-plant) stalks. *O. Claytoniana*, Linn., Gray, J. Sm. *O. interrupta*, Michaux.—Between Kingston and Kingston Mills, in wet swampy places by the roadside; Little Cataraqui Creek; Waterloo; banks of the Humber, near Toronto; Princes Island, Hamilton, Judge Logie; Ramsay, Rev. J. K. McMorine, M.A.; Ke-we-naw Point, in wet soil, R. Bell, jun.; Belleville, low rich grounds, not rare, J. Macoun; Prescott, common, B. Billings, jun.; Round Lake, W. S. M. D'Urban; Lake Settlement, and on the river shore near Gatineau Mills, D. McGillivray, M.D.; Newfoundland, Miss Brenton, in Hook. Bor. Am.; Osnabruck and Prescott Junction, Rev. Dr. Epstein; on Judge Malloch's farm and elsewhere about Brockville; Dartmouth River, Gaspé, John Bell, B.A.; St. Fereol, Abbé Provancher. Abundant on uncleared land along the Bedford Road, where the dried fronds are used by the farmers as winter-fodder for sheep. Augmentation of Granville, C. E., J. Bell, B.A.; near Komoka, C. W., W. Saunders. This fern is common also in the Northern States. I have a lax form, with long stipes and remarkably short somewhat triangular pinnæ, from Schooley's Mountain.

Schizæa.

[*S. pusilla*, Pursh.—Newfoundland, De la Pylaie. I have no further information respecting its occurrence in British America. Professor A. Gray indicates its distribution in the United States thus:—"Low grounds, pine-barrens of New Jersey, rare," which is not at all favorable to its being found in Newfoundland or Canadal

Mr. Eaton has sent me beautiful specimens from sandy swamps in Ocean County, New Jersey.]

Nat. Ord. OPHIOGLOSSACEÆ.

BOTRYCHIUM.

B. Virginicum, Swartz.—Barren branch sessile, attached above the middle of the main stem, thin, delicate, veiny, tripinnate, lobes of the pinnules deeply incised; fertile branch bi- or slightly tripinnate. Very variable in size, usually a foot or more in height, but sometimes only a few inches. *Botrychium Virginicum*, Swartz, A. Gray, J. Sm. *B. Virginianum*, Schk. *Osmunda Virginica*, Linn. Sp. Pl. *Botrypus Virginicus*, Michx.—Not uncommon in the woods about Kingston and the surrounding country, as near Odessa, in Hinchinbrook, &c.; Delta; Toronto; Sulphur Spring, Hamilton, Judge Logie; Prescott, in woods, common, B. Billings jun.; Nicolet, Montreal, Wolfe Island and Chippawa, P. W. Maclagan, M.D.; Belleville, rich woods, very common, J. Macoun; Ramsay, Rev. J. K. M'Morine, M.A.; River Marsouin, St. Lawrence Gulf, also opposite Grand Island, Lake Superior, R. Bell, jun., C.E.; Riviere Rouge, and De Salaberry, west line, W. S. M. D'Urban; Montreal, Osnabruck, and Prescott Junction, Rev. E. M. Epstein; Hill Portage above Oxford House, Governor McTavish; Newfoundland, Miss Brenton, in Fl. Bor. Amer.; Lake Huron to Saskatchewan, Hook. Fl. Bor. Am.; Gaspé, John Bell, B.A.; Stanfold, Abbé Provancher; Grenville, C. E., J. Bell; London, W. Saunders.

β. gracile.—Very small (5 or 6 inches high), fertile branch less divided. *B. gracile*, Pursh. Hill Portage, above Oxford House, Governor McTavish.

γ. simplex.—Barren branch oblong, pinnatifid, the lobes ovate, incised, veiny. *B. simplex*, Hitchcock. Grenville, C. E., John Bell, B.A.

B. lunarioides, Swartz.—Barren branch long-stalked, arising from near the base of the main stem, thick and leathery, bipinnate, the pinnules slightly crenate; fertile branch bipinnate. Root of long thick tuber-like fibres. *Botrychium lunarioides*, Swartz, Gray. *B. fumarioides*, Willd., Provancher. *Botrypus lunarioides*, Michx. Gananoque Lake, May 1861: Plains near Castleton, and woods near the Hop Garden, Belleville, rare, J. Macoun; Three Rivers, C.E., P. W. Maclagan, M.D.,; Waste places west from Prescott

Junction, rare, B. Billings, jr.; St. Joachim, Abbé Provancher; L'Orignal, J. Bell: English's Woods, W. Saunders; in the Northern States this species grows in dry rich woods, "mostly southward," according to Professor Gray's Manual.

B. obliquum, Muhl., appears to be chiefly distinguished by its larger size, more compound fertile frond, and the narrower oblique divisions of the barren one. *B. obliquum* (Muhl.), Pursh. Fl. Amer. Sept., vol. ii, p. 656. Newfoundland, Dr. Morrison in Hook. Fl. Bor. Amer; Wesleyan Cemetery, London, W. Saunders.

B. Lunaria,—Swartz.—Barren branch sessile, arising from the middle of the stem, thick and leathery, oblong, pinnate; pinnæ lunate or fan-shaped slightly incised on the rounded margin. *Botrychium Lunaria*, Swartz, Schk., Hook., Moore, J. Sm. *Osmunda Lunaria*, Linn.—Nipigon, 1853, Governor McTavish; N.E.America, Dr. Hooker's tab.; Newfoundland, Saskatchewan, and Rocky Mountains to Behring's Bay in N. W. Am., T. Moore, Hbk. Brit. Ferns.

Ophioglossum.

[*O. vulgatum*, L., which is widely distributed throughout Europe and Northern Asia, and grows also in the Northern United States, although there "not common," is to be looked for in Canada. In one of its forms (*O. reticulatum*, Linn.), it extends to the West Indies.]

Nat. Ord. LYCOPODIACEÆ.*

Plananthus.

P. Selago, Pallisot-Beauvois.—Stem dichotomously branched, erect fastigiate; leaves in about 8 rows, more or less convergent or spreading, lanceolate, acuminate, entire; sporangia in the axils of the common leaves (not in spikes). *Lycopodium Selago*, Linn., E. B., Bigelow, Beck, Hook and Grev., Torrey Fl. N. Y. ii, p. 508, Gray.—Labrador, Hudson Bay to Rocky Mountains, Hook. Fl. B. A.; shore of Lake Superior and northward, Professor A. Gray, Man. Bot., N. S., p. 603. I have not seen Canadian speci-

* In this order the arrangement of A. M. F. J. Pallisot-Beauvois is adopted, as it seems to afford the best basis for a re-adjustment of the genera of *Lycopodiaceæ*, which is much required. For P.-B.'s genus *Lepidotis*, I have thought it better to substitute the name *Lycopodium*, an old name that should not be discarded.

mens of this plant. The stations known show that it encircles Canada, and some of them are probably within our limits. Principal Dawson obtained the alpine variety on the White Mountains, Herb. Bot. Soc. Canada, It is a rare plant in the United States. There are two forms of this species (both of which are figured by Dillenius): *a. sylvaticus*, leaves convergent, almost appressed; *β. alpinus*, leaves widely-spreading, stems shorter.

P. lucidulus. Stem dichotomously divided into long erect branches; leaves bright green, in about 8 rows, reflexed, linear-lanceolate, acute, denticulate; sporangia in the axils of the common leaves (not in spikes). *Lycopodium lucidulum*, Michaux, Pursh, Bigelow, Torr. Fl. N. Y. ii, p. 508, Gray, Beck, Darlington, Hook. and Grev. Bot. Mis. *L. reflexum*, Schk. *Lycopodium suberectum* of Lowe, a Madeira plant. *Selago Americana, foliis denticulatis reflexis*, Dill. Hist. Mus. t. lvi.—Gananoque Lakes, Collins's Bay, Newboro-on-the-Rideau, woods in rear of Kingston, &c.; Prescott, common, B. Billings, jun.; Nicolet, C. E., St. Catherines and Grantham, P. W. Maclagan, M.D.; Belleville, in swamps and cold woods, rather common, J. Macoun; River Ristigouche, St. Lawrence Gulf, R. Bell, jun., C.E.; L'Orignal, J. Bell, B.A.; London, W. Saunders; Ramsay, Rev. J. K. McMorine, M.A. This species is stated by Professor Torrey to be rather common in New York State. "Frequently bears bulbs instead of capsules," Pursh.

[*P. alocuperoides*, P. Beauv.—The habitat "Canada" is given for *Lycopodium alocuperoides*, Linn., in the "Species Plantarum," ed. 3, vol. ii, p. 1565; but it is probably not a Canadian plant.]

P. inundatus, P. Beauv. Stems prostrate, adherent to the soil, the fertile ones erect? leaves secund, yellowish-green, lance-awl-shaped, acute; sporangia in distinct, terminal, leafy, sessile, solitary spikes. *Lycopodium inundatum*, Linn., E. B., Michaux, Pursh, Beck, Tuckerman, Torr. Fl. N. Y. ii, p. 508, Gray. *Plananthus inundatus*, Beauv. *L. alocuperoides*, Linn., in part?—In cedar swamps and overflowed woods, Canada, Pursh. Professor Torrey notices its occurrence in the north-western part of the State of New York. Professor Gray observes, that the leaves are narrower in the American than in the European plant, and suggests that it may be a distinct species. I have not yet seen Canadian specimens.

Lycopodium.

L. clavatum, Linn.—Stems robust, and very long, prostrate, rooting, forked, with short ascending branches; leaves pale, in-

curved, linear-awl-shaped, tipped with a white hair point; sporangia in scaly catkins, which are usually in pairs on common peduncles. *Lycopodium clavatum*, Linn., E. B., Michaux, Pursh, Bigelow, Beck. Darlington, Spring, Hook., Torrey, Gray. *L. tristachyum*, Pursh? *L. integrifolium*, Hook. *L. aristatum*, Humboldt.—Occasionally found in the woods in rear of Kingston, but not common; Newfoundland, Hook. Fl. Bor. Amer.; between Thessalon and Missisagui Rivers, Lake Huron, R. Bell, jun.; Prescott, common, B. Billings, jun.; Three Rivers, Temiscouata, and Wolfe Island, P. W. Maclagan, M.D.; Seymour, in pine woods, rare, J. Macoun; Ramsay, Rev. J. K. McMorine, M.A.; River Ristigouche, St. Lawrence Gulf, R. Bell, jun.; London, W. Saunders, L'Orignal and L'Anse au Cousin, Gaspé, J. Bell; Belmont. The spores, chiefly of this species, constitute the *pulvis lycopodii*, which is used by apothecaries, and was at one time employed for making artificial lightning in the theatres.

L. annotinum, Michaux.—Stems very long, prostrate, creeping, forked, with ascending branches; leaves bright green, spreading or slightly deflexed, in about five rows, linear-lanceolate, mucronate, serrulate; sporangia in scaly catkins, which are sessile, solitary, oblong-cylindrical, thick. *Lycopodium annotinum*, Michaux, E. B., Pursh, Beck, Tuckerman, Torrey, Fl. New York State, ii, p. 509. —Pine forests in Hinchinbrook; rocky woods in Pittsburgh, on the north bank of the St. Lawrence, near Kingston; Gananoque Lakes; L'Anse au Cousin, Gaspé, John Bell, B.A.; Prescott, common, B. Billings, jun.; Rivière du Loup, Nicolet, Montreal, and Kingston, P. W. Maclagan, M.D.; Belleville, in cool woods, common, J. Macoun; Ramsay, Rev. J. K. McMorine, M.A.; Priceville, C. I. Cameron, B.A.; Newfoundland, Hook. Fl. Bor. Amer.; St. Augustin and Cape Tourmente, Abbé Provancher. Frequent in New York State, according to Professor Torrey. Of this species there are two forms, only one of which, the normal one, or type, I have as yet observed in Canada. The var. *β alpestre*, Hartm. Scan. Fl., having broader, shorter, paler, less spreading leaves, I have from the Dovrefield (T. Anderson, M.D.), Lochnagar, Scotland (A. Croall), and entrance to Glen Fee, Clova, where I found it growing with the typical form.

L. dendroideum, Michx.—Stems upright, bare below, bushy above (giving the plant a tree-like aspect), arising from a long creeping rhizome, leaves more or less appressed; sporangia, in scaly catkins, which are sessile, cylindrical. *Lycopodium dendroideum*,

Michx., Pursh, Bigelow, Hook., Beck, Darlington. *L. obscurum*, Linn., Bigelow, Oakes.—White-cedar woods near Bath, abundant, and throughout the woods generally in rear of Kingston; Gananoque River; Priceville, C. I. Cameron, B.A.; Prescott, common, B. Billings, jun.; Nicolet, Mount Johnson, and Montreal, P. W. Maclagan, M.D.; Seymour and Cramahe, in cool moist woods, J. Macoun; River Ristigouche, Gulf of St. Lawrence, R. Bell, jun.; Ramsay, Rev. J. K. McMorine, M.A.; New Brunswick, Hook, F.B.A.; Osnabruck and Prescott Junction, Rev. E. M. Epstein; London, W. Saunders; Harrington, L'Orignal, and Gaspé, John Bell, B.A.; St. Joachim, Abbé Provancher.

L. complanatum, Linn.—Stems rhizome-like with ascending branches, which are dichotomously divided, flattened; leaves short, in four rows, those of two rows imbricated, appressed, of the other two somewhat spreading; sporangia in scaly cylindrical catkins, in twos, threes, or fours, on a common peduncle. *Lycopodium complanatum*, Linn., Gray, Blytt. *L. chamæcyparissias*, Braun. *L. sabinæfolium*, Willd.—Not uncommon in the woods about Kingston, and in rear; Newboro-on-the Rideau; Gananoque River; River Ristigouche, St. Lawrence Gulf, and St. Joseph's Island opposite Campment d'Ours, Lake Huron, R. Bell, jun.; Ramsay, Rev. J. K. McMorine, M.A.; pine grove near Blue Church Cemetery and woodlands west from Brockville, not common, B. Billings, jun.; Three Rivers and Temiscouata, C.E., P. W. Maclagan, M.D.; sandy woods around Castleton, sterile hills, Brighton and Murray; J. Macoun; L'Orignal and L'Anse au Cousin, Gaspé, J. Bell, B.A., Trois Pistoles, Abbé Provancher; London, W. Saunders. To this species is referred *L. sabinæfolium*, Willd., *L. chamæcyparissias*, A. Braun; with branches more erect and fascicled. Prof. Asa Gray remarks:—"The typical form of *L. complanatum*, with spreading, fan-like branches, is abundant southward (in N. States), while northward it passes gradually into the var. *sabinæfolium*." I have only one rather imperfect specimen of the European *L. chamæcyparissias*, collected at Bonn on the Rhine, by my friend Professor G. S. Blackie, which does not differ in the branching from ordinary Canadian forms of *L. complanatum*. It appears to be quite a common species in the States, for I have it from a great many places.

Selaginella.

S. spinulosa, A. Braun.—Small, prostrate, leaves lanceolate, acute, spreading, spinosely toothed; fertile branch stouter, ascend-

ing spike sessile. *Selaginella spinulosa*, A. Braun, Blytt, Norges Fl.; *Lycopodium selaginoides*, Linn. Pursh Fl. Am. Sept, ed. ii, p. 654. *Selaginella spinosa*, Beauv. *Selaginella selaginoides*, A. Gray, Man. Bot. N. States, p. 605.—Gaspé, John Bell, B.A.; Canada, Michaux; Lake Superior and northward, pretty rare, Professor Asa Gray in Man. Bot. N. States; Canada, Pursh, who observes, "the American plant is smaller than the European."

STACHYGYNANDRUM.

S. rupestre, P. Beauv.—Much branched, leaves slightly spreading when moist, appressed when dry, carinate, hair-tipped; compact and moss-like, growing on bare rocks. *Selaginella rupestris*, Spring, A. Gray, Eaton. *Lycopodium rupestre*, Linn., Pursh Fl. Am. Sept., ed. ii, p. 654.—On the perpendicular faces of Laurentian rocks, along the north bank of theSt. Lawrence, in Pittsburgh, and on the Thousand Islands at Brockville, &c.; Long Point on the Gananoque River; near Farmersville, C. W., T. F. Chamberlain, M.D.; rocks in pine groves two miles west from Prescott, near the river, and on rocks west from Brockville, not common, B. Billings, jun.; Ramsay, Rev. J. K. McMorine, M.A.; Belœil and Mount Johnson, C. E., P. W. Maclagan, M.D.

DIPLOSTACHYUM.

D. apodum, P. Beauv.—Stems creeping, branched; leaves pale vivid green, of two kinds,—the larger spreading horizontally, ovate-oblique, the smaller appressed, acuminate, stipule-like. Forms compact tufts. *Lycopodium apodum*, Linn., Pursh. Fl. Am. Sept., ed. 2. ii, p. 654. *Selaginella apus*, Gray, Eaton.—Abundant on low wet ground east of Front street, Belleville, below the hill, where it was pointed out to me by Mr. J. Macoun, July 1863. In September 1863, I found it sparingly but fertile, on grassy flats by the river side at Odessa. Near London, ... Saunders; Detroit River, C. W., P. W. Maclagan, M.D. Apparently not common in the United States. I have it from Schooley's Mountain. This is a very small, compactly-growing moss-like species, well adapted for cultivation under a glass shade. It was a great favorite with the late Dr. Patrick Neill, in whose stove-house, at Canonmills, Edinburgh, I first saw it many years ago.

Nat. Ord. MARSILEACEÆ.

AZOLLA.

A. Caroliniana, Willd.—Pinnately branched with cellular, imbricated leaves; plant reddish, circular in outline, ½–1 inch in

diameter; leaves ovate obtuse, rounded and roughened on the back (Eaton). Resembles a floating moss or Jungermannia (Torrey). Gray, Man. Bot., t. 14. Floating on the waters of Lake Ontario, Pursh Fl. Am. Sept., ed. 2, ii, p. 672. In the adjoining states, Professor Asa Gray notices it as occurring in pools and lakes, New York to Illinois and southward, and observes that it is probably the same as *A. magellanica* of all South America.

SALVINIA.

[*Salvinia natans*, = *Marsilea natans*, Linn. Sp. pl. "Floating like Lemna on the surface of stagnant waters, in several of the small lakes in the western parts of New York and Canada."—Pursh Fl. Amer. Sept. ed. 2, ii, p. 672. Professor Asa Gray states, that it has not been found by any one except Pursh, and he therefore omits it from his Manual of Botany of the Northern States.]

ISOETES.

I. lacustris, L.—Belœil, C. E., P. W. Maclagan, M.D.; Saskatchewan, Hook. Fl. Bor. Amer. This plant is spoken of by Pursh as growing in the Oswego River, near the Falls; and Professor Gray and others allude to it as not rare in the New England States. It should be carefully looked for in the numerous lakes and creeks of Upper Canada. It grows in muddy bottoms, forming green meadows under water. Much interest is attached to the genus *Isoëtes*, since Professor Babington has shown tha instead of one there are many species, or at least distinct races or forms, in Britain. In the United States four are known:—*I. lacustris*, Linn.; *I. riparia*, Engelm.; *I. Engelmani*, Braun; and *I. flaccida*, Shuttlew., the last a southern form. Professor Babington is certain of the existence of at least eight European species:—*I. lacustris*, L.; *I. echinospora*, Dur.; *I. tenuissima*, Bor.; I. *adspersa*, A. Br.; *I. setacea*, Del.; *I. velata*, Bory.; *I. Hystrix*, Dur.; and *I. Duriœi*, Bory. As yet we know of only one Canadian species, which is here rendered, rather uncertainly, *I. lacustris*. The American species are described in Gray's Manual, the British ones in the new Journal of Botany, London.

Nat. Ord. EQUISETACEÆ.

EQUISETUM.

The *Equiseta* having been described in a previous paper, it will be sufficient to give here a mere list of the species, with some additional notes obtained since the former paper was written.

E. sylvaticum, Linn. Newfoundland and New Brunswick, Hook. Fl. Bor. Amer.

E. sylvaticum, *β. capillare*. Much branched; branches very long straight, and exceedingly slender (capillary). Farmersville.

E. ambrosum, Willd. Belmate.

E. arvene, Linn. West from London, W. Saunders. The rhizome bears large spherical pill-like modules, which are however more conspicuous in var. *β. granulatum*.

E. arvense, *β. granulatum*.

E. Tclmateja, Ehrhart. Shores of Lake Ontorio, Beck.

E. limosum, *Fories*.—The great value of this species and of *E. arvense* as fodder-plants, is confirmed. On the western prairies horses are said to get "rolling fat" on equisetum in ten days; and experienced travellers tell me, that their horses always go faster next day after resting at night on equisetum pasture. The horses do not take to it at first; but after having a bit of equisetum put occasionally into their mouths, they soon acquire a liking for it, and prefer it to all other herbage. Near Komoka, W. Saunders.

E. hyemale, Linn. Lake Huron, Hook. Fl. Bor. Am.; St. Joachim, Abbé Provancher; London, W. S.

E. robustum, Braun. Stems much thicker than in *E. hyemale*, the ridges with one line of tubercles; sheaths shorter than broad, with a black band at base, and a less distinct one at the margin; teeth about forty, three-keeled. *E. robustum*, Braun, A. Gray. Grenadier Pond, on the Humber River near Toronto, 3d June 1862. It is difficult to decide whether this and other forms are really distinct from *E. hyemale;* certainly that species varies in size, in roughness, and in other characters. In *E. robustum* the teeth are twice as many as in *E. hyemale*, but even this is perhaps not a constant character.

E. variegatum, Weber and Mohr.; St. Joachim, Abbé Provancher.

E. scirpoides, Michaux.

E. scirpoides, *β. minor*.

E. palustre, Linn.—"Canada, from Lake Huron, Dr. Todd, Mr. Cleghorn, Mrs. Perceval, to the shores of the Arctic Sea, Dr Richardson, Drummond, Sir John Franklin, Captain Back."—Hook. Fl. Bor. Amer.—Professor A. Gray speaks of "the European *E. palustre*," attributed to this country (the N. American States) by Pursh, probably incorrectly." Dr. Hooker indicates its

existence, without doubt, in Arctic West America and Arctic East America. The name of the plant has occasionally appeared in Canadian lists, but I have as yet seen no Canadian specimen. It remains for Canadian or Hudson Bay botanists to trace its southern limit on the American Continent. In Europe and Asia it has no tendency to Arctic limitation.—*From the Edinburgh New Philosophical Journal.*

OBSERVATIONS ON SUPPOSED GLACIAL DRIFT IN THE LABRADOR PENINSULA, &c.

By Henry Youle Hind, M.A., F.R.G.S.

[The most important part of this paper is that which relates to the Labrador Peninsula, which we copy entire:—Eds.]

During an exploration of a part of the interior of the Labrador Peninsula in 1861, I had an opportunity of observing the extraordinary number, magnitude, and distribution of the erratics in the valley of the Moisie River and some of its tributaries, as far north as the south edge of the table-land of the Labrador Peninsula (lat. 50° 50′ N., long. 66° W.), and about 110 miles due north of the Gulf of St. Lawrence. Boulders of large dimensions, ten to twenty feet in diameter, began to be numerous at the Mountain Portage, 1460 feet above the sea, and sixty miles in an air-line from the mouth of the Moisie River. They were perched upon the summits of peaks estimated to be 1500 feet above the point of view, or nearly 3000 feet above the sea-level, and were observed to occupy the edges of cliffs, to be scattered over the slopes of mountain-ranges, and to be massed in great numbers in the intervening valleys.

At the "Burnt Portage," on the north-east branch of the Moisie, nearly 100 miles in an air-line from the Gulf of St. Lawrence, and 1850 feet above the ocean, the low gneissoid hills for many miles around were seen to be strewed with erratics wherever a lodgment for them could be found. The valleys (one to two miles broad) were not only floored with them, but they lay there in tiers, three or more deep. Close to the banks of the rivers and lakes near the "Burnt Portage," where the mosses and lichens have been destroyed by fire, very coarse sand conceals the rocks beneath; but on ascending an eminence away from the immediate banks of the river, the true character of the country becomes apparent. At the base of the gneissoid hills which limit the valley of the east

branch (about three miles broad) at this point, they are observed to lie two or three deep, and, although of large dimensions, that is from five to twenty feet in diameter, they are nearly all ice or water-worn, with rounded edges, and generally polished or smoothed. These accumulations of erratics frequently form tongues, or spots, at the termination of small projecting promontories in the hill-ranges. I have several times counted three tiers of these travelled rocks where the mosses, which once covered them with a uniform mantle of green, had been burnt; and occasionally, before reaching the sandy area which is sometimes found on the banks of the river, I have been in danger of slipping through the crevices between the boulders, which were concealed by mosses, a foot and more deep, both before and after passing through the "Burnt Country," which has a length of about thirty miles where I crossed it. I extract the following note from my journal of the appearance of these travelled rocks in the "Burnt Country":—

"Huge blocks of gneiss and labradorite lie in the channel of the river, or on the gneissoid domes which here and there pierce the sandy tract through which the river flows. On the summit of the mountains, and along the crest of the hill-ranges, about a mile off on either side, they seem as if they had been dropped like hail. It is not difficult to see that many of these rock-fragments are of local origin; but others have evidently travelled far, on account of their smooth outline. From a gneissoid dome, I see that they are piled to a considerable height between hills 300 and 400 feet high; and from the comparatively sharp edges of many around me, the parent rock cannot be far distant."

On all sides of Cariboo Lake, 110 miles in an air-line from the Gulf, and 1870 feet above it, a conflagration had swept away trees, grasses, and mosses, with the exception of a point of forest which came down to the water's edge and formed the western limit of the living woods. The long lines of enormous unworn boulders, or fragments of rocks, skirting the east branch of the Moisie at this point, were no doubt lateral glacial moraines. The coarse sand in the broad valley of the river was blown into low dunes, and the surrounding hills were covered with millions of erratics. No glacial striæ were observed here, but the gneissoid hills were rounded and smoothed at their summit; and the flanks were frequently seen to present a rough surface, as if they had been recently exposed by land-slides, which were frequently observed, and the cause which produced them, namely, frozen waterfalls.

No clay or gravel was seen after passing the mouth of Coldwater River, forty miles from the Gulf, and 320 feet above it. The soil, where trees grew, was always shallow as far as observed; and although a very luxuriant vegetation existed in secluded valleys, yet it appeared to depend upon the presence of labradorite-rock or a very coarse gneissoid rock, in which flesh-colored feldspar was the prevailing ingredient.

Observers in other parts of the Labrador Peninsula have recorded the vast profusion in which erratics are distributed over its surface. There is one observer, however, well known in another branch of science, who has left a most interesting record of his journey in the Mistassinni country, between the St. Lawrence at the mouth of the Saguenay, and Rupert's River, in Hudson's Bay. André Michaux, the distinguished botanist, traversed the country between the St. Lawrence and Hudson's Bay in 1792. He passed through Lake Mistassinni; and in his manuscript notes, which were first printed in 1861, for private circulation, at Quebec, a brief description of the journey is given. "The whole Mistassinni country," says Michaux, "is cut up by thousands of lakes, and covered with enormous rocks, piled one on the top of the other, which are often carpeted with large lichens of a black color, and which increase the sombre aspect of these desert and almost uninhabitable regions. It is in the spaces between the rocks that one finds a few pines (*Pinus rupestris*), which attain an altitude of three feet; and even at this small height showed signs of decay."

The remarkable absence of erratics in the Moisie, until an altitude of about 1000 feet above the sea is attained, may be explained by the supposition that they may have been carried away by icebergs and coast-ice during a period of submergence, to the extent of about 1000 feet. I am not aware that any traces of marine shells or marine drift have been recognized, north of the Labrador Peninsula, at a greater elevation than 1000 or 1100 feet. In the valley of the St. Lawrence, marine drift has not been observed higher than 600 feet above the sea. Glacial striæ were seen on the "gneiss-terraces" at the "Level Portage," 700 to 1000 feet above the sea. The sloping sides of these terraces are polished and furrowed by glacial action. Grooves half an inch deep, and an inch or more broad, go down slope and over level continuously. It is on the edge of the highest terrace here that the first large boulders were observed.

The entire absence of clay, and the extraordinary profusion of both worn and rugged masses of rock piled one above the other in the valley of the east branch of the Moisie, as we approach the table-land, lead me to attribute their origin to local glacial action, as well as the excavation of a large part of the great valley in which the river flows. Its tributary, the Cold-water River, flows in the strike of the rocks through a gorge 2000 feet deep, excavated in the comparatively soft labradorite of the Labrador series.*

The descriptions which have recently been published† of different parts of the Labrador Peninsula not visited by me, favor the supposition that the origin of the surface-features of the areas described may be due to glacial action, similar to that observed in the valley of the Moisie River.

The remainder of the paper treats of the "Forced Arrangement of Blocks of Limestone in Boulder Clay," "The Driftless Area in Wisconsin," "Beaches and Terraces," "Anchor-ice and Excavation of Lake-basins," "Parallelism of Escarpments in America." Many interesting facts are adduced in these subjects; and the author takes strong ground in advocacy of the action of glaciers rather than of icebergs in the production of glacial striæ. He claims this view as suggested by him in 1859. His view in reference to the excavation of lake-basins is stated in the following terms. It suggests some new views; though probably all geologists will not accept the cause assigned, as the most important of those which have acted in producing this effect:

It has been frequently stated that a difficulty arises as to the *modus operandi* by which a moving glacier can excavate lake-basins. May not the manner in which stratified rocks, at least, over which a glacier may be moving, can be involved in its mass in the form of slabs or mud, constituting dirt-beds, be partially explained by the phenomena attending the formation of anchor-ice? It is

* See Sir William Logan's "Geology of Canada" (1863), on the Division of the Laurentian Rocks into "two formations":

1st. The Labrador series.

2nd. The Laurentian.

The Labrador series, I have been recently informed by Sir William Logan, has been ascertained by him to rest unconformably upon the older Laurentian, and will be distinguished by a separate color on his new Map of Canada. See also Mr. Sterry Hunt on Chemistry of Metamorphic Rocks.

† See my "Explorations in the Interior of the Labrador Peninsula." Longmans, 1863.

no uncommon occurrence for the anchors of the nets of a "seal-fishery" on the north shore of the Gulf of St. Lawrence to be frozen to the bottom at the depth of from thirty to sixty feet; and when anchors are then raised, they bring with them frozen masses of sand. But it is in rapid rivers that the formation of anchor-ice is most remarkable, and most effective in excavating these beds. It forms on the beds of rivers above the head of a rapid, and frequently bursts up with a load of frozen mud or shingle, or slabs of rocks, which it has torn from the bottom. This phenomenon is witnessed every winter in the valley of the St. Lawrence; but it is best observed after a prolonged term of cold, when the thermometer indicates a temperature considerably below zero. Anchor-ice has only been observed, as far as my knowledge of the subject goes, in rapid currents in open water; and the sudden and apparently inexplicable rise of the St. Lawrence during extreme cold is most probably due to this cause.* It is not difficult to see how the rivers issuing from beneath the precipitous walls of glaciers, as described by Dr. Rink, may rapidly excavate deep channels by means of anchor-ice, to be widened by the subsequent operations of the glacier itself. Nor is it improbable that by this means a glacier in very cold climates may increase from the bottom upwards with a load of frozen mud and fragments of rock, particularly near its base, when that does not meet the open sea. The great lakes of North America, including Lake Winnipeg, are excavated on the edges of the fossiliferous rock-basins; and these lakes may represent the boundary of a glacial mass similar to that which now covers Greenland.—*From the Journal of the Geological Society.*

DESCRIPTION OF TWO AMERICAN SPONGES.

By Dr. J. S. Bowerbank, F.R.S., &c.

1. *Tethea hispida*, Bowerbank.

Sponge sessile. Surface strongly and thickly hispid. Oscula and pores inconspicuous? Dermis abundantly spiculous; spicula disposed at right angles to the surface, uniformly crowded together; super-fusiformi, sub-ovo-spinulate, very minute; forming a secondary series of defensive spicula. Primary series of defensive spicula super-fusiformi-acuate or sub-ovo-spinulate, very large and long. Skeleton spicula super-fusiformi-acuate and sub-

* See "Notes on Anchor-Ice," by T. C. Keefer, C.E., Canadian Journal, new series, vol. vii, p. 173, (1862).

ovo-spinulate, large and long. Tension spicula super-fusiformi sub-ovo-spinulate, small, irregularly dispersed, numerous.

Color. Dried, light gray.

Habitat. Portland, Maine, N. America.

Dr. Dawson, McGill College, Montreal:

Examined in the dried state.

I received a small slice of this sponge from Prof. Dawson. From the curve of the surface the specimen appears to have been about an inch and a half in diameter. In its present state the hispidation of the surface is very strongly produced, and probably much exaggerated by drying; the spicula are comparatively very large and long, more so than those of the skeleton fasciculi. The secondary series of defensive spicula are of the same form as those of the interstitial membranes, but not more than half their average size. The whole of the spicula are exceedingly fusiform, the middle of the shaft being frequently twice the diameter of the base of the spiculum. The ovo-spiculate character prevails more or less in all the spicula, but is more distinctly produced in those of the interstitial membranes, and the secondary dermal defensive ones. I could not detect any gemmules in the piece of sponge sent to me.

2. *Spongilla Dawsoni*, Bowerbank.

Sponge sessile?, branching; surface smooth. Oscula and pores inconspicuous. Dermal and interstitial membranes abundantly spiculous; spicula fusiformi-acerate, entirely spined; spines numerous, short, and conical. Skeleton-spicula acerate or subfusiform-acerate. Ovaria spherical; dermal spicula numerous, disposed in flat fasciculi, or groups of spicula parallel to each other; groups irregularly dispersed; spicula acerate or subcylindrical, entirely spined; spines numerous, obtuse, and ill-defined. Sarcode aspiculous.

Color, in the dried state, emerald-green.

Hab. River St. Lawrence, Montreal, Canada (*Mr. Fowler*, and *Rev. A. Kemp*); a lake near Brockville (*Rev. A. Kemp*).

Examined in the dried state.

About two years ago I received a small fragment of this species from Dr. Dawson, who stated that it was found in the River St. Lawrence, at Montreal; but, as the fragment was destitute of gemmules and very small, there were not sufficient characters to warrant a specific description of it. In October 1859 I received

from the same gentleman a further supply of fragments of this species, containing ovaria, and giving a better idea of its form than those first sent to me. The largest of the pieces sent was 1½ inch in length and 2½ lines in diameter, evidently a portion of a longer branch. At the proximal end there is a short branch, 3 lines in length and one line in diameter; and the distal end divides into two small branches of similar dimensions to the first, thus satisfactorily indicating the branching habit of the species. In several parts of this piece there are ovaries imbedded in the sponge, and there were many others in the fragments of the same species that accompanied it. The general external characters appear very like those of the European species *S. lacustris;* and from this similarity, I have very little doubt of its surface in the living state having been smooth and even, as in that species. In the European species the branches spring from a broad spreading base, about half an inch in thickness; and I think it highly probable that the American species will be found to possess the same habit. I could not detect oscula on any of the fragments in my possession.

The dermal and interstitial membranes abound with tension-spicula, and especially the dermal one, in which they seem to attain their fullest degree of development. Their normal form is fusiformi-acerate; but, from the abundant production of the spines at their terminations, they frequently appear to be cylindrical rather than acerate. They are dispersed on these tissues rather unevenly, abounding in some spots, while they are comparatively scarce in others.

The spicula of the skeleton are of about the same proportions as those of the European species. They are usually of the regular acerate form, but occasionally become subfusiform.

The spicula and their mode of arrangement in the dermis of the ovarium cannot be readily seen without the aid of treatment with hot nitric acid, in which they should be immersed for a few seconds, and the acid should then be immediately diluted with water, after which they should be dried on the glass, on which they are to be mounted in Canada balsam. The spicula in the dermis of adult ovaries are very abundant. They are similar in form and proportions to those of the dermal membrane; but, generally speaking, they are more fully produced, and the greater portion of them are subcylindrical from the profusion of spines at their apices. Their form and mode of arrangement in the ovary render

them exceedingly valuable as specific characters. In some of the young and incompletely developed ovaries I could not detect a single specimen of these spicula. The only difference I could find between ,these spicula and those of the dermal membrane was, that the spines on those of the latter were more sharply and fully produced, while on those of the ovary they were frequently ill-defined and often only in an incipient state, but very abundant.

In the preparation of the spicula for examination, I found a few birotulate ones having the rotulæ very deeply divided. These spicula were no part of the sponge in course of description, but were undoubtedly from the gemmules of another species inhabiting the St. Lawrence.

(NOTE BY THE EDITORS.) The above descriptions may be taken as a first instalment of descriptions of Canadian and other American Sponges, now in the hands of Dr. Bowerbank. The first was forwarded to us in MS. by the author. The second is taken from a late paper in the Proceedings of the Zoological Society of London.

The first of the above species was dredged by Dr. Dawson at Portland. The original specimen, part of which was sent to Dr. Bowerbank, is of an oval form, an inch and a half in its longest diameter, and about a quarter of an inch thick in the centre. It is attached partly to a stone, and partly to the side of a large specimen of *Balanus porcatus*.

The second species was collected by Mr. Fowler and Rev. Mr. Kemp, and the specimens were presented by these gentlemen to the Museum of McGill University, whence the portions examined by Dr. Bowerbank were sent with a number of others by Dr. Dawson.

MISCELLANEOUS.

HAIL-STORM IN PONTIAC.—*Extract of a Letter from Wm. King, Esq., of Bristol.*—Two days ago a very destructive hail storm occurred in this and the neighboring townships. Some singular circumstances connected with it may be noteworthy. On Monday, the 11th, about two p.m., the storm came, accompanied by thunder and lightning. Its course was from west to east, and about two miles wide. Almost all the glass in the westerly windows of the farm-houses within its range was broken; the crops of wheat, in

corn, oats, potatoes, &c., greatly injured, and in some instances wholly destroyed. The pieces of ice were from half an inch to over two inches diameter, round, angular, and square; some of them had small spiculæ round their edges. A farmer told me that on his land the hail covered the ground from three to four inches deep, hard and closely packed; but the most extraordinary thing is, that a respectable farmer of undoubted veracity says he picked up a piece of hail or ice, in the centre of which was *a small green frog* dead. Deeming such a thing rather rare in meteorology, I communicate it to you. I may remark that the heaviest hail-storms occur here in the month of July.—*Bristol, July* 13, 1864.

NATURAL HISTORY SOCIETY.

Report of the Scientific Curator.

In this account of the work done since the last annual meeting, I propose to adopt a natural history order. A large case, divided into five compartments, has been erected (at a cost of $120) for the reception of the Society's collection of mammals. A few species, viz., the moose, the white whale of the St. Lawrence (*delphinapterus*) and two seals, are too bulky to be admitted into this case without much disturbing the general classification: these have accordingly been omitted. With these exceptions, the rest of the collection has been arranged as far as practicable in accordance with Prof. Baird's elaborate monograph on North American mammals. Large printed labels have been attached to each species, the nomenclature adopted being that of the author just quoted. Several new specimens have been put up; and the collection now contains eighty-nine specimens, illustrating forty-nine North American species.

The miscellaneous mammalia have been grouped in one compartment by themselves, and have been named according to the most recent authors. It would be very desirable if a small sum of money could be voted annually for the purchase of specimens of such of the wild animals of Canada as are wanting to complete our local collection. I propose in the annual report of this year to publish a list of all the Canadian species of mammals, birds, reptiles, and fishes contained in the museum, so that our friends may see what species we want. The collection of birds has been re-grouped, and a number of additional cases full of specimens

have been prepared. The series of names printed by the Society some years ago is out of date, and it is proposed to substitute for them the labels issued by the Smithsonian Institute. The present arrangement of the species in small cases, and these not of uniform size, causes a great waste of room. Were each specimen mounted on a proper separate stand, as is usually done in large museums, the collection might be arranged in a much more accurate scientific order. We have now about 210 species of Canadian birds, but several species are wanting to complete our local series. A collection of the eggs of our local birds has been made; the series has been named and arranged in a glass case, with a covering of green baize, to prevent the injurious effects of light on the specimens. We have now the eggs of some fifty Canadian species carefully identified; and friends at Quebec have kindly promised to add largely to this branch of our collection during the summer. The reptiles have been arranged and named as far as our cases would admit, with the exception of several exotic snakes. Three cases of Canadian fishes have also been prepared by Mr. Hunter, containing some thirty-one species: these I have named and labelled. Two cases of miscellaneous fishes have also been prepared, and have been named so far as the limited access to proper books of reference in Canada will admit. Our collection of Canadian fishes is still very imperfect, particularly as regards the marine fishes of the gulf, which are almost unrepresented in the museum.

In the invertebrate section of the animal kingdom progress has been made as far as our material would admit. We have now 25 cases of shells, all carefully arranged and named. Of species purely Canadian we have nearly 200. Five cases are devoted to the illustration of the land and fresh water shells of the United States, and to the marine shells of the east and west coasts of the same country. The general series occupies thirteen large cases. This portion of our collection has been considerably more than doubled during the past fourteen months. The crustaceans, barnacles, sea-urchins, corals, and sponges have been named as far as possible, and arranged in one large case at the end of the gallery. Large donations of insects have been made to the Society, by Mr. Saunders and Mr. J. Ferrier; and a cabinet to hold all our specimens has been made at a cost of some $37. I am waiting for the arrival of some proper cork from England for the lining of the drawers, to work at this important branch of our collection.

I would call special attention to the large series of rocks and

minerals belonging to the Society, many of which are still unpacked. Four table-cases, to hold our fossils and minerals, would cost us from 100 to 120 dollars, and this is an improvement which I think should be our first object when the state of our funds will permit. I think it is no exaggeration to say that we have some 3000 or 4000 specimens of rocks, minerals, and fossils that we have no means of exhibiting, The only proper case we have contains some 1800 specimens. Of these I have carefully classified and labelled a little over 1200. Our collection of fossils I have partially arranged and named, and have placed them temporarily in the drawers under the mineral cabinet. In acknowledgment of the liberality of the Geol. Survey, the council of the N. H. S. have authorized me to pack up and distribute five series of the duplicate shells, sea-urchins, &c., belonging to the Survey, to the following Societies: Laval University, and the Museum of the Literary and Historical Society, Quebec; McGill College, Montreal; Queen's College, Kingston; and University College, Toronto. I have accordingly selected, named, and forwarded these sets to the afore-mentioned institutions; and among the results proceeding from this, may be mentioned a valuable donation of books from the Literary and Historical Society of Quebec, and the acquisition of several interesting additions to the Museum from McGill College in this city, and from the Laval University of Quebec. Since the date of my first connection with the Society, some 2000 specimens have been added to the Museum, and it is hoped that satisfactory progress has been made during the past year in the work of arrangement and classification. Dr. Smallwood having adverted to the course of lectures I had the pleasure of giving during the past winter, further allusion to them is unnecessary.

As Recording Secretary to the Society, it has been my duty to issue notice of council meetings, and to prepare and direct circulars calling the usual monthly meetings, to keep the minutes of all ordinary and special meetings, to prepare proper accounts of our monthly proceedings for the press, and for the Naturalist, to return thanks for donations, to issue diplomas and notices of election, and to transact many little items of general business for the Society. Finally, as an ex-officio member of the editing committee of the Naturalist, I have endeavored to do what I could for the Journal, whether directly or indirectly.

J. F. WHITEAVES, F.G.S., &c.,
Rec. Secretary and Scientific Curator, N. H. S.

Mr. Jas. Ferrier, jun., then presented his Report as Treasurer of the Society, which will be found on the other side.

It was moved by the Right Rev. the Lord Bishop, seconded by Stanley C. Bagg, and unanimously resolved: "That the reports just read be adopted, and printed for distribution among the members."

A vote of thanks to the officers of the past year was moved by Dr. David, seconded by L. A. H. Latour.

The following gentlemen were elected as office-bearers during the coming year, as follows:

OFFICERS FOR 1864-65.

President.—Principal Dawson, LL.D., F.R.S., &c.

Vice-Presidents.—Rev. A. De Sola, LL.D.; Sir W. E. Logan, LL.D., F.R.S., &c.; E. Billings, F.G.S.; Dr. T. Sterry Hunt, M.A., F.R.S., &c.; W. H. A. Davies; The Right Rev. the Lord Bishop; C. Smallwood, M.D., LL.D.; Rev. A. F. Kemp, M.A.; John Leeming.

Treasurer.—Jas. Ferrier, jun.

Cor. Secretary.—Prof. P. J. Darey, M.A.

Rec. Secretary and Scientific Curator.—J. F. Whiteaves, F.G.S., &c.

Librarian.—Stanley C. Bagg.

Council.—A. Rimmer, G. Barnston, E. Murphy, Dr. Hingston, L. A. H. Latour, D. A. P. Watt, C. Robb, J. H. Joseph, and Dr. David.

Library Committee.—Messrs. J. C. Becket, Prof. Cornish, Dr. Fenwick, Dr. David, and Dr. Mackay.

Editing Committee of the "Canadian Naturalist."—D. A. Poe Watt, Acting Editor; Dr. Dawson; Dr. Hunt; E. Billings; Rev. A. F. Kemp, M.A.; Prof. Robins, B.A.; Dr. Smallwood; and the Corresponding and Recording Secretaries.

THE NATURAL HISTORY SOCIETY OF MONTREAL IN ACCOUNT WITH JAMES FERRIER, JUN., TREASURER.

Dr. Cr.

1864. RECAPITULATION.		1864. RECAPITULATION.	
May 1.		May 1.	
To Cash paid, Salary to J. F. Whiteaves	$350 00	By Cash received Government grant	$750 00
" " " " W. Hunter (and vote $25)	225 00	" Member's yearly subscriptions	864 00
" " Interest	208 00	" Proceeds Conversazione	66 75
" " For "Naturalist" sent free	195 24	" " Museum entrance-fees	33 00
" " Furniture, cases, &c.	191 51	" For gas used by Literary Society	20 60
Printing	151 69	" Balance in Treasurer's hands	353 10
Furnace	133 14	" Received from, and due the Treasurer, May 1, 1864	15 43
Wood and coals	144 63		
Books and binding	131 57		
Sundry petty charges, repairs, &c.	121 65		
Gas accounts	61 08		
Water "	40 62		
Commission to Mr. McCormick	57 85		
City taxes	45 10		
Insurance	40 00		
P. O. acct	5 80		
	$2102 88		$2102 88

Examined and Vouchers compared and found correct.
Montreal, 1st May, 1864.

J. H. JOSEPH, W. H. A. DAVIES, } Auditors.

STATEMENT OF LIABILITIES OF THE NATURAL HISTORY SOCIETY, MAY 1ST, 1864.

Mortgage on Society's Building held by Scottish Provincial Insurance Co.	$2000 00	
" in favor of Wm. Watson, Esq.	400 00	$2400 00

List of Donations to the Museum.

N.B.—The dates refer to the meetings of the Society at which the specimens were presented.

Donors' Names.	Donations.
	July 1st, 1863.
G. Barnston, Esq.....	Stuffed specimen of the smaller, or "pulling-down" otter. (*Lutra destructor*, Barnston.)
	Eggs of thirteen species of birds from New Brunswick.
John Leeming, Esq.....	Egg-capsule of Pyrula. (*A marine univalve shell.*)
	12 species of marine shells from Jamaica.
J. F. Whiteaves, Esq....	9 species of foreign shells.
Jas. Thompson, Esq....	The mud or beaver fish. Amia ocellicauda, Richardson; (*Amia calva*, Linnæus?) from Sorel.
H. Taylor, Esq.....	Red snake.
Mrs. H. Bailey.....	Specimen of the granulated (?) salamander. (*Salamandra granulata?* Holbrook).
Jas. Ferrier, jun., Esq...	Abnormal growth of spruce from the White Mountains, with specimens of quartzite in which it was imbedded.
Mr. W. Hunter.....	Dendroica coronata? Gray, male. (*Yellow-crowned wood-warbler.*)
	Troglodytes hyemalis, Viellot, male. (*Winter-wren.*)
	Certhia Americana, Bonaparte. (*American creeper.*)
	Chrysomitris pinus, Bonaparte. (*Pine-finch.*)
	Cyanospiza cyanea, Baird. (*Indigo-bird.*)
Prof. P. J. Darey.....	Tree-Frog. (*Hyla versicolor*, Leconte.)
	September 28th, 1863.
Jas. Ferrier, jun., Esq...	3 cases of miscellaneous insects.
	1 chameleon. (*Chamæleo vulgaris?*)
	Large block of crystals of calc-spar.
W. Saunders, Esq., London, C. W.....	Collection of Canadian insects (*in five cases*), which took the first prize at the Provincial Exhibition of 1863, and of which the following is an estimate :
	Lepidoptera, (*Butterflies and Moths,*) 78 species.
	Coleoptera, (*Beetles,*) 294 "
	Hymenoptera, (*Bees, wasps, &c.,*) 15 "
	Diptera, (*Flies,*) 3 "
	Neuroptera, (*Dragon-flies, &c.,*) 6 "
	Hemiptera, 4 "
	Orthoptera, (*Crickets, locusts, &c.,*) 5 "
	(In all nearly 400 species of Canadian in-

Donors' Names.	Donations.
	September 28th, 1863. (*Continued.*)
	sects, beautifully prepared and carefully named.)
Dr. Wolff, Quebec.....	5 species of corals.
Mr. J. F. Wolff, Quebec..	Egg of eider duck (*Somateria mollissima, Leach,*) from Hare Island.
Dr. Douglas, Quebec....	Sea-urchin. (*Palæasterina*—?)from the Eocene
Mr. Jos. Hartley, (Park Farm, near Brantford, C. W.)	limestone at the base of the great pyramid at Ghizeh. 5 species of Devonian fossils, from Canada West.
R. J. Fowler, Esq.....	4 Echinocyamus pusillus, (*A small echinoderm,*) and 4 Trochus Magus, (*A marine shell,*) both from Britain.
	1 specimen of the violet salamander. (*Salamandra subviolacea*, Barton.)
	Sponge. (Halichondra?) from Portland, Me.
John Leeming, Esq.....	Specimen of the violet salamander. (*Salamandra subviolacea,*) and do. of another species of Salamandra.
Jas. Sherar, Esq.....	Two species of fossils (*Turritella carinata?* and an *Ostræa*), from the Potomac.
Jno. Swanston, Esq.....	Dress worn byone of the Loucheau or "Squint-eyed" Indians, from the McKenzie River.
G. Barnston, Esq.....	The red throated diver. (*Colymbus Septentrionalis*, Linnæus.)
Principal Dawson.....	2 Species of marine shells. (*Myadora ovata*, Reeve, N. S. Wales; and *Donax anatinus*, Britain.)
J. F. Whiteaves, Esq....	4 eggs of the chipping-sparrow. (*Spizella socialis*, Bonaparte.)
	6 species of fresh-water shells from the Southern States.
W. L. Doutney, Esq....	Specimen of the chipmunk. (*Tamias striatus*, Linnæus.)
Captain Jno. McMurtchie	3 scorpions from the West Indies.
Mr. W. Hunter.....	The red bat. (*Vespertilio Noveboracensis*, Linn.)
	The swamp sparrow. (*Melospiza palustris*, Baird.)
	The Philadelphian flycatcher. (*Vireo Philadelphicus*, Cassin.)
David Moss, Esq	Facsimile of *London Times* of October 3rd, 1798, containing despatches announcing the victory of the Nile.
Mrs. Edwin Atwater....	A home-made wedding-apron, spun, woven, and embroidered by Mrs. Almy, about the year 1650.
——————.....	Capelin (*Mallotus villosus*), in a drift nodule from the Ottawa district.

Donors' Names.	Donations.
	October 26th, 1863.
Principal Dawson.....	The banded pipe-fish, (*Syngnathus fasciatus*, DeKay) from Nova Scotia, also an exotic species of Syngnathus.
	Two corallines from Florida. (*Leptogorgia virgata*, and *Ziphigorgia anceps*, both of Edwards and Haime.)
G. Barnston, Esq.....	Star fish, (*Ophiura Egertoni*,) from the Lias of Lyme Regis, England.
Mr. W. Hunter.....	8 specimens of native copper, from the Lake Superior district.
	1 example of iron pyrites, in conglomerate from Massachusetts.
	Meadow mouse. (*Arvicola riparia*, Ord.)
John Gilmour, Esq., Quebec.....	Head of the common or woodland caribou, (*Rangifer Caribou*, Audubon and Bachman.)
Jas. Ferrier, jun., Esq...	2 sea-gulls, in immature plumage, species undetermined.
	November 30th, 1863.
Jas. Ferrier, jun., Esq...	1 specimen of the hooded merganser. (*Lophodytes cucullatus*, Reich.)
Rev. O. Brunet, Laval University, Quebec...	2 species of exotic starfishes.
	8 " of foreign shells.
J. F. Whiteaves, Esq ...	2 species of foreign shells.
	21 fossils (named), from the Trenton limestone, near Quebec.
Mr. W. Hunter.....	Specimen of the chipmunk or striped ground-squirrel. (*Tamias striatus*, Linnæus.)
Principal Dawson.....	7 "cone in cone" concretions from the coal fields of Glace Bay, Cape Breton.
	December 28th, 1863.
C. Robb, Esq., C. E.....	Star-nosed mole. (*Condylura cristata*, Linnæus.)
A. Rimmer, Esq.....	The mole shrew. (*Blarina talpoides*, Gray.)
Captain Noble	Snowy owl. (*Nyctea nivea*, Gray.)
Jno. Brown, Esq., Hamilton, C. W.....	The double-crested cormorant. (*Graculus dilophus*, Gray.)
M. Cochrane, Esq.....	Specimen of the spotted Menobranchus, (*Menobranchus lateralis*, Say) in spirits.
W. Learmont, Esq.....	Cairngorm stone, cut and polished.
	Jan. 25th, 1864.
Rev. M. De Villeneuve..	8 species of Chinese marine shells.
Rev. M. Billion.....	1 example of Andonta implicata, Say. (*A rather scarce Lower Canadian fresh-water bivalve shell.*)

Donors' Names.	Donations.
	Jan. 25th, 1864. (*Continued.*)
Andrew Allan, Esq.....	Star-Fish, (*Astrophyton* —?) from the Gulf of St. Lawrence.
H. G. Vennor, Esq.....	Two specimens of the "drinker" moth, (*Gonoptera libatrix*,) from a cave at the Cote St. Michel, near Montreal.
	February 29th, 1864.
Prof. Miles, Lennoxville.	2 Specimens of gutta percha in its crude state, of qualities No. 1 and 2. Fibres from the bark of the Spanish aloe, (*Agave*,) as extracted by machinery. Another example of aloe fibre. Specimen of Cingalese aloe fibre, with piece of cord made from the same and reddened by vegetable juices. 2 examples of raw mohair, as it comes from the animal,—of two intermediate qualities. Another sample of mohair. Specimen of pure mohair "top," combed in preparation for manufacture. Example of yarn spun from pure mohair "top." 2 specimens of down of the silk cotton tree. (*Eriodendron anfractuosum.*) Prepared Sarracenia purpurea, (*The pitcher-plant*,) the Indian remedy for small-pox, as used by the Micmacs; from Nova Scotia. Samples of Mr. Harben's proposed substitute for cotton, the fibrous alva. Specimen of a Javan vegetable fibre proposed as a substitute for cotton, but as prepared for manufacture by Messrs. Marshall & Dalmer of London, (England,) found to answer better in admixture with silk.
Principal Dawson.....	10 specimens of fossil plants (named), from the coal measures of Nova Scotia.
Mr. W. Hunter.....	Small brown weasel. (*Putorius cigognanii*, Bonaparte. Hairy woodpecker, variety. (*Picus villosus*, Linnæus.) Bohemian chatterer. (*Ampelis garrulus*, Linnæus.)
	March 28th, 1864.
Jas. Ferrier, jun., Esq...	1 stuffed specimen of the goshawk, female, (*Astur atricapillus*, Bonaparte.)

Donors' Names.	Donations.
	April 25th, 1864.
Mr. W. Hunter.....	Fine example of the woodchuck or ground-hog, (*Arctomys monax*, Gmelin,) from Brockville, C. W.
	The downy woodpecker. (*Picus pubescens*, Linnæus.)
Mrs. H. Parkinson.....	A small collection of marine shells, bryozoa, annelida, and sea-weeds, from Little Metis Bay, Gaspé.
	May 30th, 1864.
A. Ramsay, Fsq.....	The snow-goose. (*Anser hyperboreus*, Pallas,) shot at Nun's Island.
Jas. Ferrier, jun., Esq...	The turnstone. (*Strepsilas interpres*, Illiger.) Curious Japanese mirror and case.
Mr. W. Hunter.....	The yellow-bellied woodpecker. (*Centurus flaviventris*, Swainson.)
	The golden-winged woodpecker. (*Colaptes auratus*, Swainson.)
	Two robins, male and female. (*Turdus migratorius*, Linnæus.)
	The blue yellow-backed warbler. (*Parula Americana*, Bonaparte.)
Mrs. McCulloch.....	138 skins of Canadian birds.
	5 " Foreign "
	20 mammals, (mostly however duplicate specimens).
E. E. Shelton, Esq.....	4 Indian pipes, from an excavation in Hospital street, Montreal.
Jas. Claxton, Esq.....	8 specimens of minerals, viz., quartz, and quartz with pyrites, calc-spar and sulphate of barytes;—from Devon and Cornwall, England.

J. F. Whiteaves, F. G. S., &c.,

Scientific Curator & Rec. Secretary N. H. S.

The Canadian Naturalist.

The *Canadian Naturalist* is sent to the following Institutions and Societies:

CANADA, ETC.

University College,.....Toronto.
Trinity College,.....Toronto.
Canadian Institute,.....Toronto.
Knox's College, ...Toronto.
Victoria College,.....Cobourg.
Queen's College,.....Kingston.
McGill College,.....Montreal.
Bishop's College,.....Lennoxville.
Laval University .....Quebec.
Literary and Historical Society, ...Quebec.
Natural History Society, ...St. John, N. B.

UNITED STATES.

Harvard College,.....Cambridge, Mass.
Amherst College, ...Amherst, Mass.
Yale College,.. ....New Haven, Conn.
Natural History Society,.....Boston, Mass.
State Library, ...Albany, New York.
Albany Institute,..... ...Albany, New York.
Essex Institute,.....Salem, Mass.
Lyceum of Natural History,.....New York.
Astor Library,.....New York.
Academy of Natural Sciences,.. .....Philadelphia.
Franklin Institute,.....Philadelphia.
Smithsonian Institute,.....Washington.
Academy of Science,.....St. Louis, Missouri.
University of Nashville,.....Tennessee.
Natural History Society.....Portland, Maine.

GREAT BRITAIN.

Geological Society,.....London.
Linnæan Society,.....London.
Royal Society,.....London.
Royal Geographical Society,.....London.
British Museum Library,.....London.
University College,.....London.

Society of Arts,.....London.
Geological Survey of Great Britain,....London.
Natural History Society, Dawson St....Dublin.
Royal Dublin Society,.....Dublin.
Literary and Philosophical Society,.....Manchester.
Natural History Society, ...Newcastle-upon-Tyne.
Bodleian Library,.....Oxford.
University Library,.....Cambridge.
University Library, ...Edinburgh, Scotland.
University Library,.....Glasgow, Scotland.
University Library, ...St. Andrew's, Scotland.
College Library,.....Maynooth, Ireland.
Queen's College,.....Cork, Ireland.
Queen's College, ...Belfast, Ireland.

CONTINENT OF EUROPE.

Société Géologique de France, ...Paris, France,
Académie des Sciences, ...Paris, France.
Académie des Sciences, ...Bologna, do.
Academia Car. Leop,.....Jena, Saxe Weimar.
Imper. Geological Institute,.....Vienna, Austria.
Deutsches Geolog. Gesellschafft,.....Berlin, Prussia.
Société Hollandaise des Sciences,.....Haarlem, Holland.
Konigl. Sachs. Gesellschaft der Wissenschaften,.....Leipzig, Saxony.
Société Impériale des Naturalistes,.....Moscow, Russia.
Konigl. Bayerischen Akademie der Wissenschaften,.....Munich, Bavaria.
Stockholm Biksbiblioleket,.....Stockholm, Sweden.
Upsala University,.....Upsala, Sweden.
Academy of Sciences,.....Stockholm, Sweden,
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Royal Library,.....Copenhagen, Denmark.
St. Petersburg, Bibliothèque Impériale,St. Petersburg, Russia.
Dorpat University,.....Dorpat, Russia.
Kasan University,.....Kasan, Russia.
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Amsterdam Stadsch Bibliotheck,.....Amsterdam, Holland.
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Gröningen University,.....Gröningen, Holland.

Bonn University,.....Bonn, Prussia.
Breslau University,.....Breslau, Prussia.
Freiberg Royal Acad.,.....Freiberg, Saxony.

And to the following Periodicals:—

CANADA.

Canada Medical Journal,.....Montreal.
Journal of the Board of Arts,.....Toronto.

UNITED STATES.

Silliman's Journal,.....New Haven.

GREAT BRITAIN.

Zoologist, ...1 Paternoster Row.
Intellectual Observer, ...5 Paternoster Row.
Technologist, ...23 Paternoster Row.
Geological Magazine,.....39 Paternoster Row.
Popular Science Review,.....192 Piccadilly.
Seeman's Journal of Botany, ...192 Piccadilly.
Journal of Science, ...11 New Burlington St.
Natural History Review,.....14 Henrietta Street, Covent Garden.
Phytologist.....28 Upper Manor St.

CONTINENT OF EUROPE.

Annales des Sciences Naturelles,.....Paris, France.
Allgemeine Deutsches Naturh. Zeitung,Dresden, Saxony.
Archiv. fur Naturgeschichte by Weigman,.....Berlin, Prussia.
Leopoldoia,.....Jena, Saxe Weimar.
Leonhard und Brohn Jahrbuch,.....Stutgardt, Wurtemburg.

Published, Montreal, September 15, 1864.

ABSTRACT OF METEOROLOGICAL OBSERVATIONS,

Taken at the Montreal Observatory, Latitude 45° 31′ N. Longitude, 4h. 54m. 11s. W. of Greenwich. Height above level of the Sea 182 feet. For the month of March, 1864.

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

Day of Month.	Reading of the Barometer, corrected, and reduced to 32° F.			Reading of Thermometer.			Mean Tension of Vapor.	Mean Humidity of the Atmosphere.	General direction of Wind.	Horizontal movement in 24 hours in miles.	Mean extent of Clouds in 10ths.	Depth of Rain in inches.	Depth of Snow in inches.	Ozone in 10ths.	Weather, &c.	Remarks for the Month.
	Highest.	Lowest.	Mean.	Max.	Min.	Mean										
	Inches.	Inches.	Inches.													
1	29.943	29 770	29.868	32.0	16 0	25.9	.135	.834	W	87.61	8 0	....	....	1.6		
2	.900	.619	.777	34 1	18 9	28.4	.131	.887	wbyN	115.18	6.3	....	Inapp	3.0	Snow.	Barometer.... Highest, the 22nd day, 30.295 inches. Lowest, the 12th day, 29.197 "
3	30.042	.920	30 001	34 0	8.9	24 5	.138	.867	wbyN	149 88	0.0	....	....	1 3		Monthly Mean, 29.824 "
4	29.551	.483	29 510	56 7	21 1	40.2	.251	.826	S W	65.63	0 6	....	....	1 3		Monthly Range, 1.098 "
5	.508	.451	.480	40.1	34 6	37.4	.212	.878	N E	280.25	8 6	Inapp	....	3 6	Rain.	Thermometer Highest, the 29th day, 54°7.
6	.700	541	.496	40.2	31 9	36.5	.206	.869	S W	103.00	10 0	0 170	....	3 3	Rain.	Lowest, the 21st day, 2°1.
7	.501	.411	.501	34 9	32.0	33.0	.188	.890	S W	290 82	10.0	...	2 34	5 0	Snow.	Monthly Mean, 32°07.
8	.721	.523	.632	37.3	25.1	31 3	.173	.887	S W	104 59	6 3	...	6 10	4 0	Snow.	Monthly Range, 52°6.
9	.935	.773	.885	40 0	18 2	29.3	.155	.819	W	146 61	0.6	...	....	1.6	Aurora Bor.	Greatest intensity of the Sun's rays, 74°7.
10	.862	.722	.792	42.4	22.4	30.7	.171	.863	W	95.56	3 6	....	....	1 6		Lowest point of Terrestrial radiation, —7°0.
11	.482	.268	368	48.3	31 1	39.9	.246	.939	N E	98 63	8.6	Inapp.	Inapp.	3.3	Rain.	Mean of Humidity, .880.
12	.601	.179	.428	42.2	31.9	38.7	.226	.886	W	152.25	8.6	0.849	0.849	3.6	Rain.	Rain fell on 8 days, amounting to 1.235 inches.
13	.726	.700	.717	48.2	31 4	36 6	.209	.860	W	204.40	3 3	....	.. .	3.3		Snow fell on 7 days, amounting to 8.93 inches.
14	.804	.709	.736	41.2	15.0	28 7	.160	.829	W	208 00	1.0	...	..	2.0		Most prevalent wind, N. E.
15	.784	.761	.776	37.2	16 2	24.8	.105	.861	wbyN	177 01	8.6	....	....	1 3		Least prevalent wind, S. W.
16	.614	.610	.612	34 9	16.1	26.4	.146	.872	W	46.49	3.6	....	....	2.0		Most windy day the 24th day, mean miles per hour, 22.14.
17	.678	.650	.666	35 0	14 1	27.1	.149	.868	N E	120 34	7.6	Inapp.	.	2 0	Rain. L. Halo	
18	.425	.352	.381	42 3	27 9	34 8	.197	.891	S W	77.01	8 6	...	....	2 3		Least windy day the 16th day, mean miles per hour, 1 68.
19	.709	.530	.695	29.1	11.2	21.7	.122	.882	W	379 14	1 3	.025	....	2.3	Rain.	
20	.792	.579	.674	28.4	12.4	19.4	.116	.881	N E	162.00	6.6	...	Inapp	2.6	Snow.	Aurora Borealis visible 2 nights.
21	30 046	.837	.969	30.8	2.1	15.9	.102	.869	W	89.02	3.3	....	. .	1 3		Zodiacal light, bright.
22	.295	30 129	30.189	84 4	5 9	19.1	.116	.890	N E	163 50	3.3	....	Inapp	2.6	Snow.	Lunar Halo, 17th day.
23	.021	29.840	29.950	35.2	3 5	22.3	.127	.840	S W	133.80	4.0	....	....	1.3		
24	29.802	.697	.756	52.3	18.4	36.8	.222	.865	W	731.40	0.6	....	....	2.3		
25	.900	.741	.820	49 9	20 4	35.7	.216	.890	N E	105.40	0.0	....	....	2.6		
26	.900	.769	.845	42.3	28.1	36.5	.212	.909	N E	152.19	3 3	Inapp	....	2.6		
27	30.046	.961	.995	47.0	36 4	43.0	.267	.913	N E	124 00	10.0	....	...	3.3		
28	.117	30.052	30.089	53 1	24 2	37.8	.233	.893	N E	167.41	0.0	....	....	2.0	Aurora Bor.	
29	29.973	29.856	29.911	54.7	21.4	38.3	.233	.866	N E	244.20	6.4	...	....	2.6		
30	.691	.669	.669	37.4	29.9	35.2	.198	.893	N E	294.56	10.0	0.191	....	2.6	Rain.	
31	.696	.549	.620	46.4	31.5	39.1	.234	.909	N E	235.55	8.6	....	....	3.0		

ABSTRACT OF METEOROLOGICAL OBSERVATIONS,

Taken at the Montreal Observatory, Latitude 45° 31′ N. Longitude, 4h. 54m. 11s. W. of Greenwich. Height above the level of the Sea 182 feet. For the month of April, 1864.

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

Day of Month.	Reading of the Barometer, corrected, and reduced to 32° F.			Reading of Thermometer.			Mean Tension of Vapor.	Mean Humidity of the Atmosphere.	General direction of Wind.	Horizontal movement in 24 hours in miles.	Mean extent of Clouds in 10ths.	Depth of Rain in inches.	Depth of Snow in inches.	Ozone in 10ths.	Weather, &c.	Remarks for the Month.
	Highest	Lowest.	Mean.	Max.	Min.	Mean										
	Inches.	Inches.	Inches.													
1	29.710	29.650	29.687	56.8	29.0	41.0	.263	.913	N E	265 85	7.6	Inapp	. . .	3.0	Rain.	
2	.720	.673	.703	49.7	31.7	40.5	.245	.915	N E	219 44	8.0	0.114	....	4.0	Rain.	
3	.942	.882	.908	51.1	34.3	41.0	.244	.804	N E	114 10	3.3	....	....	2.6	Aurora Bor.	
4	.949	.936	.941	61.2	27.1	44.0	.284	.862	N E	115 10	1.8	....	....	1.3	Aurora Bor.	
5	.969	.902	.940	51.4	25.0	40.4	.246	.884	N	189 81	0.0	....	....	1.6	Aurora Bor.	
6	30.047	.998	30.028	51.1	32.0	48.9	.340	.876	W bys	85 19	1.3	....	....	2.3		
7	.064	30.021	.045	59.6	35.1	52.6	.379	.881	N	66 41	0.0	....	....	2.0		
8	.035	.010	.019	59.8	34.1	43.6	.271	.873	N	127 39	3.3	....	....	1.3		
9	.120	.000	.047	58.8	28.9	43.2	.271	.874	N	265 41	1.3	....	....	1.0		
10	29.932	29.869	29.899	40.1	37.4	39.6	.228	.912	N E	194 40	10.0	Inapp	Inapp	3.3	Rain—Snow.	
11	.899	.749	.827	40.6	39.9	37.6	.216	.907	N E	297 18	10.0	0.213	1.90	4 0	Rain—Snow.	
12	.920	.825	.877	40.1	32.4	36.8	.212	.922	N E	123 73	10.0	0.051	0.20	2.6	Rain—Snow.	
13	.825	.804	.816	47.4	34.2	39.4	.220	.899	N E	136.00	10.0	....	....	2.6		
14	.761	.770	.767	46.1	31.1	40.2	.238	.888	N E	122 24	10.0	....	....	2.3		
15	.620	.601	.628	59.0	34.1	45.3	.306	.915	W	320 04	8.6	....	....	1.6		
16	.474	.450	.458	50.1	34.4	43.1	.268	.904	W	154.05	6.6	....	....	3.0	Snow.	
17	.599	.421	.494	46.3	34.2	40.4	.242	.898	W	110 20	8.0	....	Inapp	3.0	Snow.	
18	.851	.625	.739	45.7	26.6	37.7	.215	.888	W	133.01	10.0	Inapp	Inapp	3.3	Rain—Snow.	
19	.994	.875	.896	64.6	29.4	46.2	.305	.867	N E	199.86	4.0	....	Inapp	3.0		
20	.883	.800	.851	52.4	29.2	43.4	.281	.898	NE by E	60.95	6.6	....	....	2.3	Solar Halo—	
21	.913	.820	.861	68.2	34.7	51.8	.310	.866	N E	124.07	0.0	....	....	1.2	Lunar Halo	
22	30.011	.932	.975	75.0	32.0	52.0	.369	.815	W bys	51.42	0.0	....	....	1.0		
23	29.851	.780	.814	44.3	39.6	41.6	.257	.920	S W	244.84	10.0	0.110	....	3.0	Rain.	
24	30.041	30.024	30.032	66.0	38.4	51.3	.361	.854	W	309.72	0.0	....	....	1.3	Bril. Au. Bor.	
25	29.900	29.854	29.875	58.8	32.4	49.7	.315	.833	N N E	219.22	3.6	0.132	....	1.3	Rain.	
26	.769	.539	.616	55.0	46.0	50.4	.345	.865	N E	125.14	6.6	0.830	....	3.0	Rain Thund'r	
27	.614	.545	.585	53.3	46 9	50.1	.319	.869	N E	115.68	10.0	0.462	....	3.3	Rain.	
28	30.035	.769	.911	42.2	33.1	38.8	.231	.909	W	151.54	10.0	0.148	...	2.6	Rain.	
29	.040	.932	30.022	60.3	38.4	47.7	.311	.869	W by N	114.24	3.6	Inapp	....	2.0	Rain.	
30	29.996	.800	29.868	66.4	34.4	53.4	.361	.834	N by W	151.92	3.3	....	.....	2.3		

Barometer.... { Highest, the 9th day, 30.120 inches. Lowest, the 17th day, 29.421 " Monthly Mean, 29.765 " Monthly Range, 0.699 "

Thermometer { Highest, the 22nd day, 75°0. Lowest, the 5th day, -25°0. Monthly Mean, 44°37. Monthly Range, 50°0.

Greatest intensity of the Sun's rays, 79°0.
Lowest point of Terrestrial radiation, -20°4.
Mean Humidity .883.
Rain fell on 12 days, amounting to 2.060 inches.
Snow fell on 6 days, amounting to 2.10 inches.
Most prevalent wind, N. E.
Least prevalent wind, S. W.
Most windy day the 15th day, mean miles per hour, 13.33.
Least windy day the 22nd day, mean miles per hour, 2.14.
Aurora Borealis visible on 4 nights.
Solar Halo on the 19th day.
Lunar Halo on the 19th day.
Thunder on the 26th day.

ABSTRACT OF METEOROLOGICAL OBSERVATIONS,

Taken at the Montreal Observatory, Latitude 45° 31′ N. Longitude, 4h. 54m. 11s. W. of Greenwich. Height above level of the Sea 182 feet. For the month of May, 1864.

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

Day of Month.	Reading of the Barometer, corrected, and reduced to 32° F.			Reading of Thermometer.			Mean Tension of Vapor.	Mean Humidity of the Atmosphere.	General direction of Wind.	Horizontal movement in 24 hours in miles.	Mean extent of Clouds in 10ths.	Depth of Rain in inches.	Depth of Snow in inches.	Ozone in 14ths.	Weather, &c.	Remarks for the Month.
	Highest	Lowest.	Mean.	Max.	Min.	Mean										
	Inches.	Inches.	Inches.													
1	29.642	29.574	29.613	51.0	43.0	48.8	.326	.910	N	118.00	6.6	0.063	....	2.3	Rain.	
2	.671	.606	.640	67.8	44.1	55.4	.414	.903	S W	100.40	3.3	. . .	....	1.6		Barometer .. Highest, the 14th day, 29.971 inches.
3	.568	.530	.549	67.4	40.2	44.6	.279	.891	N E	176.96	10.0	0.472	....	2.6	Rain.	Lowest, the 27th day, 29.354 "
4	.810	.587	.692	54 3	34.3	49.8	.279	.844	Nbyw	285.26	6 6	0.686	....	3 3	Rain.	Monthly Mean, 29.703 "
5	.872	.800	.848	70.1	44.7	53.8	.432	.853	W	109 28	6.3	Inapp	....	2.3	Rain.	Monthly Range, 0.627 "
6	.842	.621	.721	56.9	40.4	48.5	.310	.851	N E	186.05	10.0	0 221	....	3.0	Rain.	Thermometer Highest, the 15th day 85° 4.
7	.836	.799	.811	59.9	37.0	50.7	.340	.880	N E	220.56	9.6	0.220	....	3.2	Rain.	Lowest, the 4th day, 34° 3.
8	.697	.612	.666	54.3	45.6	48.9	.314	.882	N E	70.41	10.0	0.163	....	2.0	Rain.	Monthly Mean, 61.79.
9	.579	.469	.522	72.2	48.1	61.5	.484	.873	N N E	81 39	6.6	....	....	3.3		Monthly Range, 51° 1.
10	.600	.403	.505	71.4	47.2	59 6	.482	.900	s byw	72 96	10.0	0.030	....	2.0	Rain.	Greatest intensity of the Sun's rays, 113° 0.
11	.784	.764	.773	63.7	35.0	46.6	.281	.927	N E	250 54	8·0	0.104	. . .	3 0		Lowest point of Terrestrial radiation, 34° 7.
12	.750	.598	.687	50 2	42 0	47.2	.311	.912	N E	143.65	10.0	0.202	....	3 0	Rain Hail.	Mean of Humidity, .879.
13	.805	.721	.768	71.2	46.0	60 9	.516	.926	N E	143.61	8.6	0.792	....	2.0	Rain.	Rain fell on 24 days, amounting to 4.823 inches, it was accompanied by Thunder on 1 day and Hail on 1 day.
14	.971	.817	.970	80.2	59.2	69.4	.660	.904	S W	63.62	6.0	0.014	....	2 2	Rain.	
15	.930	.919	.926	85.4	60.9	72.1	.706	.890	N E	134 00	4.0	Inapp	....	1.3	Rain.	Most prevalent wind, N. E.
16	.867	.802	.847	84 7	58.1	71.3	.675	.861	N E	147.10	3 3	....	....	1 3		Least prevalent wind, S. by W.
17	.645	.637	.641	84.7	61.1	70 0	.628	.838	N E	94.71	1.3	....	....	1.0		Most windy day the 4th day. mean miles per hour, 11.88.
18	.726	.717	.720	79.2	51.0	66.8	.691	.852	N E	198.61	4.0	....	. .	1.0		
19	.805	.797	.800	74.7	48 2	64 4	.495	.838	S W	142.04	8 3	Inapp	....	1.0	Rain.	Least windy day, the 21st day, mean miles per hour, 1 77.
20	.638	.619	.627	64.2	50.4	61.0	.452	.843	N E	131.80	10.0	Inapp	....	1.3	Rain.	
21	.383	.378	.380	70.1	45 7	62.3	.496	.867	N E	62.59	8.3	0.291	...	1.6	Rain.	Aurora Borealis visible on 2 nights.
22	.737	.622	.679	72.2	50 0	61 0	.405	.757	N E	106.40	2 0	Inapp	....	1.3	Rain,	Lunar Halo visible on 1 night.
23	.668	.647	.659	62.0	43.0	56.8	.366	.787	W	180.40	6 0	0 442	....	1 3	Rain.	Amount of Evaporation 1.81 inches.
24	.598	.594	.596	51.0	43.1	48 8	.338	.931	N E	159.36	10.0	0 242	....	2.6	Rain.	
25	.700	.689	.646	58.2	43.4	55.8	.419	.929	N E	220.78	6.0	0.240	....	2.3	Rain.	
26	.597	.502	.546	78.6	49.0	60.4	.659	.894	N E	117 41	10.0	....	....	3.6		
27	.500	.354	.418	80.1	53.0	69.8	.684	.871	N W	104.19	6 6	0.420	....	3.3	Rain.	
28	.700	.627	.673	69 5	50.9	59.2	460	.884	Nbyw	189.28	2.0	Inapp	....	1.3	Rain.	
29	.832	.659	.747	74.0	49.6	60.5	.482	.876	N E	108 09	4 6	....	....	1.0		
30	.662	.572	.625	65.2	43.4	60.1	.489	.930	N E	120.00	6.6	0.170	....	2.0	Rain.	
31	.571	449	.512	72.8	50.1	68.9	.641	.871	W	72 70	10.0	0.051	....	2.0	Rain.	

ABSTRACT OF METEOROLOGICAL OBSERVATIONS,

Taken at the Montreal Observatory, Latitude 45° 31′ N. Longitude, 4h. 54m. 11s. W. of Greenwich. Height above the level of the Sea 182 feet. For the month of June, 1864.

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

Day of Month.	Reading of the Barometer, corrected, and reduced to 32° F.			Reading of Thermometer.			Mean Tension of Vapor.	Mean Humidity of the Atmosphere.	General direction of Wind.	Horizontal movement in 24 hours in miles.	Mean extent of Clouds in 10ths.	Depth of Rain in inches.	Depth of Snow in inches.	Ozone in 10ths.	Weather, &c.
	Highest	Lowest.	Mean.	Max.	Min.	Mean									
	Inches.	Inches.	Inches.												
1	9.714	29.661	29.688	74.2	53.0	66.4	.539	.842	S W	189.20	7.6	Inapp	....	1.3	Rain.
2	.724	.714	.719	83.0	49.0	64.5	.487	.792	N E	91.02	1.3	....	....	1.6	
3	.691	.574	.581	66.4	44.7	57.5	.338	.799	W	148.89	3.3	0.030	....	1.3	Rain.
4	.701	.669	.681	85.1	46.0	69.3	.618	.831	W	75.52	0.0	....	....	1.0	
5	.800	.601	.721	83.8	64.2	73.0	.614	.792	W	209.67	3.3	....	....	1.3	
6	.674	.354	.467	83.4	55.0	74.7	.625	.735	W	200.04	4.6	....	....	1.0	
7	.892	.850	.866	86.0	43.0	63 4	.463	.771	W	201.57	0.0	....	....	1.0	
8	.754	.420	.552	65.2	43.0	62.1	.424	.760	W	92.36	10.0	....	....	1.3	
9	.214	.106	.168	60.1	46.0	55.1	.384	.813	W	204.47	10.0	0.472	....	1.3	Rain.
10	.500	.350	.405	69.0	55.2	56.7	.321	.660	W	351.39	4.0	....	....	1.0	
11	.800	.651	.716	72.1	55.4	60.6	.331	.670	W	119.16	5.6	....	....	1.0	
12	.880	.814	.855	73.4	48.0	61.1	.394	.729	N E	234.30	2.6	....	....	1.0	
13	.892	.874	.886	89.4	44.2	73.1	.583	.706	W	103.05	0.0	Inapp	....	1.0	Rain.
14	.792	.741	.759	91.0	52.7	73.1	.583	.706	W	133.50	0.0	....	....	0.6	
15	.706	.692	.698	91.4	55.9	76.4	.682	.743	W	14.51	2.0	....	....	0.0	
16	.614	.602	.606	92.0	59.0	79.3	.702	.697	N E	244.73	0.0	....	....	0.0	
17	.800	.714	.758	94.7	60.0	78.8	.659	.660	N E	246.13	0.0	....	....	0.1	
18	.830	.814	.819	96.7	60.5	83.5	.770	.678	S W	91.55	0.0	....	....	0.1	
19	.819	.816	.813	96.2	66.4	83.9	.772	.666	S W	192.20	0.0	....	....	0.0	
20	.852	.850	.851	89.2	63.4	77.7	.687	.773	S W	235.09	0.0	....	....	0.6	
21	30.045	30.011	30.029	89.8	59 2	77.1	.706	.784	N E	207.09	0.0	....	....	0.6	
22	29.927	29.794	29.878	92.4	69.3	80.5	.769	.709	S W	173.41	0.0	....	...	0.3	
23	.784	.633	.716	76.9	66.0	73.7	.652	.797	N E	235.70	3.3	....	....	0.5	
24	.759	.654	.723	77.0	69.0	73.4	.636	.784	S W	217.83	6.0	....	.....	0.3	
25	.609	.600	.605	90.2	68.2	79.9	.757	.749	W S W	156.07	0.0	....	....	0.1	
26	.477	.344	.423	92.3	71.1	73.9	.739	.754	W S W	114.92	2.6	0.374	....	0.1	Rain.
27	.821	.605	.680	80.0	59.0	67.0	.561	.822	N E	218.90	3.3	Inapp	....	1.0	Rain.
28	.947	.937	.940	80.4	52.2	67.1	.535	.770	W N W	214.61	10.0	....	....	0.6	
29	.934	.926	.929	91.0	64.0	74.0	.673	.779	W	427.80	0.0	....	.. ..	0.0	
30	.718	.617	.674	82.	64.2	73.8	.656	.794	W	234.20	1.3	....	....	0 6	

Remarks for the Month.

Barometer ... { Highest, the 21st day, 30.045 inches.
Lowest, the 9th day, 29.106 "
Monthly Mean, 29.703. "
Monthly Range, 0.939. "

Thermometer { Highest, the 18th day, 96° 7.
Lowest, the 10th day, 35° 2.
Monthly Mean, 70.01.
Monthly Range, 61°5.

Greatest intensity of the Sun's rays, 118° 4.
Lowest point of Terrestrial radiation, 33° 4.
Mean of Humidity, .703.
Rain fell on 6 days amounting to 0.876 inches.
Most prevalent wind, W.
Least prevalent wind, S. W.
Most windy day, the 29th day, mean miles per hour, 17.82.
Least windy day, the 15th day, mean miles per hour, 0.60.
Amount of Evaporation, 247 inches. 2.47.
Aurora Borealis visible on 2 nights.

ABSTRACT OF METEOROLOGICAL OBSERVATIONS,

Taken at the Montreal Observatory, Latitude 45° 31′ N. Longitude, 4h. 54m. 11s. W. of Greenwich. Height above level of the Sea 182 feet. For the month of July, 1864.

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

Day of Month.	Reading of the Barometer, corrected, and reduced to 32° F.			Reading of Thermometer.			Mean Tension of Vapor.	Mean Humidity of the Atmosphere.	General direction of Wind.	Horizontal movement in 24hours in miles.	Mean extent of Clouds in 10ths.	Depth of Rain in inches.	Depth of Snow in inches.	Ozone in 10ths.	Weather, &c.
	Highest	Lowest.	Mean.	Max.	Min.	Mean									
	Inches.	Inches.	Inches												
1	29.774	29.761	29.766	82.1	63.1	72.1	.632	.804	W	46.70	5.9	....	....	0.6	
2	.624	.502	.562	68.2	64.2	66.9	.591	.897	N E	120.28	6.0	0.047	....	0.1	Rain.
3	.579	.571	.574	77.4	61.4	71.7	.648	.849	S W	46.60	6.0	....	....	1.0	
4	.724	.578	.674	76.7	56.2	68.6	.868	.809	W bys	102.09	2.6	....	....	0.6	
5	.802	.677	.757	80.1	57.2	71.2	.614	.791	W	81.37	1.3	....	....	0.1	
6	.760	.698	.724	87.9	59.1	70.2	.580	.789	W	176.39	3.3	....	....	1.0	
7	.747	.679	.715	84.2	59.2	76.3	.668	.758	W	21.91	0.6	0.052	....	0.5	Rain.
8	.821	.741	.778	89.4	58.0	71.3	.664	.763	N E	180.30	0.6	....	....	0.0	
9	.887	.800	.843	90.4	59.0	78.9	.763	.749	W	126.33	1.3	....	....	0.1	
10	.750	.572	.674	92.1	64.2	79.7	.764	.756	S W	100.76	6.6	Inapp	....	0.6	Rain.
11	.564	.541	.535	89.7	66.0	77.4	.733	.802	W S W	93.06	6.6	0.864	....	1.3	Rain.
12	.722	.655	.682	75.2	65.2	70.7	.610	.819	W S W	363.97	8.0	0.211	....	0 6	Rain.
13	.808	.840	.865	93.4	61.2	78.7	.705	.696	W	48.64	0.0	....	....	0.1	
14	.998	.950	.973	94.1	64.2	83.5	.782	.679	W S W	30.06	2.6	....	....	0.5	
15	.958	.912	.949	96.4	68 2	84.7	.786	.649	S W	53.82	1.3	....	....	0.0	
16	.874	.800	.847	86.8	64.9	78.8	.715	.748	S E by E	39.08	0.0	....	....	0.0	
17	.994	.872	.925	95.9	63.4	82.0	.761	.698	N E	120.20	0 0	....	....	0.0	
18	30.062	.954	30.004	91.0	63.6	81.6	.750	.684	W	217.74	0.0	....	....	0 0	
19	29.976	.879	29.917	96.3	64.1	85.1	.784	.647	S E	45.89	0.0	....	....	0.0	
20	.680	.533	.597	88.2	70.1	80.5	.728	.713	S W	173.81	0.0	....	....	0.0	
21	.818	.796	.808	75.2	55.4	67.3	.503	.752	N by W	180.05	6.6	0.037	....	0.8	Rain
22	.799	.766	.785	64.3	49·7	60.8	.441	.767	W by N	196.67	7.6	....	....	0.6	
23	.751	.711	.730	80.0	49.7	71.1	.881	.749	S W	215.87	0.0	.....	....	0.1	
24	.782	.764	.772	84.6	64 1	76.5	.681	.762	W S W	111.00	0.0	....	....	0.0	
25	.852	.739	.812	79.3	53.2	70.0	.506	.770	N E	241.28	0.0	....	....	0.1	
26	.674	.547	.613	79.8	63.0	71.2	.581	.768	N by W	74.30	10.0	0.084	....	1.0	
27	.802	.676	.754	87.7	59.9	76.7	.696	.736	S W	172.54	3.3	....	....	0.3	
28	.808	.600	.719	82.1	58.2	77.8	.636	.727	S W	73.30	10.0	....	....	0.3	
29	.617	.572	.594	78.4	58.0	69.8	.535	.749	N W	120.18	3.3	....	....	1.6	
30	.555	.547	.551	91.4	58.4	79.6	.767	.770	S W	65.98	0.5	....	....	0.3	
31	.690	.577	.646	94.3	62.1	82.5	.790	.708	S W	14.71	0 0	....		0.0	

Remarks for the Month.

Barometer.. Highest, the 18th day, 30.062 inches.
Lowest, the 2nd day, 29.502 "
Monthly Mean, 29.782 "
Monthly Range, 0.560 "

Thermometer Highest, the 19th day 96·3.
Lowest, the 22nd day, 49·4.
Monthly Mean, 75.19.
Monthly Range, 46·9.

Greatest intensity of the Sun's rays, 112 9.
Lowest point of Terrestrial radiation, 47·4.
Mean of Humidity, .766.
Rain fell on 6 days, amounting to 1.295 inches, it was accompanied by Thunder on 2 days.
Most prevalent wind, S. W.
Least prevalent wind, S. E.
Most windy day the 12th day, mean miles per hour, 15.17.
Least windy day, the 31st day, mean miles per hour, 0.61.
Amount of Evaporation 3.46 inches.

ABSTRACT OF METEOROLOGICAL OBSERVATIONS,

Taken at the Montreal Observatory, Latitude 45° 31′ N. Longitude, 4h. 54m. 11s. W. of Greenwich. Height above the level of the Sea 182 feet. For the month of August, 1864.

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

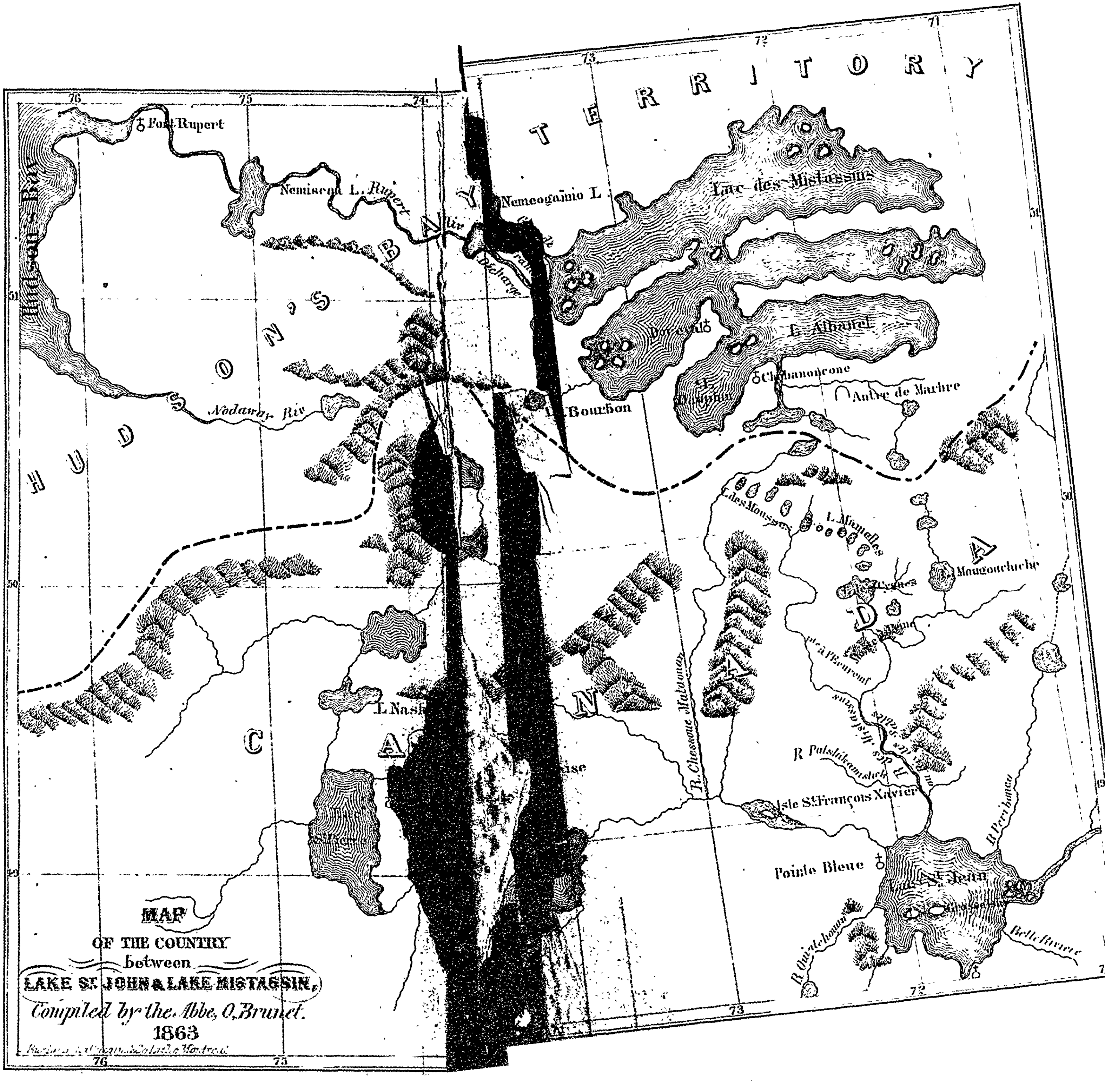
Day of Month.	Reading of the Barometer, corrected, and reduced to 32° F.			Reading of Thermometer.			Mean Tension of Vapor.	Mean Humidity of the Atmosphere.	General direction of Wind.	Horizontal movement in 24 hours in miles.	Mean extent of Clouds in 10ths.	Depth of Rain in inches.	Depth of Snow in inches.	Ozone in 10ths.	Weather, &c.
	Highest.	Lowest.	Mean.	Max.	Min.	Mean									
	Inches.	Inches.	Inches.												
1	29.583	29.539	29.564	96.2	74.4	85.0	.863	.667	S by E	120.71	4.6	Inapp	....	0.3	Rain.
2	.582	.568	.573	86.0	68.2	76.4	.728	.807	N by W	73.59	4.6	....	....	1.0	
3	.660	.591	.625	72.8	58.2	67.9	.489	.729	N E	211.41	8.0	Inapp	....	1.1	Rain.
4	.589	.564	.574	63.2	59.0	64.8	.502	.823	N E	173.70	6.6	0.013	....	1.0	Rain.
5	.765	.653	.697	86.7	58.4	76.6	.747	.822	S W	50.28	6 6	....	....	1.0	
6	.846	.702	.799	89.8	62.2	76.2	.695	.765	S W	86.91	8.0	....	....	0.3	
7	.712	.700	.705	90.2	61.1	77.1	.734	.785	S W	56.20	4.6	....	....	1.0	
8	.834	.714	.786	79.1	62.0	71 2	.558	.800	W	95.20	5.3	....	....	1.0	
9	.546	.506	.537	89.2	62.4	81 5	.844	.801	N N W	65.54	3.3	....	....	2.0	
10	.501	.474	.483	84.6	69 0	79.1	.776	.800	S E	239.89	0 0	....	....	1.0	
11	.611	.599	.640	95.1	67 0	80.8	.775	.802	N by W	111.52	0.0	....	....	0.3	
12	.704	.672	.692	85.1	58 9	72 9	.640	.742	N by W	48.74	5 3	....	....	1.0	
13	.588	.529	.534	94 2	64.7	78.2	.765	.716	S W	167.93	6.0	....	....	1.3	
14	.741	.660	.650	87.2	63 2	77.4	.761	.867	W	124.40	1.3	....	....	1.3	
15	.812	.761	.749	94.2	61 0	77.6	.694	.716	W	187.21	0.3	....	....	0.3	
16	.891	.871	.878	87.2	66.4	78.7	.726	.739	W	10.13	6.0	....	....	1.0	
17	.719	.715	.717	74.1	68.1	70 9	.596	.862	N E	77.16	10.0	Inapp	....	0.3	Rain.
18	.874	.798	.825	81.6	56.0	69.1	.546	.781	N E	162.96	0.0	....	....	0.3	
19	30.014	.928	.979	82.3	55.4	70.9	.525	.702	N W	130.08	8.0	....	....	0.3	
20	29.990	.984	.973	78.9	58.4	69.7	.558	.785	W	58.38	10.0	....	....	1.0	
21	.987	.770	.899	76.0	65.0	73.0	.624	.792	N E	27.00	8.0	....	....	0.3	
22	.734	.542	.636	82.4	60.0	74.8	.646	.760	S W	96.07	3.3	Inapp	....	0.5	Rain.
23	.647	.548	.609	74.1	66.0	70.3	.603	.816	W	120.47	8.0	0.952	....	1.3	Rain.
24	.737	.714	.750	84.4	63.0	74.7	.671	.791	W	170.61	6.3	....	.....	1.3	
25	.519	.423	.488	88.2	65.2	79.0	.753	.816	W	94.02	7.6	....	....	1.0	
26	.571	.424	.514	83.2	62.6	72.1	.675	.889	W	36.56	6.6	0.815	....	1.3	Rain.
27	.311	.254	.281	75.9	61.1	68.7	.628	.799	S E	18.40	5.6	0.216	....	1.3	Rain.
28	.524	.424	.486	75.0	60.0	66.9	.546	.826	W	122.00	1.6	....	....	1.0	
29	.847	.424	.494	74.0	58.1	65.7	.539	.871	W by N	223.42	6.6	Inapp	....	1.3	Showers.
30	.796	.616	.677	69.4	55.0	59.1	.429	.874	W by W	128.91	6.0	Inapp	....	1.0	Rain.
31	.829	.811	.819	74.9	53.2	65.0	.510	.811	N W	78.80	0.0	....	....	0 0	

Remarks for the Month.

Barometer ... { Highest, the 19th day, 30.014 inches.
Lowest, the 27th day, 29.281 "
Monthly Mean, 29.694. "
Monthly Range, 0.833. "

Thermometer { Highest, the 1st day, 96° 2.
Lowest, the 30th day, 55° 0.
Monthly Mean, 71.17.
Monthly Range, 41° 2.

Greatest intensity of the Sun's rays, 114° 0.
Lowest point of Terrestrial radiation, 51° 4.
Mean of Humidity, .748.
Rain fell on 10 days, amounting to 2.126 inches, and was accompanied by Thunder on 4 days.
Most prevalent wind, W.
Least prevalent wind, N. by W.
Most windy day, the 10th day, mean miles per hour. 11.24.
Least windy day, the 16th day, mean miles per hour. 0.42.
Amount of Evaporation, in inches, 2.21.
Aurora Borealis visible on 1 night.


TERRITORY
HUDSON'S BAY
Hudson's Bay
Fort Rupert
Nemiscau L.
Rupert Riv
Nemeogamio L.
Lac des Mistassins
Doré
L. Albanel
L. Dauphin
Chibanoucone
Antre de Marbre
Bourbon
Nodaway Riv
L. Nash
CANADA
L. des Mousses
L. Mamelles
Mougouchiche
R. Chessoue Matamau
R. Patshikamsheb
Isle St. François Xavier
R. Peribonca
Pointe Bleue
Belle Riviere
R. Ouiatchouan
MAP
OF THE COUNTRY
between
LAKE ST. JOHN & LAKE MISTASSIN,
Compiled by the Abbe, O. Brunet.
1863