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THE

CANADIAN RECORD

OF SCIENCE.

VOL. II. JULY, 1886. NO. 3.

Studies in the Comparative Physiology of the Heart.

By T. Wesley Mills.

(*Concluded.*)

ON THE PHYSIOLOGY OF THE HEART OF THE ALLIGATOR.

The animals experimented upon belonged to the species *Alligator Mississippiensis*. The heart in the *Crocodilia*, with its two auricles and paired ventricles, though showing much resemblance to lower forms and retaining the pulsatile sinus venosus, both in its general appearance and in its action, approximates sufficiently to that of the higher vertebrates to suggest on superficial examination the heart of a mammal or bird (with slower action). The blood, too, is more highly oxidized than in the Chelonians, so that altogether the circulatory system shows physiological as well as anatomical advance. With the exception of Gaskell's short paper on the crocodile, (*Journal of Physiology*, Vol. V., No. I), nothing has

been published on the heart physiology of this group of animals.

The work of the present writer, while it confirms Gaskell's conclusions as regards the cardiac accelerator, is wholly at variance with his views as to the functions of the vagus. The vagus in the *Crocodilia*, at least in the alligator, is not a pure cardial depressor, but is on the contrary a powerful cardiac augmentor.

The result of the stimulation of the vagus may be thus stated:

(1.) Stimulation of the vagus with a weak, interrupted current may weaken the cardiac beat with or without arrest of the auricles; the latter may be arrested and give rise to a brief stop of the ventricles.

(2.) With a stronger current, the sinus may be so weakened as to lead to arrest of the auricles and ventricles; or the sinus may be arrested wholly, in which case the auricles and ventricles invariably cease to beat.

(3.) When the cardiac beat recommences, it may be in the order, sinus, sinus extension, ventricles; or sinus, auricles, s. extension, ventricles, *i. e.*, the auricles may remain quiescent as in the Chelonians and fishes when all the rest of the heart is beating.

(4.) The rhythm after vagus stand-still may be (*a*) without acceleration, or (*b*) accelerated.

The augmentation in the force of the beat is more marked than acceleration in the rate. Both rate and force follow, as in the Chelonians, the law of *inverse proportion.*

Comparison of the Vagi and Results of their Prolonged Alternate Stimulation. The vagi in the alligator, as in the Chelonians, have not, as a rule, equal power in causing and *maintaining* cardiac inhibition; the right, as in the other cold blooded animals examined, being more effective. Prolonged stimulation of the vagi alternately leads to corresponding lengthened cardiac arrest.

Accessory Vagi. Certain small nerves are in the alligator given off from the Glossopharyngeal shortly after its exit from the skull, proceed downwards, apart from the vagus, and pass beneath the trachea over the vessels to the heart.

Stimulation of these nerves has led to similar results to those furnished by stimulation of the vagus, *i. e.*, retardation of the rate, weakening of the beat and after acceleration. Hence they have been called by me *acccssory vagi*. There seem to be nerves of somewhat similar function in the sea turtle.

Peculiar Cardiac Inhibition followed by Acceleration. Special attention is called to the following experiment which is believed to be *unique* in physiology. In a small alligator with the *whole brain destroyed* for some time, *both vagi divided* and dead throughout the greater part of their course (stimulatation not producing cardiac arrest), a sharp tap over the liver and stomach with a dissecting forceps caused cardiac arrest of brief duratio n, then slowed irregular rythm followed by acceleration of a very pronounced kind (from 40 to 50 beats). Here then were the usual phenomena of reflex vagus inhibition, as when the vagi and medulla are intact. *This experiment was tried three times.* It does not seem possible to explain this unparalleled result by present theories. I conclude that the impulses passed through the sympathetic system of nerves and that probably other inhibitory fibres than those of the vagus were concerned, and that accelerating fibres were also involved. It is also possible to conceive that terminations of the vagi were in some way reached by these impulses, but in any case the results are new to physiology, the only published case at all resembling it being Marshall Hall's experiment on the eel's stomach (*Todd's Cyclopedia of Anat. and Phys.*, article "Heart.")

Cardiac Augmentors. As described by Gaskell, there is in the *Crocodilia*, from the ganglion of the eleventh metamere of the sympathetic chain, a strong well-defined branch passing to the heart.

Stimulation of this nerve has given rise to [1] acceleration following the law of *inverse proportion*, which seems applicable to all kinds of acceleration. [2] Decided augmentation of the force of the beat. This is more marked than the acceleration in rate, and in fact may disguise the effects of the nerve, for no actual acceleration of beat may follow.

In all cases, stimulation of a genuine cardiac augmentor

causes *increase in the work* done by the heart, hence these nerves should be called augmentors rather than accelerators.

Application of the Rapidly Interrupted Current to the Heart itself. In addition to the white dots seen at the points of application of the electrodes and the dilation and blue appearance following the use of a weak or moderate current, another effect noticed in the alligator, on the use of a very strong current deserves mention. From the part where the electrodes touched the auricle, a considerable area took on a pale, even whitish aspect and seemed to diminish in size; by gradually moving the electrodes along, more and more of the auricle passed into the same condition. The part involved was thrown out of action, as in the case of the dilated position. This condition seemed to be one of pronounced contraction, probably tetanic, and confirms the view that the white dots seen in all cases just where the electrodes touch are caused by the contraction of the muscle fibres.

THE CARDIAC RHYTHM OF FISHES AND THE ACTION ON THE SAME OF CERTAIN DRUGS AND POISONS.

The object of the investigation was (1) to ascertain whether there were considerable physiological differences in the hearts of different fishes, and (2) to ascertain the laws regulating the rhythm of some one fish heart specially suitable for investigation, and (3) to determine the action of certain drugs and poisons on the fish's heart; these being, many of them, such as have been studied in their influence on the heart of the frog.

In general it may be said that the hearts of fishes are so sensitive to changes in normal conditions, and that most fishes are so easily killed, that it is not possible to pursue prolonged investigations on their hearts *in situ.* This remark applies especially to the Selachians, whose hearts, from many points of view, are exceedingly interesting.

Batrachus Tau (toadfish), is a fish of great vitality, resisting unfavorable conditions admirably, and its heart has a corresponding vital resistance, and being excellently suited for experimentation, this fish was the subject of a majority

of the experiments of this investigation. Most of the work was done on the heart *in situ*, but the isolated heart was also studied. For the former experiments, the fish was kept on its dorsal surface in a dish of water, the latter reaching sufficiently high to cover the gills but not flow over the exposed heart. The respirating centre was left intact. Under these circumstances, the heart may be maintained fairly normal for several hours.

Considerable differences in physiological behavior have been found in the hearts of fishes, some of which will be noticed under different headings in this synopsis.

The Structure and Action of the Fish's Heart. In the Selachians, as examined by the present writer in the shark and and skate, the heart consists of a *Conus arteriosus*, in addition to the sinus, auricle and ventricle. This structure is pulsatile and seems to be the most sensitive part of the whole heart.

The corresponding *Bulbus arteriosus* of other fishes is highly elastic but not pulsatile.

In observing such a heart as that of *Batrachus* during systole of the ventricle, the longitudinal and transverse diameters of the latter are seen to be shortened and the antero-posterior lengthened. It is seen that the apex ascends and the bulbus descends.

In the Selachians, the beat is more highly peristaltic than in the hearts of other fishes, and in the former, a reversal of the order of pulsation for the different parts is most easily originated and maintained.

In some fishes, as in the eel [McWilliam] and *Batrachus*, there is a part of the heart intermediate between the sinus and the auricle proper, as to appearance, structure, and functions; and, as it is in most respects physiologically like a corresponding part in the Chelonians, has been named by me sinus extension in both fishes and Chelonians ["basal" wall, and "flattened" portion of Gaskell, "Canalis Auricularis" of McWilliam]. This part of the heart is often, under peculiar circumstances, in action when the auricle proper is quiescent, and then serves to conduct the wave of construction on from the sinus to the ventricle.

Influences Affecting the Natural Rythm of the Heart. Among these, in addition to mechanical excitation inducing a reversed rythm already referred to, must be especially mentioned the condition of the blood supplying the heart as to degree of oxidation. Blood, poor in oxygen, with greater readiness than in other cold-blooded animals, causes irregularity or arrest of the heart in a fish.

Faradisation of the heart in the fish leads to results very closely allied to those obtained in the Chelonians.

Reflex Cardiac Inhibition. The ease with which the heart of a fish can be reflexly inhibited by the stimulation of various parts of its body, is one of the most remarkable facts brought out by investigation on the heart physiology of the animal.

The results are much the same whether mechanical or electrical stimulation with the rapidly interrupted current be employed. The parts that have been found most effective in *Batrachus* are the gills, the air bladder, the abdominal viscera, the mucus lining of the mouth, the tentacular appendages of the mouth, the pectoral fins, the anus and the tail.

The results may be either (1) decided arrest of the heart for several seconds, followed by a slowed rythm, or (2) brief arrest of the slowed and irregular rhythm or (3) the latter lasting from one to two minutes or longer without any actual stop of the heart. In some cases the operative procedure necessary to expose the heart is sufficient stimulus to keep the heart long inhibited. *The results of inhibition* are not uniform. In some cases no acceleration seems to follow, but in others and the majority, there is decided acceleration of the rythm.

Peculiar Results associated with Reflex Cardiac Inhibition. Stimulation of several of the parts mentioned above, and especially of the anus and tail, have given the following results:

(1.) At first an accelerated rhythm followed by a slowed rhythm, or

(2.) An accelerated rhythm followed by a slowed rhythm on increasing the current, or

(3.) Only an accelerated rhythm.

This subject is further treated in the account of the turtle and alligator above.

It should be noted that in the *skate*, stimulation along certain lines on the ventral surface of the fish, apparently the course of mucous glands and likely associated with special sensitive structures, has produced remarkably good cardiac inhibition, and the results have been constant. The mucous membrane of the mouth, is also in the skate, a part giving decided results.

Independent Rhythm of Various Parts of the Heart. A large number of experiments on both the isolated heart and the heart *in situ* have brought out the following facts:

(1.) There is very great variety in the hearts of different fishes as to capacity for independent rhythm; between such fishes as the skate, the shark and the toadfish (*Batrachus*) this difference is enormous.

(2.) In *Batrachus* every part of the heart is capable of good, independent rhythm; even the apex of the heart when isolated has shown such.

(3.) The order of the parts of the heart with greatest independent rhythmic power is—sinus, sinus extension, auricle, ventricle.

[4.] The independent rhythm of the ventricle *begins* soon after its separation from the rest of the heart (by ligature), speedily reaches a maximum and gradually declines.

The *Action of Certain Drugs and Poisons on the Heart.* Experiments have been made on the heart *in situ* and the results confirmed on the isolated heart. The agent was in each case applied in solution directly to the heart itself. The results are stated below very briefly.

Pilocarpin and *Atropin* in one per cent. solution. (1.) These agents are antagonistic in action. (2.) Pilocarpin is a cardiac depressant; atropin an excitant; the former lowers cardiac excitability; the latter most decidedly heightens it; the former weakens the beat and tends to arrest the heart in diastole, the latter calls into action the resources of the heart quickly and fully.

Carbonates of Soda and *Potash* in five per cent. solution. These agents are antagonistic in action. Sodium carbonate

is a cardiac excitant, potassium carbonate a depressant. The former tends to quicken the beats and diminish diastole. A heart arrested in diastole by potassium carbonate may be excited to action by sodium carbonate. Potassium carbonate must be regarded as a cardiac poison.

Lactic Acid. (1) In five per cent. solution this is a rapid cardiac poison. (2) In one per cent. solution its action is slower, but it proves a decided depressant, and the heart arrested by lactic acid cannot be excited to action by digitalis, sodium carbonate, &c.

Nicotin in one per cent. solution. (1) Its first action was often to arrest the heart in diastole. (2) This was sometimes followed by an irregular, slowed rhythm giving way to a more rapid but weaker heart beat. But the fish heart shows great power of resistance against the effect of nicotin in weak solution and can, it would seem, recover almost wholly from the effect of this poison. Nicotin tends strongly to produce inco-ordination of the beat.

Chloroform (undiluted) acts as a decided cardiac depressant, tending to arrest the heart in diastole. The heart can, however, recover fairly well from a considerable quantity of this poison applied directly to it.

Acetate of Strychnia in one per cent. solution. This poison did not seem to have the most pronounced action, but *tended* to strengthen the systole, diminish diastole and arrest the heart in systole.

Veratria in rather less than one per cent. solution. The most distinct action is on the diastole, which it retards. The heart in action has a generally sluggish movement rather than a weakened one; the systole may in fact be slightly improved. It also tends to cause arythmic phenomena—want of harmony in the sequence of the beats of different parts and of different fibres in the same part, *e. g.*, there may be two or more beats of the auricle for one of the ventricle, &c., or one part of the ventricle may be pulsating out of harmony with the rest.

Digitalin in somewhat less than one per cent. solution has more than any other of the agents tested a *constant*, decided and well-defined action. (1) A short time elapses before its

action is manifested; but when this begins it quickly and steadily rises to a maximum. (2) It causes diminished diastolic relaxation; but especially characteristic is the effect on the systole which is both more perfect and when complete more prolonged than usual. (3) The ventricle is always arrested in most pronounced (tetanic?) systole and then always looks very small and pale. It is inexcitable.

The action of drugs on such sensitive hearts as those of the Selechians was found correspondingly rapid. The action on the isolated heart was also more rapid than in the heart *in situ*, as was to be expected.

In many cases the first effect of a drug was to arrest the auricle proper, leaving the sinus extension comparatively unaffected.

Our North-West Prairies, their Origin and their Forests.

By A. T. Drummond.

The origin of our North-West prairies may be traced to two causes, one long since removed, the other still operating. During the pre-glacial and glacial periods, the inequalities of the surface over vast tracts of the country in our North-West were filled up by clays and gravels, and more or less levelled. These clays were, to some extent, subsequently re-arranged under water, and at the same time new material, chiefly gravels, sands and sandy loam, was deposited. Then these extensive tracts were gradually upheaved above the level of the water or were left dry by the fall in the water through the diminution in the sources of supply, or by the greater facilities afforded for rapid drainage. There had been previous upheavals during the drift period, and there were traces of resulting vegetation. The second cause, then, or immediately previously, came into play, and consisted in the annual growth and decay, for long periods of time, of grasses, sedges and aquatic plants generally, over extensive areas in the shallower waters and along the shallow lake

margins, each year forming a deposit there on the lake bottom and gradually thus increasing the encroachments of the land upon the water.

There is strong evidence which seems to point to the fact that about the close of the drift period, or immediately after it, when the glaciers, probably, were slowly retreating, the central portions of the continent formed the bed of a vast fresh water inland sea, of which Lakes Winnipeg, Manitoba and Winnipegosis, are now the mere remnants. The outlet of this sea to the ocean was probably at that time by way of the Mississipi Valley. Into this sea the glaciers from the Rocky Mountains and from the country north and east of the Saskatchewan, perhaps for long periods of time, flowed, and huge icebergs freighted with boulders, debris and earth were continuously floated off to wend their way at the will of winds and currents. It was not the first time during the drift period that this part of the country had been under water. The resemblance to the Polar Seas of to-day was probably very striking, except in these points that the icebergs would be more deeply sunken, for the water was fresh, and that this inland sea was more vast, covering not merely our North-West prairies, but extending probably as far south as Iowa and Illinois. Boulders were thus scattered at random over the bottom of the sea hundreds of miles away from their point of origin. Huge masses were carried enormous distances. Dr. George Dawson mentions one of the Huronian quartizite, lying near the Waterton River, which measured forty-two feet long, forty feet broad and twenty feet high, and which must have come from east of Lake Winnipeg or the Red River.

The very uniform nature of the deposits over very great areas would indicate quiet waters, at least in later periods of the occurrence of this inland sea, probably ending, as the land rose, in the creation of vast marshes, like the existing great grass swamps at Westbourne, and on the Boyne River in Manitoba, but on an immense scale. The successive annual growth and decay of sedges and grasses in these marshes gave rise to deposits of vegetable loam which have gone on increasing since the rise of the land to its present level, by

the annual decay of the ordinary prairie grasses, and perhaps of forest trees. The elevation which took place in the land was greatest at the Rocky Mountains and the different steppes between these mountains and the eastern limits of the prairie, would seem to indicate different stages or intervals in the elevation during which the various sandhills and stretches of sand at the extended edges of these steppes have been formed. The contraction in the area of this inland ocean took place from the Rocky Mountains eastward, so that the present Province of Manitoba east of the Duck, Riding and Pembina Mountains, is the most recently formed as well as the lowest in level. Between the mouth of the Saskatchewan at Grand Rapids and the Assiniboine River between Portage la Prairie and Winnipeg and thence to the United States boundary line, there is not much difference in level, as the following heights above the sea indicate:

Lake Winnipeg	710 feet.
St. Martin's Lake	737 "
Lake Manitoba	752 "
River Assiniboine, near Baie St. Paul	766 "
Lake Winnipegosis	770 "
Cedar Lake, near Grand Rapids, on the Saskatchewan	770 "

This comparatively level area occupies a stretch of country 330 miles in length by an average of 150 miles in breadth.

Lakes Winnipegosis and Manitoba, and St. Martin's and Water Hen Lakes, are mere shallow depressions on the surface of the prairie. The two first named lakes are each over a hundred miles in length, but increase in depth so gradually that at the narrows where they nearly unite, Winnipegosis has only six feet of water at 2,000 feet from the shore, whilst Lake Manitoba, at a mile from the shore, shows a depth of only three feet. St. Martin's Lake, again, has only eight feet, and Water Hen Lake an average of three feet of water. Lake Winnipeg is deeper, being an average of forty feet to sixty feet, with a somewhat uniformly level bottom, but it is relatively very shallow for a lake of its great

extent. Its eastern shores form here the western limits so far as observable, of the great eozoic rocks, and were also, no doubt, the eastern shore of the great inland sea.

It has been proposed to lower the level of Lake Manitoba by removing the obstructions in the channel through which its waters are conducted by way of St. Martin's Lake to Lake Winnipeg, and there is no doubt that if this could be effected to the extent of only a few feet, large tracts of country would be reclaimed which around its margin are presently more or less under water. The southern end of the lake is now bounded by a narrow sand bank elevated a few feet above the water. Inside of this are very considerable tracts once forming a part of the lake and now more or less submerged, but in which the process of growth and decay of the grasses and aquatic plants and the resulting annual deposit of soil will eventually end in their reclamation from the water. This same process is going on in a large tract covering four or five townships about ten miles to the westward of Lake Manitoba, known as the Big Grass Marsh, as well as in many other places in the province, and will, in coming years, result in the formation of prairie land with a rich covering of black vegetable loam.

The County of Essex in Ontario has a considerable extent of prairie land which was no doubt largely formed under similar conditions of annual growth and decay, and which in its origin points to a time when Lakes Erie and St. Clair, were more intimately connected than they now are. Long Point, Point Pelée and Sandusky Harbour, all on Lake Erie, are illustrations of prairies now in process of formation. These prairies all have a fresh water origin. Those south of Montreal, and extending beyond St. Johns and St. Hyacinthe, are rather of marine origin, dating back to the Leda clay period, when the drift clays were re-assorted under water and added to, and the land then elevated to its present level.

Probably contemporaneous with the formation of the prairies was the creation of the deep valleys of the Assiniboine and the Qu'Appelle Rivers. The valley of the Assiniboine above Brandon has an average depth of towards 200

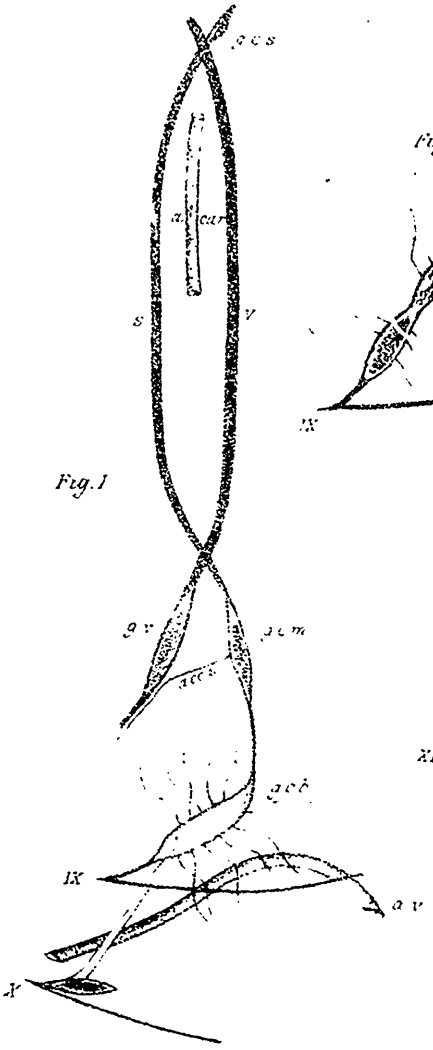

Fig. 1

Fig. 3.

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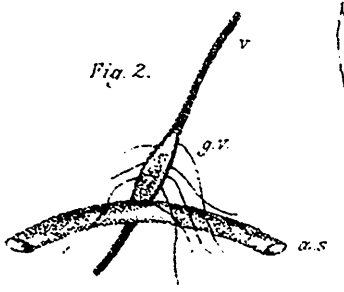

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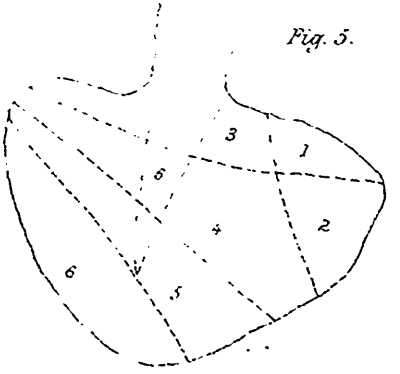

Fig. 5.

HEART OF SEA-TURTLE.

feet; that of the Qu'Appelle is somewhat less. Their width varies from half a mile to a mile. As the waters fell in the prairie country to the east of Brandon, these rivers, which appear to have been enormous streams with strong currents, cut their way into the drift deposits of the upper steppe gradually downward to the level of the lower steppe below Brandon. The sources of supply for these streams may have been in part the retreating glaciers, but were more probably a greater rainfall than now and the general drainage of the country through which they ran. This country must have been in its earlier days covered with grass marshes. The smaller river valleys as those of the Souris, Cut Arm Creek and the Little Saskatchewan have probably somewhat similar origins. A contributing cause in every case has however no doubt been the annual spring freshets which extend into the month of July in the larger rivers, and which year by year carry down with them in their constantly turbid waters large quantities of soil to the Red River.

A writer in the February number of The Century, speaking of the vast prairies of the valley of the Mississippi and its tributary streams, tells us "This region was not originally wooded. This is proved not only by the story told by the soil, but by the fact that though it was not without its woodlands at its settlement, it has no characteristic trees. All are derived either from the Appalachian region or from the west and north, ninety varieties coming from the east and only nine or ten from the west and north. The great prairie region has sought all the trees it possesses from adjoining regions." This opinion probably expresses the generally prevailing impression of the relations of forest trees to the prairies. And yet in regard to our Canadian prairies, whether in the North-west or in Ontario and Quebec, it is not altogether correct. The subject is in some respects associated with the early history of the prairies. There is no doubt that when these prairies were in process of formation, when immense areas were in the condition of marsh in which tall grasses were the leading feature, and when this marsh was being gradually changed in its character to dry

land by the successive annual growth and decay of these grasses, circumstances existed which rendered the growth of forest trees impossible. Great tracts of country are still in this condition. There are also many areas of great extent, as on the Pembina branch of the Canadian Pacific Railway, around Gladstone and Westbourne on the Manitoba & Northwestern Railway, and between Baie St. Paul and Lake Manitoba, where, during the wet seasons—and these seem periodically to follow each other for two and three years in succession—very extensive tracts of magnificent prairie land, which in other seasons are dry and capable of cultivation, are practically under water for most of the summer months. Thus trees, which in dry seasons might spring up in such stretches of country, would during the successive wet seasons be gradually killed. Wherever such conditions have prevailed, whether in far distant or present times, forests, for the time, could not be expected to appear.

The question however arises whether, once the condition of dry land was attained, did trees spread over the prairies as they have elsewhere, and whether subsequent causes may not have prevailed in removing them. That certain trees will freely grow on the prairies is proved by the frequent bluffs of timber, especially to the north of the Assiniboine and Qu'Appelle. These bluffs often occur in stretches of miles in extent and often again are found isolated. North of the Qu'Appelle they are so frequent as to give the country a park-like appearance and to render that country very attractive for settlement. Beyond this point northward they continue to occur until they finally merge into the true forest region which in this section extends from Lake Winnipeg westward to the sources of the Athabasca River, and from between these localities northward to the extreme limits of forest growth—including within this are a great stretches of what should correctly be termed prairie country. On the prairies proper the prevailing trees are the poplars, and only in the deep river valleys or skirting the margins of the lakes and the smaller streams and on the hills are the other trees of the prairies found in numbers.

It is quite true that the total number of species of trees

in our North-west is limited. Most of the Ontario and Quebec species do not range west of Lake Superior or Lake of the Woods and probably Manitoba, west of the Red River, does not include more than sixteen species. Were there, however, forests in this part of Manitoba as there are in Ontario and Quebec, this paucity of species would probably not be so marked. That there has been a time when the present prairies of Manitoba and the North-west Territories have been more or less under wood is extremely probable. There seems no reason why the true forests should have extended everywhere northward, often covering, even there, what would be otherwise prairie, and should have left the vast country to the south an open, more or less treeless, plain. The deep valleys of the Assiniboine, Qu'Appelle and other streams would seem to indicate a greater rainfall to have at one time prevailed, and this greater rainfall would result from extended areas of forest. It is not an argument against this that the prairies with us can hardly be said to have any characteristic trees. The vast forests to the northward have none. It is not because trees will not grow, as bluffs of timber are of frequent occurrence and wherever tried, hardy trees, when properly protected, readily thrive. Those who have observed the almost yearly occurrence in almost every part of the prairie country of great fires, sweeping sometimes over immense stretches of country, and of the destructive effects of forest fires in Ontario and Quebec, can readily suppose that such fires may have been an important factor in rendering the prairies largely treeless and that, aided by the light rainfall and the dry atmosphere, they have gradually widened the areas originally burned, until these areas have attained their present extent. The general flatness of the country and consequent exposure to winds has contributed much to the rapid accomplishment of this. In the country bordering the upper reaches of the Peace and Athabasca Rivers and their tributaries there are at present large stretches of prairie land completely surrounded by forest, and which suggest an origin resulting from forest fires. Prairie fires are almost invariably the result of human agency, so that the present condition of

the prairies probably dates its origin within a comparatively recent period. Certainly these prairie fires now prevent the encroachments of the forest upon the plain, as otherwise these forests would in the natural order of things extend themselves westward and southward if allowed to do so. The same is true of the bluffs or stretches of timber found growing in frequent places south of the true forests, though even there the trees are of relatively moderate size proving that these bluffs are of comparatively recent or of very slow growth. There can be no question that as prairie fires cease with the progress of cultivation of the land and with the enforcement of preventive laws, the tendency of these stretches of timber and of the true forests will be to extend themselves further over the prairie. In the meantime, the effect of the absence of timber is to create a drier climate by diminishing the rainfall, and on account of the general flatness of the prairie by exposing every object upon it to constant and unbroken, drying winds. That there is, therefore, a general tendency of trees to skirt the river banks can be readily understood, as there they obtain that moister atmosphere which is absent on the open prairie. Even in the valleys of such great streams as the Assiniboine and the Qu'Appelle, trees are generally found on the southwestern or western sides, the eastern being frequently bare, and this can only be accounted for by the greater protection from drying winds the western and southern banks have, and therefore the greater moisture in the soil there.

Again, only in the river valleys, on and near the lake margins and on the hills or rising grounds are the forest trees of the North-west completely represented, and it is suggestive whether the trees there are not the relics of a larger forest flora which more or less covered the whole country. At present the cosmopolitan poplars are the chief occupants of the plains, their very hardiness, however, constituting them fitting pioneers of new forests some day to appear.

I cannot help thinking that as the prairies become thickly settled and protective laws are properly enforced, prairie

fires will largely cease and trees will have an opportunity to extend their area of growth in every direction. Further, as cultivation increases and a drainage system is more generally carried out, summer frosts will largely disappear and the climate become more suitable for forest trees as well as grain. The extension of the forests will, no doubt, have its effect in somewhat increasing the rainfall, but will also afford breaks to the winds which now prevail. The general effect must be a modification of the climate in some degree, probably rendering the atmosphere less dry and somewhat moderating the cold in winter.

The Protection of North American Birds.

By Alfred H. Mason, F.C.S.

A communication on this subject having been addressed to the Society by Mr. Montague Chamberlain, a member of the Council of the "American Ornithologists' Union" and Canadian Superintendent of that union, the Council of the society decided that it was a subject of importance to naturalists, and I was invited to bring the matter forward.

The American Ornithologists' Union was organised in 1883 at New York, at a convention of the leading scientific workers in that branch of study. The object of the Union is to advance the study of ornithology and to organise for systematic and combined action in the determination of important questions. It has issued a new classification of North American Birds, established a successful journal "The Auk," and organised and made successful a very large body of observers of the phenomena of bird migration. Allen, Baird, Coues, Merriman, Ridgway and Henshaw, are among the leading professional Zoologists of America.

Author's Note.—This paper consists mainly of a résumé of the work of the American Ornithological Union, and of extracts from its recent circular, and the chief object aimed at is to aid in directing general attention to the ruthless destruction of birds.

Brewster and Lawrence are gentlemen of large fortune, who study the science for occupation, and for the love of it, and stand high as scientists. Lawrence helped Baird with his greatest ornithological work, published in 1859.

One of the investigations being conducted by the Union is that of Bird migration and the geographical distribution of North American Birds, and during the first year of its existence, it received communications from more than a thousand observers. The area over which these observers are scattered is co-extensive with the boundaries of the inhabited portions of the North American continent, and includes parts of the West Indies, and Central and South America.

Stations now exist in every state in the Union, and in every Territory excepting Nevada. The extreme points from which reports have actually been received will appear from the following: in the east, the southernmost station is Sombrero Key, off Southern Florida (Lat. 24°37′); and the most northern, Belle Isle off Labrador (Lat. 51°53′), whilst from the west, reports have been received from Arizona and Southern California, as well as from Point Barrow, the most northerly point of Arctic Alaska (Lat. 71°18′). The most eastern station from which data have been obtained, is St. John's Newfoundland (West Long. 52°45′) projecting well into the Atlantic; while on the Pacific, the committee has observers at various points in California, Oregon, Washington and British Columbia.

Hence it appears that the migration stations are sprinkled over 46°41′ of latitude (approximately three thousand two hundred miles in a north and south direction) and 72°15′ of longtitude (approximately three thousand five hundred miles in an east and west direction.) The distance in a straight line between the two most remote points (Sombrero Key and Point Barrow) is about four thousand three hundred miles. This territory is divided into sixteen districts, each under the immediate direction of a competent superintendent. In Canada there are stations with the following superintendents:—North West Territories: Ernest E. T. Seton, Assiniboia, via Carbery, Manitoba; British

Columbia: John Fennin, Burrard Inlet, B.C.; Manitoba: Prof. W. W. Cooke, Moorhead, Minnesota; Quebec and Maritime Provinces: Montague Chamberlain, St. John, New Brunswick; Ontario: Thomas McIlwraith, Hamilton.

Each observer is asked to give a brief but careful description of the principal physical features, including latitude, longitude, and altitude, of the locality which is the seat of his observations, and the data collected arranged in three general classes; (a) Ornithological Phenomena, (b) Meteorological Phenomena, (c) Contemporary and Correlative Phenomena. The first class requires the observer to prepare a complete list of the Birds known to exist in the vicinity of his station, indicating to which of the following five categories each species pertains:—

1. *Permanent Residents,* or those that are found regularly throughout the year.

2. *Winter Visitants,* or those that occur only during the winter season, passing north in the spring.

3. *Transient Visitants,* or those that occur only during the migrations, in spring and fall.

4. *Summer Residents,* or those that are known to breed, but which depart southward before winter.

5. *Accidental Visitants,* or stragglers from remote districts.

The second class requires information upon:—

1. The direction and force of the wind.

2. The direction, character and duration of storms.

3. The general conditions of atmosphere, including rainfall.

4. The succession of marked warm and cold waves, including a record of all sudden changes of temperature.

Whilst the committee ask for a large amount of information upon a variety of subjects, they are also glad to receive meagre and isolated records. Comparatively few of the observers are ornithologists or even bird collectors, the great majority being intelligent farmers, tradesmen and light-keepers. Those who know only the commonest birds, such as the Robin, Bluebird, Bobolink, Martin, Hummingbird and Chimney Swift, can furnish important data and their services are eagerly sought.

Another object engaging the attention of the Union is to determine as nearly as possible the true status in America, of the European Home Sparrow (*Passer Domesticus*), commonly known as the English Sparrow—by collecting the facts necessary to settle the question of the eligibility or ineligibility of this sparrow as a naturalized resident of the country. The question is regarded as one of great economic consequence, to be determined primarily by ascertaining whether this bird be, upon the whole, directly or indirectly, injurious or beneficial to agriculture and horticulture, its economic relations, depending directly and mainly upon the nature of its food; indirectly upon the effect, if any, which its presence may have on useful native birds and beneficial insects.

The chief object of my communication this evening, is to call attention to that portion of the work of the Union which relates to the consideration of the important question of the destruction of the native birds in North America, and more especially, to join in the crusade against the fashion of wearing birds for decoration. This work is not likely to have been initiated by those scientists whom I have named, had they not been quite certain that there was an urgent need for it.

In the bird-world, as elsewhere, the struggle for existence even under natural conditions, is a severe one, undue increase being held well in check. Birds and their eggs and young, are not only the natural prey of many predaceous mammals and reptiles, but also of predaceous birds. Squirrels spermophiles and mice, although not in a strict sense rapacious, are among the worst natural enemies of the smaller birds, whose eggs and young they seek and devour with avidity; while many birds, not usually classed as predatory-as the jays, crows, grackles, cuckoos, and some others, wage unremitting warfare upon the eggs and young of the weaker species. "The elements are also far more destructive of bird-life than is commonly recognized. Late cold storms in spring destroy many of the early migrants, sometimes nearly exterminating certain species over considerable areas where they had become prematurely settled

for the season. The unusual southward extension of severe cold waves and heavy snow-falls, such as have marked the present winter, are destructive to the bird-life of the regions thus exceptionally visited. During the migrations, both in the fall and spring, immense numbers of birds are sometimes caught by storms, and blown far out to sea and drowned, or perish in attempts to cross the larger inland lakes. There is abundant evidence to show that the annual destruction of birds by the elements alone must prove a severe check upon their increase. But all this is a part of nature's routine, which has characterized past ages as well as the present, and which, so far as we know, may be only the natural and necessary check upon undue increase. It is only when man comes upon the scene that nature's balance is seriously disturbed.

"Man's destructive influence is to some extent unavoidable, but in far greater part selfish and wanton. The removal of forests, the drainage of swamps and marshes, the conversion of wild lands into farms, and the countless changes incident to the settlement of the country, destroy the haunts and the means of subsistence of numerous forms of animal life, and practically result in their extermination over vast areas. The birds, particularly the larger species, suffer in common with vertebrate life in general. Electric-light towers, light-houses, and light-ships are also a fruitful and modern source of disaster to birds, particularly during their migrations, when, in thick weather, thousands upon thousands kill themselves by dashing against these alluring obstructions. Telegraph-wires contribute also largely to the destruction of bird-life. While the destruction by these agencies is greatly to be regretted, it is not directly chargeable to cupidity and heartlessness, as is the far greater slaughter of birds in obedience to the dictates of fashion.

"The history of this country, as is well known, is the record of unparalleled destruction of the larger forms of animal life. Much of this destruction, it is true, was unavoidable, sooner or later. But it is no less true that the extirpation of our larger game animals has been needlessly hastened by what may be fairly termed a disgraceful

greed for slaughter,—in part by 'pot hunting' on a grand scale, in part for the mere desire to kill something,—the so-called 'love of sport.' The fate of extermination, which, to the shame of our country, has already practically overtaken the bison, and will sooner or later prove the fate of all of our larger game-mammals and not a few of our game-birds, will, if a halt be not speedily called by enlightened public opinion, overtake scores of our song-birds, and the majority of our graceful and harmless, if somewhat less 'beneficial,' sea and shore birds.

"The decrease in our song and shore birds is already attracting attention; and the protest against it, which reaches us from many and widely distant parts of the country, is not only painful evidence of this decrease, but gives hope that the wave of destruction, which of late years has moved on in ever-increasing volume, has at last reached its limit of extension, and that its recession will be rapid and permanent. But to secure this result, the friends of the birds—the public at large—must be thoroughly aroused as to the magnitude of the evil, and enlightened as to its causes and the means for its retrenchment."

The American Ornithologists' Union, through its Committee on Protection of Birds, "has caused the publication of a series of papers to throw some light upon the extent, the purposes, and the methods of the present wholesale slaughter of native birds. Birds are killed for food, for sport, for natural history specimens, to stuff as objects of curiosity or ornament, and for personal decoration. The birds killed for food are, of course, mainly the commonly so-called game-birds,—pigeons, grouse of various kinds, ducks and geese, and the great horde of smaller waders, known as 'peeps,' snipes, plovers, rails, etc. The slaughter of these has been so improvident, and their decrease of late so marked, that they are now more or less cared for by the numerous game-protective associations, but are still, in the main, very inadequately guarded. In addition to the birds commonly recognized as game-birds, many song-birds are hunted for food, notably the reed-bird, or bobolink, the robin, the meadow-lark, the blackbird, and the flicker, and, in some

localities, all the larger song-birds. This is particularly the case in portions of the south, where strings of small birds may be seen suspended in the game-stalls. In March of last year, a well-known ornithologist reports finding in the market at Norfolk, Va., hundreds of wood-peckers and song-birds exposed for sale as food, the list of species including not only robins, meadow-larks, and blackbirds, but many kinds of sparrows and thrushes, and even warblers, vireos, and wax-wings. While some of the stalls had each from three hundred to four hundred small birds, others would have but a dozen or two. 'Nearly all the vendors were colored people, and doubtless most of the birds were captured by the same class.' This 'daily exhibition in southern markets' indicates an immense destruction of northern-breeding song-birds which resort to the southern states for a winter home," and we in Canada must not overlook the fact that many of our birds migrate to these districts, to escape our severe winter, never to return, and hence this is a subject for serious consideration by us.

The eggs of many species of terns, gulls, plovers, and other marsh and shore breeding species, are systematically taken for use as food, the egg-hunting busines being prosecuted to such an extent as to prove a serious cause of decrease of the species thus persecuted, while the value as food of the eggs thus destroyed, is too trivial to be for an instant regarded as of serious importance.

Mr Sennett writes a paper in which he refers to the destruction of young birds rather than to eggs, and makes a statement which he says, for fiendish enterprise, exceeds anything that has ever come under his notice. In 1877, and also in 1878, while studying the birds about Corpus Christi Bay, Texas, he examined a low grass-flat called Pelican Island, so named on account of the numbers of brown pelicans that had for years taken it for their breeding-place, to the exclusion of all other species. Here many thousands of these great birds were tending their eggs and young, breeding in such numbers that one could step or jump from nest to nest, over nearly, if not quite, every square yard of the island. Four years later he cruised over the same course,

and noticed that the pelicans had deserted this grassy island entirely, and were scattered, in diminished numbers, on other islands which were not occupied by them when he made his former trips. On inquiring into the cause of this change, he learned from prominent citizens, that two or three enterprising (?) men had conceived the idea of making their fortunes from pelican-oil, and had erected 'trying-out' shanties on the mainland. They went to the island in question in large boats, and carried off cargoes of young pelicans in all stages of growth, and boiled them up for their oil. The only satisfaction he could get from the history of this experiment was, that the men could not sell the oil, and had nothi g but their nefarious labor for their pains. Think of the enormous sacrifice of life for a foolish experiment! This heartless slaughter is hardly equalled in cruelty by the so-called sport of the union troops during the war against secession, who, while idly lying in transports off the passes along the coast, amused themselves by fastening a fish to a plank which was so weighted as to be quite submerged; they would then watch the pelicans dive for the fish, while bets were freely interchanged as to the probability of the bird getting a broken neck, with the odds decidedly in favor of the death of the pelican. Instances without number might be given to show that man, unchecked by law, will ruthlessly destroy the very things most useful to him if preserved and protected.

"The same havoc prevails all along the coast lines; and many localities might be cited where the destruction is equally sweeping, as on the Pacific coast and at frequent points on the Atlantic coast from Florida to Labrador,—wherever, in fact, the birds occur in sufficient numbers to render such wholesale plundering practicable. The marsh-breeding rails are at some localities subject to similar prosecution. At one locality on Long Island, it is reported, a 'bay-man,' who keeps a house of entertainment for sportsmen during 'the season,' supplies his table for weeks at a time with the eggs of the rails that breed numerously in this vicinity,—in strange conflict, too, with his own interests, since, by destroying the eggs of rails, he 'kills

the goose that lays the golden egg' for the rail-shooting season.

"In general, the game and quasi-game birds are killed for sport rather than for gain or for their intrinsic value as food; exception, however, is to be made of the 'professional' or 'market' gunners, by whom the ranks of the water-fowl are so fearfully thinned, and who often resort to any wholesale method of slaughter their ingenuity may be able to devise. But the slaughter of birds in general is doubtless largely due to the mere fascination of 'shooting.' Many song-birds are killed 'for sport' by the 'small boy' and the idler, whose highest ambition in life is to possess a gun, and whose 'game' may be any wild animal that can run or fly, and wears fur or feathers. Some slight depredation on the small fruits of the garden, or on field-crops, is ample pretext for a war of extermination on robins, catbirds and thrashers, jays and chewinks as well as blackbirds and crows, and the birds so unfortunate as to fall into the category of hawks and owls, notwithstanding the fact that every one of these species is in reality a friend. Yet the slaughter is winked at, if not actually encouraged, by those who are most injured by it; while the 'general public' of the districts where such practices prevail are either too ignorant of the real harm done, or too apathetic, to raise any serious protest.

"Among the important agencies in bird-destruction is the 'bad small boy'—and in the ornithological sense his name is legion—of both town and country. Bird-nest robbing is one of the besetting sins—one of the marks 'of natural depravity'—of the average small boy, who fails to appreciate the cruelty of systematically robbing every nest within reach, and of stoning those that are otherwise inaccessible. To him the birds themselves, too, are also a fair target for a stone, a sling, a catapult, or a 'pea-shooter;' to the latter many a sparrow, a thrush or warbler falls a victim. Says a recent writer on the subject of bird-destruction, 'Two ten-year old lads in that quiet and moral hamlet [Bridgehampton, Long Island] confessed this autumn, that with pea-shooters they had killed during the season fifty robins and other birds which frequent the gardens, orchards and

cemetery. Such boys exist all over the country, and war on birds as things made to be killed. . . . The pea-shooter gives no sound, and can be carried in the vest-pocket; but so destructive is it in the hands of a skillful child that the legislatures of some of the western states were obliged to pass laws making the sale of the thing a misdemeanor, and preventing the possession or use of it.

"The destruction of birds by taxidermists, and for alleged 'scientific purposes,' has justly attracted attention and has unjustly brought into disrepute the legitimate collecting of both eggs and birds for scientific use; but much of this alleged scientific collecting is illegitimate, being really done under false colors, or wrongly attributed to science. Of the birds killed or mounted by taxidermists, some, not unfrequently a large part, are for museums or private cabinets: another large share is put up for parlor or hall ornaments, either as groups or singly. All this by a little license, may be allowed as legitimate, or at least not seriously reprehensible. But, unfortunately, the average taxidermist has too often an unsavory alliance with the milliner, and in addition to his legitimate work, is allured into catering on a large scale to the 'hat-trade.' Although a few of them are too-high principled and too much the naturalist at heart, to thus prostitute their calling, taxidermists as a class are at present in deserved disrepute, and are to a large degree responsible for much of the public and mistaken criticism of scientific collecting. This criticism is perhaps more especially directed against the 'egg-collector,' who ranges in calibre and purpose from the schoolboy, who gathers eggs as he gathers postage stamps or 'show-cards,—for the mere purpose of 'making a collection',—to the intelligent oologist or ornithologist, who gathers his eggs in sets, prepares them with great care, with the strictest regard to correct identification, and in series sufficient to show the range of variation —often considerable—in eggs of the same species, and takes a few additional sets for exchange. He may have in the aggregate a large collection, numbering hundreds of species, and thousands of specimens: but, in general, the same species is not laid under serious requisition, and the sets are gathered

at considerable intervals of time and from a large area of country. A squad of street urchins set loose in the suburbs will often destroy as many nests in a single morning's foray as a collector, gathering for strictly scientific purposes, would take in a whole season, and with far more harmful results, because local and sweeping. Much of the egg-collecting by schoolboys should be stopped, and can be easily checked under proper statutory regulations."

Having called your attention to various agencies and objects affecting the decrease of birds, we now come to consider the most important—many-times exceeding all the others together—the most heartless and least defensible, namely, the sacrifice of birds to fashion, for hat and bonnet ornamentation and personal decoration. Startling as this assertion may seem, its demonstration is easy.

"In the United States of 50,000,000 inhabitants, half, or 25,000,000, may be said to belong to what some one has forcibly termed the 'dead-bird wearing gender,' of whom at least 10,000,000 are not only of the bird-wearing age, but—judging from what we see on our streets, in public assemblies and public conveyances—also of bird-wearing proclivities. Different individuals of this class vary greatly in their ideas of style and quantity in the way of what constitutes a proper decoration for that part of the person the Indian delights to ornament with plumes of various kinds of wild fowl. Some are content with a single bird, if a large one, mounted nearly entire: others prefer several small ones,—a group of three or four to half a dozen; or the heads and wings of even a greater number. Others, still, will content themselves with a few wings fancifully dyed and bespangled, or a wreath of grebe 'fur,' usually dyed, and not unfrequently set off with egret-plumes. In the average, however, there must be an incongruous assemblage made up of parts of various birds, or several entire birds, representing at least a number of individuals. But let us say that these 10,000,000 bird-wearers have but a single bird each, that these birds may be 'made over' so as to do service for more than a single season; and still what an annual sacrifice of bird-life is entailed! Can it be placed at less than 5,000,000?—ten

times more than the number of specimens extant in all our scientific collections, private and public together, and probably a thousand times greater than the annual destruction of birds (including also eggs) for scientific purposes.

"Fortunately, perhaps, the supply of bird-skins for decorative purposes is not all drawn from a single country, the whole world being laid under tribute. The ornithologist recognizes in the heterogeneous groups of birds on women's hats, met with on every hand, a great preponderance of North American species; but with them are many of the common birds of Europe, and a far greater variety from South America, and many from Africa, Australia, New Guinea, and India. But, on the other hand, it is well known that our own birds are exported in immense numbers to Europe; but, whether the exportation exceeds the importation, it is impossible to determine, from lack of proper statistics.

"With the foregoing facts before us in regard to the annual destruction of birds, it is no longer surprising that many species, and even genera, of birds, are fast disappearing from our midst. Considering that this slaughter has been waged for years, but with rapid increase year by year, is it not rather a wonder that so many birds are still left?

"The destruction of 40,000 terns in a single season on Cape Cod for exportation, a million rails and reed-birds (bobolinks) killed in a single month near Philadelphia, are facts that may well furnish food for reflection. The swamps and marshes of Florida are well known to have recently become depopulated of their egrets and herons, while the State at large has been for years a favorite slaughter-ground of the milliner's emissaries. The present winter parties organized and equipped in this interest are said to be prosecuting the same wholesale warfare against the birds at various points along the whole gulf-coast.

"But why, some may be supposed to ask, should the slaughter be interfered with? Does it not yield profit to many an impecunious idler, who receives so much per head from the 'taxidermist' for the freshly killed birds? Do not their preparation and manufacture into the gaudy or otherwise

untasteful hat-gear give employment to many a needy hand, and add materially to the milliner's gains? Why is not their use for personal decoration, *à la sauvage*, as legitimate and defensible as their use for food, with the added advantage of being able to utilize decoratively a great many species otherwise of no commercial value? Why should we be anxious to preserve our birds? Are they, when alive, of any practical value, or do they contribute in any way to our pleasure or well-being?

"In regard to the first of these inquiries, the men and boys really get little more in the average for the raw material than enough to pay them for their powder and shot: it is the 'sport' that affords them their real reward. The middlemen,—the skinners and manufacturers,—and an occasional professional gunner, make most of the profit, which must be more or less considerable to induce them to run the gauntlet of public opinion and the occasional risks of prosecution in their illegal enterprise. The milliner shares, of course, in the profits of the trade in such supplies; but, if birds were not used to such an extent, other and more fitting decorations would be adopted in their place, and their business would not suffer.

"Respecting the latter inquiries, birds may be said to have a practical value of high importance and an æsthetic value not easily overestimated. Birds in general are the friends of man, and it is doubtful whether a single species can be named which is not more beneficial than harmful. The great mass of our smaller birds, numbering hundreds of species, are the natural checks upon the undue multiplication of insect-pests. Many of them rarely make use of other than insect-food, while all, as shown by scientific investigations already made, depend largely or wholly, during considerable periods of the year, upon an insect-diet. Even the ill-reputed hawks and owls prey upon field-mice, grasshoppers, and other noxious insects or vermin, some never molesting the farmer's poultry, and others only exceptionally. In the present general summary of the subject, it may be sufficient to say, that, while the beneficial qualities of birds vary widely with the species, none can be set down as

proven to be unmitigatedly injurious. With the decrease of birds at any point is noted an increase of insects, especially of kinds injurious to agriculture. The relation of birds to agriculture has been studied as yet but imperfectly; but results could be cited which would go far to substantiate the above statement of their general utility. The investigation of the subject has now been systematically entered upon by the department of agriculture at Washington, under the supervision of experts especially fitted for the work.

"Birds, considered æsthetically, are among the most graceful in movement and form, and the most beautiful and attractive in coloration, of nature's many gifts to man. Add to this their vivacity, their melodious voices and unceasing activity,—charms shared in only small degree by any other forms of life,—and can we well say that we are prepared to see them exterminated in behalf of fashion, or to gratify a depraved taste? Says a recent writer, 'A garden without flowers, childhood without laughter, an orchard without blossoms, a sky without color, roses without perfume, are the analogues of a country without song-birds. And the United States are going straight and swift into that desert condition.'

"Indeed, as previously noted, there is already an encouraging recognition of that fact. Here and there bird-protective associations are being formed, and more care is taken to secure proper bird-protective legislation; but the public at large is still too apathetic, or too ignorant of the real state of the case, to insist upon, and support by proper public sentiment, the enforcement of legislative acts already on our statute-books. The American ornithologists' union has moved in the matter by the appointment of a large and active committee on bird-protection, which is at present bending its energies toward the diffusion of information among the people, in the hope of awakening a healthy sentiment on the subject, and is also working to secure not only more effective and intelligent legislation, but the proper enforcement of the laws enacted in behalf of birds. This, too, notwithstanding a recent writer in a popular magazine characterized ornithologists as being among the worst ene-

mies birds have, and to whose egg-collecting and bird-stuffing propensities was principally attributed the woful decrease of our song-birds!

"In England the same rage for hat decoration with dead birds has gone so far that anti-plumage-wearing societies have already been established by the more intelligent women of that country; and it has already been suggested, apparently independently of any similar action abroad, by ladies themselves, that the women of this country throw their influence in a similar way against the barbarous custom of using birds for personal decorations. Much could doubtless be done in behalf of the birds in this way; for, once let it come to be considered vulgar and in 'bad form' to thus decorate one's person, and the power of fashion would be a mighty weapon in defence of the birds.

"Of all the means that may be devised for checking the present wholesale bird-slaughter, the awakening of a proper public sentiment cannot fail of being the most powerful. Without this, all other means would prove, to a great degree, ineffectual. Laws, however good, cannot be enforced unless backed by public opinion. To arouse this, it seems only necessary to enlighten the community respecting the nature, the enormity, and the leading cause of this great evil."

It is with this object that the Union appeals to us as workers in Natural History—and asks for sympathy, encouragement and support; and to aid them to prevent the birds being exterminated by thoughtlessness, they ask us to endorse their work and to help them in drawing public attention to it, and thus to create a public sentiment in favor of the movement. Already in the larger cities of the United States, in New York, Boston, Philadelphia and Buffalo, and indeed all over the States, the movement is gaining rapidly, and people of all classes are becoming interested in it, and assisting to advance it.

Already the Natural History Society of Toronto have taken up the subject energetically and at their last meeting, it was moved by Mr. J. H. Pearce, and seconded by Dr. Brodie, the President, and carried:—

"That the President be authorized to issue a circular to the ministers of the various congregations of the city especially, and as far as possible of the Province, and ask them to bring to the notice of the ladies of their respective congregations, the subject of the slaughter of birds for millinery purposes, of which five to ten millions are ruthlessly and unnecessarily slaughtered every year to decorate their head-gear."

It would be an easy matter to cite instances of the extent of this bird decoration; as you walk in the streets you have only to look at the head-dress of the ladies and count the birds as you go along. Look in the milliner's windows, and you will be astonished, as I have been. A gentleman walking on Yonge street Toronto, last week, between Trinity Square and Wellesley street, counted no less than 38 whole birds on hats. not to mention all the wings &c. used as embellishments. "The assemblage of diverse and incongruous forms sometimes met with on the same hat is often striking in the extreme; birds from the opposite ends of the earth, and of the ornithological scale of classification, being brought into most inharmonious combination, viewed even from the artistic stand-point. Bearing on this subject, and illustrating the range of taste in such matters, as well as the extent to which birds are used for hat embellishment, may be given the following inventory, furnished by an ornithological friend; of what recently met his eye in a Madison Avenue horse-car in New York. The car contained thirteen women, of whom eleven wore birds, as follows: (1) heads and wing of three European starlings; (2) an entire bird (species unknown), of foreign origin: (3) seven warblers, representing four species; (4) a large tern; (5) the heads and wings of three shore-larks; (6) the wings of seven shore-larks, and grass-finches; (7) one-half of a gallinule; (8) a small tern; (9) a turtle-dove; (10) a vireo and a yellow-breasted chat; (11) ostrich-plumes. That this exhibition was by no means exceptional as to number or variety is obvious to any one who has given close attention to the ornithological displays one daily meets with in street-cars and elsewhere, wherever he may travel. Advertisements in newspapers, by milli-

ners, of the stock in hand, also give some suggestions of the extent of the traffic in wings and bird-skins; it being not uncommon to see thousands of wings(plain or fancy, in natural colors or dyed), as well as thousands of bird-skins (mounted or made up) and thousands of plumes (dyed or plain), advertised by a single dealer, while the dealers themselves number hundreds, if not thousands, in each of our larger cities. Add to these the smaller shops, in country and city, throughout the land, and we get at least some comprehension of the extent of the traffic in birds by the milliners, and the support they receive from the ladies of our population.

"Take up any daily or fashion paper, and one can see such items as the following, clipped from a New York newspaper of recent date: '[Miss———] looked extremely well in white, with a whole nest of sparkling, scintillating birds in her hair, which it would have puzzled an ornithologist to classify,' and '[Mrs. —— ——] had her gown of unrelieved black, looped up with blackbirds; and a winged creature, so dusky that it could have been intended for nothing but a crow, reposed among the curls and braids of her hair.' It is said, 'Where ignorance is bliss, 'tis folly to be wise.' Perhaps, if the lady in question could have seen the crow during its lifetime perched upon and feeding on the decaying carcass of a horse, she might have objected to the association.

"Respecting the traffic abroad, there were sold in one auction-store in London, during the four months ending April, 1885, 404,464 West Indian and Brazilian bird-skins, and 356,389 East Indian, besides thousands of Impeyan pheasants and birds-of-paradise. On the other hand, London *Truth* publishes an item showing the humanity of England's Queen: 'I am glad to hear that the Queen contemplates issuing a ukase censuring the barbarous fashion which so many women have lately adopted, of wearing the bodies of birds, or parts of their bodies, in bonnets and hats and on dresses. Her Majesty strongly disapproves of this practice, which of late has greatly increased, which is daily increasing, and which most assuredly ought to be abolished.' As

long as the ladies continue to demand bird-skins for ornamental purposes, so long will the gunners and taxidermists undertake to supply the market, therefore the initiative in the movement for the protection of birds must be with the 'wives, sweethearts, and mothers,' and not alone with the laws and lawmakers."

Time will not permit of my bringing before you for consideration more fully the questions of the destruction of the eggs of birds for food; the relation of birds to agriculture, (a most important consideration to Canadians) or the subject of bird laws, or laws for the protection of birds, or to make a more earnest appeal to the ladies in behalf of the birds, but before concluding I should like to call your attention to a society which has been formed in order to give an opportunity for definite and systematic effort by all those who believe that our birds ought to be protected. It is called "The Audubon Society" and is for the protection of American birds not used for food. To accomplish this purpose it will—

1. Secure and publish information to show the extent of the present enormous destruction of birds for millinery, decorative and other purposes.
2. Expose the outrageous and indefensible cruelty of such wanton taking of feathered life.
3. Point out the injury to the agricultural interests of the land which must certainly follow the decimation of the insectivores.
4. By thus presenting the subject in its ethical, humane and economic aspects enlist the sympathy and active personal co-operation of a large membership in the effort to check the evil.

Three forms of pledges have been adopted, viz.:—

1. To discourage the killing of any bird not used for food.
2. To discourage the robbing of any bird's nest or the destruction of its eggs.
3. To refrain from the use of any wild birds' plumage as an article of dress or ornament.

Certificates of membership are issued to those who subscribe to one or two or all of the pledges. There are no membership fees of any kind, the society being supported entirely by voluntary contributions.

In conclusion, I would re-echo the appeal of the American Ornithologists' Union, and say that so long as demand continues, supply will come. Law of itself can be of little, perhaps of no ultimate avail. It may give check, but this

tide of destruction it is powerless to stay. The demand will be met; the offenders will find it worth while to dare the law. One thing only will stop this cruelty—the disapprobation of fashion. It is our women who hold this power. Let them say the word, and hundreds of thousands of birds' lives every year will be preserved, and, until they do use their influence, it is vain to hope that this nameless sacrifice will cease before it has worked out its own end, and the birds are gone.

Those who wear them and give countenance to the fashion, doubtless do it thoughtlessly and without one moment's reflection as to the results. It is earnestly hoped that the ladies of Montreal may be led to see this matter in its true light, and to take some pronounced stand in behalf of the birds, and against the fashion of wearing them.

On Montreal Drinking Water.

By Arthur Weir, B.A.Sc.

During the session of 1885-86, while a student at McGill University, I made a series of determinations of hardness, chlorine, solids and free albuminoid ammonia in the drinking water furnished to this city, with the view of ascertaining how and to what extent these fluctuated from month to month. The determinations were made from November 1885 to March 1886, inclusive, and comprised in all fifty-one determinations of hardness, forty-eight of chlorine, forty-six of solids, ten of free ammonia and eleven of albuminoid ammonia. The following were the results obtained :—

CHLORINE.

The average quantity of chlorine during the period in question was 0.26 grains per gallon, the maximum being 0.40 on November 4th and 5th, and the minimum being 0.175 on the 23rd of the same month. Calculated as sodium chloride, this gives,

Maximum	0.659 grain.
Mean for the period	0.428 "
Minimum	0.288 "

RESIDUE.

Both suspended and dissolved matter are included under this heading; for the water was not filtered or allowed to settle previous to evaporation. Yet, notwithstanding this, the results show the water to have been fairly free from solid impurities. The average residue, calculated from the daily determinations, was 6.55 grains per gallon, the maximum being 9.3 on March 11th and the minimum 4.06 on January 11th. Wanklyn gives 40 grains of solids per gallon as the extreme quantity permissible for a drinking water,[1] and ours is evidently well within this limit.

It is not necessary to dwell upon the effect on the proportion of solid matter in running water of the country through which it runs and the gases it holds in solution. The river Loka, in the north of Sweden, flows over granite and other hard rocks, and contains but 0.0566 grains of solid matter per gallon.[2] The other extreme is seen in brine wells or other mineral springs. The water furnished to Montreal is partly St. Lawrence, partly Ottawa water and partakes of the nature of both. "The Ottawa drains a region of crystalline rocks, and receives from these by far the greater part of its waters." "The St. Lawrence * * * flows through lakes whose basins are composed of palæozoic strata which abound in limestone rich in gypsum and salt."[3]

The influence of the rock upon the water brought into contact with it is well shown in the case of the spring at the back of McGill College, which, deriving its water from the reservoir, has a hardness of 12.5, or about double that of the water before its percolation through the walls of limestone.

HARDNESS.

The hardness of a water depends, as is well known, upon the proportion of calcium and magnesium salts it contains,

[1] The Jordan, however, is used for drinking, although it contains 73 grains of solids per gallon.—Chem. Com. Life.

[2] Johnston, Chem. Common Life.

[3] Hunt, Geol. Survey Report 1853.

carbonates giving temporary and sulphates permanent hardness. Where the hardness of a water is considerable, it is often important to distinguish between that which is permanent and that which is only temporary; but where the hardness is low, as in Montreal water, such a distinction is, from an economical or hygienic point of view unnecessary.

Like the chlorine and solids and usually with them, the hardness fluctuated, but, as necessitated by the small proportion of solids, it was never large. The average for the period covered by my determinations was 4.63, a low result and one showing our water to compare favorably with that of other towns. The maximum was 6.7 on Feb 11th and the minimum 3.2 on January 12th.

NITROGEN.

The average quantity of nitrogen, estimated as ammonia, during January, February and March 1886 was 0.0031[1] parts free and 0.0194 parts albuminoid ammonia per million, the maximum and minimum for free ammonia being respectively 0.004 on several occasions and 0.0009 on March 4th, and the corresponding figures for albuminoid ammonia 0.03 on January 18th and 0.01 on February 25th.

FLUCTUATIONS.

The analyses showed from day to day and week to week, as was to be expected, certain variations in hardness, chlorine, residue &c., dependent chiefly upon the dilution of the water by rain and snow and the relative heights of the Ottawa and St. Lawrence.

These fluctuations were noteworthy in that the maximum was in every case more than double the minimum.

	Maximum.	Minimum.	Ratios.
Chlorine....	0.40	0.175	2.28 to 1
Hardness...	6.70	3.20	2.09 to 1
Residue....	9.30	4.06	2.29 to 1

[1] Or 0.0035 if the doubtfully high result for Feb. 18th (0.0074) be considered in striking the average.

FLUCTUATIONS IN HARDNESS.

The average hardness for November was 4.70 degrees Wanklyn, a little higher (5.12) in December, but lowest in January, the average for that month being only 3.77 degrees. In February the hardness was about the same as in November, namely 4.72, while in March the maximum was attained, the average for that month being 6.07 degrees.

FLUCTUATIONS IN CHLORINE AND SOLIDS.

As regards chlorine, the average was 0.264 grains to the gallon in November, but instead of rising in December like the Hardness, it fell to 0.243, became 0.235 in January and rose in February and March to 0.28 and 0.325 respectively.

The solid residue varied in a similar manner, sinking from an average of 6.83 grains per gallon in November through 6.70 in December to 5.23 in January, and then rising as regularly through 7.12 in February to 8.82 in March. Thus we see that the average results for the opening and closing months of the period were high, while those for January, the central month, were the lowest.

SUMMARY.

To sum up the results, the following was the average proportion of foreign matters in Montreal water during the time covered by the analyses :—

Hardness.....	Mean of 51	Determinations	4.63°	Wanklyn
Chlorine.....	" " 48	"	0.26	grs. per. gal.
Solids.....	" " 46	"	6.55	part per gal.
Free Ammonia	" " 9	"	0.0031	parts per mill.
Albuminoid Ammonia...	" " 11	"	0.0194	" " "

These results are calculated from the actual analyses and differ somewhat from those given by computation from the monthly averages, for the reason that the same number of analyses was not made each month. The average obtained in the latter way is, perhaps, the more accurate, as it tends

to neutralize the accidental advantage of the earlier over the later months. By this method alone can the four weekly determinations of March be made equal to the fifteen daily ones of November, as they should. The grand average corrected in accordance with this idea is given in the Table of Monthly Averages, which, with a Table of Daily Results, is hereto appended.

TABLE OF MONTHLY AVERAGES.

MONTHS.	Degrees of Hardness. Wanklyn.	Chlorine. Grs. per gal	Total Solids. Grs. per gal.	Free Ammonia. Per million.	Albuminoid Ammonia. Per million.
November ..	4.70	0.264	6.83	Not det.	Not det.
December.	5.12	0.243	6.70	"	"
January ..	3.77	0.235	5.23	0.0028	0.0250
February .	4.72	0.277	7.12	0.0040	0.0172
March....	6.07	0.325	8.82	0.00288	0.0155
Average.	4.876	0.269	6.94	0.00322	0.0192

TABLE OF ANALYSES OF MONTREAL WATER MADE BETWEEN NOV. 1st, 1885, AND APRIL 1st, 1886.

DAY.	DATE.	Hardness Wanklyn.	Chlorine. Grs. per gal.	Residue. Grs. per gal.	Free H_2N. Per million.	Alb. H_2N. Per mill'n.
Monday ...	Nov. 2	4.66	—	—	Not deter	mined.
Tuesday ...	" 3	5.5	.40	—	"	"
Wedn'sday.	" 4	4.8	.25	7.1	"	"
Thursday ..	" 5	4 8	.40	7.3	"	"
Monday ...	Nov. 9	4.8	.25	7.1	"	"
Tuesday	" 10	4.75	.27	7.7	"	"
Wedn'sday.	" 11	4 63	25	7.1	"	"
Monday ...	Nov. 16	4.7	.25	6.5	"	"
Tuesday ...	" 17	4.8	.20	6.6	"	"
Wedn'sday.	" 18	4 55	.30	6.1	"	"
Thursday ..	" 19	4 5	30	—	"	"
Monday ...	Nov. 23	4.5	.175	6.9	"	"
Wedn'sday.	" 25	4 5	.20	6.9	"	"
Thursday ..	" 26	4.5	.25	6.3	"	"
Monday ...	Nov. 30	4.5	.10	6.4	"	"
Tuesday ...	Dec. 1	4.5	.25	6.3	"	"
Wedn'sday.	" 2	4.5	.20	6.4	"	"
Monday .	Dec. 7	5.8	.20	6.4	"	"
Tuesday ...	" 8	5.7	.25	7.0	"	"
Wedn'sday.	" 9	6.1	.25	6.9	"	"
Thursday ..	" 10	4.6	.35	6.9	"	"

TABLE OF ANALYSES OF MONTREAL WATER.—(*Continued.*)

Day.	Date.	Hardness Wanklyn.	Chlorine. Grs. per gal.	Residue. Grs. per gal.	Free H_3N. Per million.	Alb. H_3N. Per mill'n.
Monday	Dec 14	5.0	Not det.	6.9	Not deter mined.	
Friday	" 18	4.8	.25	Not det.	"	"
Tuesday ...	Dec. 22	5.1	.20	Not det.	"	"
Tuesday ..	Jan. 5 '86	5.0	.25	5.9	"	"
Wedn'sday.	" 6	4.7	.25	5.7	"	"
Thursday ..	" 7	4.7	.25	5.7	"	"
Monday ...	Jan. 11	3.5	Not det.	4.06	Not det.	.028
Tuesday ..	" 12	3.2	.20	4.76	"	Not det.
Wedn'sday.	" 13	3.1	.25	6.3	"	"
Thursday ..	" 14	3.4	.20	6.3	.00266	.022
Monday ...	Jan. 18	3.6	.25	5.3	.00372	.030
Tuesday ..	" 19	3.5	.25	4.4	Not deter	mined.
Wedn'sday.	" 20	3.6	.20	4.5	.00200	.020
Thursday ..	" 21	3.6	.25	4.9	Not deter	mined.
Monday ...	Jan. 25	3.5	.20	5.1	"	"
Wedn'sday.	" 27	3.5	.25	4.7	"	"
Thursday ..	" 28	3.6	.25	5.7	"	"
Monday ..	Feb. 1	3.6	.20	5.7	"	"
Wedn'sday.	" 3	3.9	.30	6.7	"	"
Thursday ..	" 4	3.9	.25	6.7	.00400	.020
Monday ..	Feb. 8	4.5	.25	7.5	Not deter	mined.
Wedn'sday.	" 10	5.0	.30	7.5	"	"
Thursday ..	" 11	6.7	.35	7.8	"	"
Monday .	Feb. 15	5.0	.30	7.1	"	"
Thursday ..	" 18	5.0	.30	7.2	.00746	.0216
Thursday ..	Feb. 25	4.9	.25	7.9	.00400	.010
Thursday ..	Mar. 4	5.5	.30	7.8	.00092	.016
Thursday ..	Mar. 11	6.0	.35	9.3	.00400	020
Thursday ..	Mar. 18	6.4	.30	9.0	.00260	.012
Thursday ..	Mar. 25	6.4	.35	9.2	.00400	.014

Note.—On May 5th and 15th two determinations were made with the following results:—

Thursday ..	May 5	3.0	0.25	6.90	0·0035	0.015
Thursday .	" 15	3.0	0.20	5.90	0.0040	0.018

POLYEMBRYONY.

BY D. P. PENHALLOW, B.Sc.

According to Strasburger,[1] polyembryony, as it occurs in *Funkia, Allium, Nothoscordum*, oranges, &c., arises from adventitious outgrowths, which, originating in the nucleus external to the embryo-sac, ultimately penetrate the latter and then form true embryos, although independently of fecundation. They therefore represent, according to Gray, instances of true parthenogenesis. More recently, Guignard[2] has shown that polyembryony is not uncommon in the Mimoseæ; while B. Jönossn[3] points out a similar case in *Trifolium pratense*, which he ascribes to the development of several ovum cells in the same embryo-sac.

Although the common occurrence of polyembryony in oranges is well known, a very interesting instance of its frequency in certain varieties was recently brought to notice.

Among several hundred seeds planted, it was observed that in the Florida oranges of the more common sorts, and the ordinary Spanish oranges, polyembryony was comparatively of little frequency, but in the Tangierine, its occurrence was most marked. In transplanting some young trees on the 26th of April, then about three weeks old, opportunity was taken to note the number of plants to each seed. Of all those examined, only six were found to have produced a single plant, while all the others had produced from three to four plants each. The following is a summary of the results obtained :—

Whole number of Seeds	38	
Seeds producing one plant	6	= 15.8 p. c.
" " two plants	19	= 50 "
" " three "	9	= 23.7 "
" " four "	4	= 10.5 "

[1] Am. Jour. of Science, 1879. xvii, 334.
[2] Bull. Soc. Bot., 1881. xxviii. 177.
[3] Bot. Notiser, 1883. 135.

Proceedings of the Natural History Society.

The Fifth Monthly Meeting of the session took place on Monday evening, March 29th, 1886.

Sir William Dawson, the President, occupied the chair.

The minutes of the previous meeting and also those of the last council meeting were read and approved.

Donations to the Library were announced: from Dr. Wolfred Nelson, of Panama, of a book containing over a hundred photographs taken by him in Guatemala; from Thomas Macfarlane, Esq., of Ottawa, of a bound copy of his papers "On the primitive formations in Norway and Canada" and other subjects; and from E. T. Chambers, Esq., of a copy of "Lettres sur Les Roches du Jura," by Jules Marcou. For these donations votes of thanks were passed.

The President called attention to the rather unfavorable tenor of the Hon. J. G. Robertson's letter in response to the petition for a renewal of the Government grant.

The first paper of the evening was then read by A. T. Drummond, Esq., on "Our North-west Prairies, their Origin and their Forests," which elicited remarks from Sir William Dawson, Charles Gibb, Alex. McGibbon and others.

Professor Penhallow followed with Dr. Robert Bell's article on the Forests of Canada, when further criticism of both papers took place.

The thanks of the Society were tendered to both authors for their valuable communications.

The Sixth Monthly Meeting was held on Monday evening, May 3rd, 1886, Dr. Harrington occupying the chair.

The minutes of the meetings of 29th March and 26th April were read and confirmed. The minutes of council meeting of April 19th were also read.

Regarding the grant, Mr. J. A. U. Beaudry reported the receipt of a private communication from the Premier of the Province, intimating that the petition of the Society would have his personal attention and hoping to secure at least a portion of the sum asked for.

Alfred Henry Mason, Esq., was elected a delegate to represent the Society at the annual meeting of the "Royal Society of Canada" at Ottawa on May 25th, 1886.

John S. Shearer and Wm. T. Costigan were re-elected auditors.

It was resolved that the annual Field Day excursion should take place to Belœil Mountain, St. Hilaire, on the 5th or 12th of June, whichever day was considered the more suitable by the excursion committee.

A valuable donation of pottery from Dr. Wolfred Nelson, of Panama, was exhibited on the table, and on motion it was resolved that a hearty vote of thanks be conveyed to Dr. Nelson and that the corresponding Secretary should request him to favor the Society with a copy of his field notes on the collection.

Dr. T. Sterry Hunt presented a copy of each of his works entitled "Chemical and Geological Essays" and "Azoic Rocks of South Eastern Pennsylvania," the receipt of which were highly appreciated.

Mr. Charles Robb also presented a geological chart and several pamphlets to complete missing parts of serials belonging to the Society, for which a vote of thanks was passed.

Mr. Alfred Henry Mason then read a paper on the "Protection of North American Birds," at the close of which a vote of thanks was given to him.

The following resolution, prepared by Mr. Mason, was then unanimously adopted: "That the members of the Natural History Society of Montreal endorse the work of the 'American Ornithologists Union' for the protection of North American birds, and sympathize with their endeavours to prevent the destruction of birds for millinery and decorative purposes, and will use their best efforts to call public attention to the evil, and to bring about its suppression."

The chairman then read Mr. C. N. Bell's paper on the "Aboriginal Trade of the Canadian North-west" and a short communication from Prof. Penhallow on "Polyembryony."

The Annual Meeting of the Society took place on Monday evening, May 31st, 1886, the President, Sir J. William Dawson, in the chair.

The minutes of the last annual meeting and of the previous monthly meeting were read and approved. The minutes of the last council meeting were also read.

Rev. John Nichols was proposed as an ordinary member and Bertie Nichols as a junior member.

Dr. J. A. Beaudry was elected a member of the Society.

The President's annual address was next delivered.

ADDRESS OF THE PRESIDENT, SIR J. WILLIAM DAWSON, C.M.G., F.R.S.

We close, this evening, what may be regarded as a successful session of the Natural History Society of Montreal, which has now been pursuing its useful work for fifty-four years. In the past session our museum has been cared for and augmented. Our library has been arranged and catalogued. Our monthly meetings have been well sustained, with larger attendance than in some previous years, and with valuable and instructive papers. The RECORD OF SCIENCE has been regularly issued and circulated, and, as usual, has been truly a record of scientific progress and discovery. The Society has contributed to popular education by its course of free lectures, and financially we are in a solvent condition. Most of these matters will be brought under your notice in detail in the various reports to be presented this evening. The only one which it falls to me to discuss in this address is the scientific work of the Society. Before entering on this, however, I would pause to make two suggestions. One is to wealthy citizens disposed to aid in the diffusion of popular science. The Sommerville endowment has hitherto been the only one in Montreal intended to promote absolutely free popular scientific lectures. In this it has borne good fruit, since we have had on this endowment every year, for nearly half a century, a course of lectures of a high scientific character, many of them equal to those of any scientific course in the world, to which all of our citizens have had free access. It is not easy to esti-

mate the amount of good which has thus been done. At the same time it is certain that an endowment of equal or greater amount added now would increase the number of lectures, improve the means of illustration and enable the Society to secure the services of eminent lecturers from abroad. There is here a good field for the exercise of enlightened liberality. My second suggestion has reference to our journal, the RECORD OF SCIENCE. This is conducted under some difficulties. Even in older and richer countries such journals are rarely paying enterprises. Here they must necessarily be conducted at some loss, even though the work of writing and editing is done gratuitously; and but for the aid which we have received from the Provincial Government, in consideration of our circulating copies abroad, the publication must have been abandoned. I trust that some measure of public assistance will be continued to this useful work, and I would put it to the members of the Society and to all our citizens that they should at least be subscribers to this oldest and most important Record of Canadian Science. I have reason to know that this periodical has been the chief book of reference to naturalists abroad in relation to the natural history and geology of Canada. Its nineteen volumes are a mine of information on these subjects, and it is by no means inferior now to what it was in former times. But it is not sufficiently large to accommodate all the matter which deserves publication. It cannot afford sufficient illustrations, and its expense has to be curtailed in several undesirable ways. A larger subscription list would greatly tend to remedy these evils.

Turning now to the scientific work of the Society, I find that of thirteen papers contributed last session, five were on geological subjects, three ethnological, one chemical and the remainder biological.

Of our geological papers, three related to the more recent periods. Two of them directed our attention to the glacial phenomena and fossils of the Pleistocene beds of the Lower St. Lawrence and of Anticosti. We have, in the terraces and varied beaches of these districts, the evidences of a deep submergence, and extensive drift of boulders over the coun-

try at a time so recent that the existing shells, fishes and cetaceans were already living in our waters, and under a climate so severe that our hills were mantled with snow and ice. Such facts present to us a truly wonderful record of geological and climatic change. The communication of Col. Grant on Anticosti was of especial interest, both on account of the position of that island and of the comparative want of information respecting it. As might be expected, the appearances were altogether those of marine glacial deposits. Along with these papers I would place that of Mr. Drummond on the origin of prairies, at a time when the glacial subsidence and cold had passed away, and when swamps and forests were taking the place of ice-laden seas, and were themselves passing into the dry prairie condition of the present time. Under the same geological head we may also place Dr. Harrington's paper on new discoveries respecting Canadian minerals, which directed our attention to the fact that there are new chemical and crystallographic points to be ascertained by careful and accurate observation even with reference to well known mineral species, and which lead to interesting comparisons with the minerals of other countries.

Curiously enough, two of our ethnological papers were not on Canadian ethnology, but on the origin and physical characters of the Ainos of Japan, whom Prof. Penhallow had an opportunity to study during his residence in that remarkable country. The Ainos are a primitive race, allied apparently more nearly to the older European peoples than to the Turanians of eastern Asia, and suggesting that in Japan the order of succession of races seems to have been the reverse of that in Europe and western Asia, a fact which, if conclusively established, would have important bearings on our views of ethnology. We had also, however, a communication from a correspondent in the West, Mr. C. N. Bell, on the mounds of our North-western territory, which seem to show that these industrious races of primitive Indians who cultivated the valleys of the Mississippi and Ohio, and worked the copper mines of Lake Superior, were early colonists of the plains of the North-west. These

mounds will furnish worthy objects of exploration to the archæologists of the western Provinces of Canada, whose special property they are, and on whom devolves the duty of their scientific study.

We are indebted to Dr. Edwards for a very full account of the various and insidious ways in which arsenic is introduced in injurious quantity into the human system, and to Prof. Penhallow for two important papers on new points of vegetable physiology. Dr. R. Bell gave us the results compiled from various sources as to the distribution of Canadian forest trees, so important to this country, in many practical ways, as well as the chief ornament of our hills and valleys. Mr. A. W. MacKay, of Pictou, Nova Scotia, has recently studied with much success the fresh-water sponges of that Province and other parts of Canada, some of which were described in our journal several years ago by Dr. Bowerbank and by Dr. G. M. Dawson, and Mr. MacKay has very properly favoured us with the very valuable and large additions which he has made to previous knowledge.

The subject of the destruction of small birds for purposes of ornament is one that has recently attracted much attention in the United States. Naturalists there seem indeed to be alarmed lest our feathered songsters should be altogether sacrificed to the exigencies of ladies' bonnets. The quantity of birds destroyed for such purposes seems to be enormous, though perhaps the fears which have been entertained may be somewhat exaggerated. The powers of multiplication of these creatures are great, but there can be little doubt that in some localities their numbers have been seriously thinned, and while we lose the pleasure derived from their beauty and their songs, we lose also the advantage of their services in the destruction of injurious insects. Our laws in the Province of Quebec provide for the protection of small birds, and in many places at least are fairly well enforced; but we are deeply interested in the question as it affects the United States. Our birds are migratory. They spend their winters in the South, and if they are not protected in the districts through which they pass in spring and autumn and in which they winter, our summer fields and woods will be

slenderly peopled. It was well therefore that Mr. Mason directed our attention to this subject, and especially to the circular issued by the American Ornithologist's Union, with whose action in the matter we can cordially sympathize.

It is proper to add that much important matter has been published in the Record which has not been read, except by title, at our monthly meetings; but the subjects I have already treated of are sufficient to show that we have not been altogether idle. There is, however, still vast scope for our exertions, and a great many fields to be cultivated in which our younger members more particularly might benefit our country and distinguish themselves. In relation to this they should bear in mind that we do not exact lengthy and profound papers. Any notes, however short, relating to new facts in natural history or useful application of those already known, will be acceptable to the Society, since it often happens that important discoveries are overlooked and irretrievably lost to science, because no attention has been paid to the matter of bringing them under the notice of those who can appreciate their value. Our monthly meetings also are of much greater interest than one would infer from the moderate number of members usually present. We have in most of these meetings several subjects under discussion, some of them illustrated by specimens, and it not unfrequently happens that lively and interesting discussions follow the reading of our papers. Nor is the benefit of our regular meetings confined to members, since our rules allow members to introduce their friends, whether ladies or gentlemen, and we shall welcome any who think it proper to favour us with their presence at these meetings.

It has been suggested, and I hope this suggestion will receive the attention of the council, that next winter we should resume the practice of inviting our fellow-citizens to a conversazione in our rooms. These meetings have in former years been very attractive, and may, I think, be renewed with advantage to the Society and to the interests of science. They constitute a legitimate means of attracting to scientific pursuits, and more especially of imbuing the young with a taste for the study of nature, while they

cultivate friendly relations between those who already take an interest in scientific subjects.

The report of the chairman of the council was next read by Mr. J. S. Shearer, as follows :—

REPORT OF CHAIRMAN OF COUNCIL.

The Council of the Natural History Society desires to submit the following report concerning the work done since the last annual meeting. There have been six meetings of the Society and twelve meetings of the Council held during the year just closed.

The Council is pleased to report satisfactory progress. Since the last annual meeting there have been elected one honorary, one corresponding, and sixteen ordinary members.

The Society has recognized the valuable services of Dr. Asa Gray, the celebrated botanist, by electing him an honorary member, and the Hon. Thos. White has been elected a corresponding member on the occasion of his departure from Montreal. The Council, however, whilst acknowledging the support that the Society has received in the past, believes that if its claims were more forcibly urged upon the citizens during the session of 1886-7, there would be a large increase in the membership. Such action, in fact, has become absolutely imperative, as it is upon increased membership that the welfare of the Society largely depends in the future.

The museum has been well patronized, having been visited by over 1,500 persons.

The proposal to improve the interior arrangements of the building has engaged attention during the year. A new light has been placed in the Hall, and other alterations made at considerable expense. The ventilation of the hall demands attention, and certain improvements in this connection will require to be made during the month of June.

The necessity of a complete re-arrangement and classification of the books in the library has long been felt, and with a view to having this accomplished, the Council took action in September last, and Mr. Chas. Robb was engaged to prepare a classified catalogue of all the books, periodicals and

pamphlets in the library. This work is now completed, and it is the intention of the Council to publish the catalogue as the funds will permit. The Council would recommend, in the meantime, that works printed or purchased should be added to the list as soon as received, in order that when the catalogue is printed it will not be necessary to make a new classification.

The revision of the by-laws has also taken practical shape during the past session, and the Council at its last meeting appointed Sir William Dawson and Messrs. Geo. Sumner and P. S. Ross, a committee for this purpose. The committee at once entered upon its work with the utmost zeal, and in February a draft of the revised by-laws was submitted to the Society, and immediately adopted and ordered to be printed. The printed copies can now be obtained by subscribers.

The Editing Committee is to be congratulated on the efficient, prompt and admirable manner in which they have issued the RECORD, and the thanks of the Society are due to them for their arduous labours in the face of many difficulties.

The Council petitioned the Local Government again this year for a renewal of the grant to the Society, and is not without hope that the Government will soon see its way clear to a favorable consideration of the petition, so that the Editing Committee may be enabled to do its work efficiently.

The Field Day has always been one of the most enjoyable features of the Society, and this year proved no exception. Owing to the kind invitation of Mr. Chas. Gibb, of Abbottsford, Yamaska Mountain was this time selected, and on the fourth of June last, a party, numbering 120 persons, left the city by the South-eastern Railway to enjoy the day's outing. On their arrival, Mr. Gibb, who, with his characteristic hospitality, had invited the entire party to be his guests for the day, personally received and conducted them to his residence where ample refreshments were provided and partaken of. The party then divided into three portions and started for their respective pursuits. At half-past four they all reassembled to partake of refreshments again, after which the prizes were awarded. There were eight entries in the botanical department, which was divided into two sections, one

for "named" and one for "un-named" plants. The first prize in the "un-named" was awarded to Miss A. Van Horne, who succeeded in securing forty-six varieties of plants. Miss Ritchie took second prize with forty-three varieties. In the named section, Mr. E. H. P. Blackadder, who had collected forty-eight specimens, carried off the first prize, and Miss F. M. Girdwood took second prize with forty-five specimens. In the Entomological department Mr. R. C. Holden obtained first prize, and Miss Rose Edwards took second honours.

The proceedings were brought to a close by addresses from from Sir J. W. Dawson, and Dr. Hunt. The party departed from Abbottsford at six o'clock, and arrived in the city at nine, after having passed one of the most enjoyable and instructive exploring days in the annals of the Natural History Society. The success of the event was largely due to Mr. Chas. Gibb, who was untiring in his exertions, and whose services were deservedly recognized by the Council in a special resolution of thanks at its meeting in June.

The Society has decided to hold its next Field Day at St. Hilaire, on the 5th of June, and it is hoped that it will be as successful as the last.

The Sommerville lectures—seven in number—were delivered in the following order:—Feb. 4th, "Antiseptics and Disinfectants," by Alfred H. Mason, Esq, F.C.S., F.S.Sc.; Feb. 11th, "The Chalk Formation," by Rev. W. J. Smyth, M.A., Ph. D.; Feb. 18th, "The Source of Igneous Rocks," by Thos. Macfarlane, Esq., F.R.S.C.; Feb. 25th, "The Chemistry of Bread and other Farinaceous Foods," by Casey A. Wood, C.M., M.D.,; March 4th, "Cotton and Cotton Manufactures," by William Hobbs, Esq.; March 11th, "Breathing and Ventilation," by J. B. McConnell, M.D.; March 18th, "The History of a Modern Volcano," by Sir William Dawson, LL.D., F.R.S.

The attendance at the lectures was large, and the thanks of the Society are due to the gentlemen who favoured the public with such an interesting series.

The Council takes great pride in being able to record the election of our worthy President, Sir J. William Dawson, to

the Presidency of the British Association for the Advancement of Science, which meets in Birmingham this year, and whose session will therefore be watched with the greatest interest by Canadians.

The Council in conclusion ventures to express the earnest hope that the Society in the near future will receive the abundant support of the public.

The Report of the Honorary Curator, Mr. A. H. Mason, was then read.

REPORT OF HONORARY CURATOR.

The following donations have been made to the Museum during the session of 1885-86:—

Presented by	
John H. R. Molson, Esq.	Teeth of Carcharodon, " " Oxyrhina, and Vertebræ of Fishes, found in the Phosphate (Eocene) Beds near Charleston, South Carolina. Egg of an Alligator, from Jacksonville, Florida.
T. D. Watson, Esq., through Dr. T. Sterry Hunt.	Specimen of Walking-stick, *Spectrum femoranthum* (Say). A dipterous Insect, (*Pyrgota undata*) (Weidman).
Wm. G. Oswald, Esq.	A curiosity of vegetation in the form of a natural budding or grafting by the interlacing of Beech-root branches.
Dr. Wolfred Nelson.	A series of Photographs made in the Republic of Guatemala, in Central America. A Collection of Central American Pottery.

The work of re-arranging and classifying the American birds is nearly completed, the specimens being arranged, and only labelling requiring completion. The work has been done according to Ridgeway's American Classification which is that adopted by the Smithsonian Institution.

It is proposed during the recess to complete a catalogue of the objects in the Museum, and to label the different departments in a more conspicuous manner. By this means it is hoped that greater interest will be taken in the museum by the general public and visitors to the city, it being a

matter of regret to your Committee that so few avail themselves of the privilege offered.

If some arrangement could be arrived at by which the Janitor may present an appearance more in accordance with the idea that he is the person to show visitors over the museum, during the hours which it is open to them, than is now provided, it might add to the credit of the Society, or if a telephone was added to the building by which means the Hony. Curator could be communicated with in case any visitor of importance called, it might be one remedy. Such an addition would facilitate also the convenience of other officers, enabling them to spend more time on the premises, if they knew they were within call elsewhere.

I would also suggest that a visitor's book be provided, and every person visiting the Museum be required to sign it.

The report of the Library Committee was next read by Mr. J. A. U. Beaudry, being as follows:—

ANNUAL REPORT OF THE LIBRARY COMMITTEE.

Your committee have to report that although the meetings held during the session have not been very numerous, considerable progress has been made in improving the condition of the library. The meetings have been characterized by the utmost unanimity, mutual good-will and devotion to the interests of the Society, and although the work of arrangement is not yet complete, the results, so far, can scarcely fail to prove satisfactory.

Agreeably to instructions, and with the funds placed at our disposal for the purpose by the Council, a classified Catalogue of the books and pamphlets has been prepared by Mr. Charles Robb, who has been assiduously occupied during the last three or four months with this work, and is still engaged in the arrangement of the books on the shelves of the library. Unfortunately, owing to the great number of missing parts and of volumes not yet bound, this work has been greatly retarded; but steps have been taken to complete, as far as possible, and at the least expense, the sets of the more important scientific periodicals; and a contract was given out, at the last meeting of the

committee, for binding such as can be completed, as well as some other volumes urgently requiring it.

The stipulated amount for preparing the catalogue has been paid; but that for arranging the books on the shelves &c., replacing the missing parts and superintending the binding has not yet been settled, as the work is still in progress. The committee have also called for tenders for printing the catalogue, and the proposals have been submitted to the Council.

Mr. Robb reports that the number of books in the library, including those about to be bound, is upwards of 3,000, and of pamphlets which it is not at present intended to bind, about half that number in addition. It is proposed to classify and deposit the unbound pamphlets in cases which have been ordered for the purpose.

Apart from the current scientific periodicals, which are very fairly represented, there is in the library a very considerable number of rare books, chiefly valuable for their antiquity, which have hitherto been, for the most part, buried in the lower cases, but are now transferred to the shelves and may prove an attractive feature.

A list of duplicates in the library, consisting of 13 volumes, bound or in boards, and 284 pamphlets and parts of periodicals has been printed; and a list of deficiencies has been prepared, so as to enable the Society to dispose of the duplicates and to fill up the deficiencies by purchase or exchange as the case may be. Mr. Robb is now engaged in distributing these lists.

Your committee have not yet prepared the regulations for the use of the books in the library, as their arrangement in the shelves is not yet complete; and it has been thought advisable to defer the matter until the new committee shall have assumed office, when they could probably be printed in their appropriate connection with the catalogue.

The following is a list of donations to the library during the session now coming to a close, not including, however, the parts or numbers of scientific periodicals, transactions &c., usually received in exchange for the "Record."

LIST OF DONATIONS.

From the U.S. Department of the Interior—Geological Survey, Monographs Vols. III. V. VIII.
Two Atlases.
Third, Fourth and Fifth Annual Reports.
Mineral Resources for 1883-84.
Older Mesozoic Flora of Virginia.
International Polar Expedition to Alaska.
Smithsonian Institution.—Report for 1883.
Bulletin of U.S. Fish Commission 1885.
British Association.—Report of Montreal Meeting, 1884.
Montreal Committee.—Canadian Economics.
H. Carvell Lewis Esq.—"On Marginal Kames."
"On the discovery of a Mastodon's Remains."
"On the Progress of Mineralogy."
"On a great Trap Dyke in S. E. Pennsylvania."
Brookville Society of Nat. His.—Bulletin.
Dr. Perisfor Fraser.—"Archaean-Palæozoic contact near Philadelphia."
Dr. G. M. Dawson.—"Superficial Deposits in vicinity of Bow and Belly Rivers."
J. A. U. Beaudry Esq.—Cassil's Natural History and 3 vols. Engineering News.
28 Blue books, Reports of Goverment Departments &c.
Dr. T. S. Hunt.—"Chemical and Geological Essays."
"Azoic Rocks and Trap Dykes of S. E. Pennsylvania."
Thos. Macfarlane Esq.—A collection of Essays and Reports in bound volume.
E. T. Chambers Esq.—Marcou on the Rocks of the Jura. 2 vols.
J. H. Bartlett Esq.—"Manufacture and Statistics of Iron and Coal in Canada."
Charles Robb Esq.—Explorations and Surveys, Railroad Mississippi to Pacific. Vol. XI.
Figures and Descriptions, (Decades) Hall's Graptolites. 3 vols.
Transactions American Inst. Mining Engineers. 3 vols.
Mr. Walter Shanly's Report on Ottawa and French River Navigation.
Sir W. Logan's Esquisse Geologique du Canada. Full bound.
Chart of Geological Formations. Mounted on cloth.
Hind's Report on the Waverley Gold district, Nova Scotia.
Desor on the retrocession of Niagara Falls, with plates.
Newfoundland Geological Survey Reports.
Sir Wm. Dawson's Air-breathers of the Coal period and 4 other pamphlets.

Index and Maps to Pallisser's Report on the North West.
Cox's Report and Atlas of Geological Survey of Indiana.
David Dale Owen's do do Wisconsin.
Foster and Whitney's do Lake Superior.
Thomas Macfarlane "To the Andes."
Richard Brown "Coal Fields and Coal Trade of Cape Breton."
Walter Johnson on American and B. N. A. Coals. 2 vols.
Sandford Fleming's Intercolonial Railway Report.
T. C. Keefer's Miscellaneous Reports, Lectures &c. 2 vols.
Atlas to "Geology of Canada 1863."
Proceedings of Nova Scotia Institute. 6 parts.
Dr. Hingston.—On the Climate of Canada.
John Macoun Esq.—Catalogue of Canadian Plants.
Geological Survey.—Report of Progress for 1882-83-84, with maps of Canada.
Label List of Insects of the Dominion of Canada.
"Osteology of Alma Calvia."

The following Report of the Editing Committee was then submitted :—

REPORT OF THE EDITING COMMITTEE.

During the past year, the work of the Editing Committee has presented somewhat more than the usual duties. Upon assuming office in May, 1885, the editors found the RECORD OF SCIENCE in a somewhat neglected condition, and showing a serious arrearage of regular issues.

During the summer, however, all the numbers of the first volume were brought up to date, and with the October number, the Journal began to appear at the proper time. Owing to the many changes required in the first four numbers, it was deemed wise to make the first volume contain four numbers only, and commence the second volume with the January issue of the present year. Several changes have been made in style and general appearance, all of which, it is hoped, will commend themselves to the Society and to subscribers.

Under arrangements with a new publisher, the work has been much more promptly and satisfactorily performed, and so long as equal satisfaction is given, the Committee would

urge no further change in this direction. It was also found desirable to relieve the regular Committee of the burden of editorial work, for which purpose a paid editor has been employed. In most respects, this plan has proved satisfactory, though it will doubtless be well to further modify and improve the working of the Committee in this direction, particularly if additional funds become available.

An effort has been made to offset a certain portion of expense of publication, by the insertion of advertisements. Very little encouragement has been met with, or is to be hoped for in this direction, the three advertisements so far obtained, not returning very large profits.

One of the most important works of the Committee has been in extending the list of exchanges. Many former exchanges were found to have dropped off entirely. Most of these have once more been placed on our list and are regularly received, while a large number of new ones have been added, so that the list now embraces 178 regular exchanges in all parts of the world including some of the most important scientific journals published.

The work of the Society was chiefly represented in the publication of the RECORD OF SCIENCE, and the Committee trust every effort will be made to continue its publication under competent management. It has been our endeavour to make it a representative Journal of Canadian Science, but the very many difficulties encountered, have often rendered it impossible to properly approach this ideal. One of the great difficulties is found in securing papers of a proper character. This might be overcome, to a large extent, were the incoming editorial committee to be composed of a paid editor, who should be primarily and chiefly responsible, and and four associate editors representing different branches of Science. The work of necessity falls upon one or two at most, before the printer is reached, and it is most desirable that every editor, or associate editor, should be capable of passing judgment upon articles in his particular department, as well as able to contribute original articles.

The Treasurer, Mr. P. S. Ross, then read the following Report :—

Report of Treasurer.

Annexed I beg to present a detailed statement of the financial affairs of the Society during the past year.

The year commenced with a balance on hand of $267.41 and ends with cash in hand amounting to $232.44, but there are outstanding accounts which will absorb this balance.

The subscriptions from members show a list of one hundred and thirty paying members.

The excursion of 1885 yielded a surplus of $35.50, besides a sum of $20 specially donated, to be distributed in prizes among the excursionists.

The rent from the rooms has been largely in excess of that obtained in previous years.

A special subscription list for binding books for library purposes has been opened, and so far about $55 have been subscribed, which, it is hoped, will be materially increased. It will be observed that the publication of the Record of Science makes a considerable draft on our funds, and in addition to the amount shown in the statement, there are outstanding claims against it of about $200.

Annual Statement of Treasurer (Mr. P. S. Ross) for 1885–6.

Receipts.

Balance from last year		$ 267 41
Rents	$ 919 00	
Subscriptions	515 00	
Excursions $160.50; less paid out $125.00	35 50	
Donations—Excursions, Joseph $5, Dawson $5, Molson $10 ..... $20.00		
Less paid for prizes $20.00		
Do. Binding	10 00	
Do. Plumbing per Costigan	6 40	
Life membership, G. Sumner	50 00	
		$ 1,535 90
		$ 1,803 31

DISBURSEMENTS.

Printing and advertising	$ 181	98
Taxes	137	30
Repairs $170.81; less allowed by church $30	140	81
Tools	23	45
Fuel	110	40
Light	72	60
Insurance	15	00
Salaries, commissions and office charges, J. Potts $282.20, J. Foote $34.48, sundries $28	344	68
Record of Science, salary of editor	121	55
Do. printing	185	00
Catalogue for library per C. Robb	50	00
Furniture, chairs purchased	9	00
In hands of caretaker for petty expenses	25	00
Postage, stationery, &c	92	17
Cleaning, per caretaker's account	37	75
Sundry petty expenses	18	68
Freight on books	5	50
Balance on hand	232	44
	$ 1,803	31

Audited and found correct.

J. S. SHEARER,
W. T. COSTIGAN.

It was resolved that the foregoing reports be received, adopted and printed in the RECORD OF SCIENCE.

The President called upon Messrs. W. F. Ferrier and F. B. Caulfield to act as scrutineers.

On motion, the rules were suspended, and Sir J. William Dawson, re-elected President by acclamation.

The rules were further suspended when Alfred Hy. Mason was re-elected Honorary Curator, P. S. Ross, Honorary Treasurer, Professor Penhallow, Honorary Corresponding Secretary, and William T. Costigan, Honorary Recording Secretary.

On a ballot being taken for Vice-Presidents, the following gentlemen were declared elected:—

T. Sterry Hunt, LL.D., F.R.S., Sir D. A. Smith, J. H. R. Molson, J. H. Joseph, Edward Murphy, B. J. Harrington, Ph. D., F.R.S.C., W. H. Hingston, M.D., D.C.L., J. Baker Edwards, Ph. D., D.C.L., and Major L. H. Latour, M.A.

The ballot for members of Council resulted as follows:—

J. S. Shearer, Geo. Sumner, Joseph Bemrose, J. A. U. Beaudry, M. H. Brissette, A. T. Drummond, J. T. Donald. J. B. McConnell, M.D., and Rev. Robert Campbell, M.A.

The Library Committee was elected as follows:—

J. A. Beaudry, H. R. Ives, E. T. Chambers, F. B. Caulfield and J. H. Burland.

The President complimented the retiring officers on the efficient manner in which they had performed their duties.

On motion, an enthusiastic vote of thanks was passed to the President.

The chairman of the Excursion Committee roported the completion of arrangements for the Annual Field Day at Belœil Mountain on June 5th, 1886.

ANNUAL FIELD DAY.

The Annual Field Day of the Society was held on Saturday June 5th. The field days are always made the occasion of a very enjoyable outing for members and their friends, but that on Saturday was, in the opinion of those present. one of the most successful ever held under the auspices of the Society. The destination this year was Belœil Mountain, and about 150 ladies and gentlemen, including not only members of the Natural History Society, but also several members of the Montreal Microscopic Society availed themselves of the opportunity which the excursion and the delightful weather of Saturday afternoon afforded them of spending a pleasant day in the country, combining recreation with scientific research. The party left the Bonaventure depot shortly after nine o clock, among those present being Very Rev. Dean Carmichael, Dr. T. Sterry Hunt, Prof. B. J. Harrington, Dr. J. Baker Edwards, Prof Penhallow, Mr. A. H. Mason, Mr. P. S. Ross, Mr. J. S. Shearer, Mr. W. T. Costigan and M[illegible]ior Latour. After a pleasant hour's ride, St. Hilaire station was reached, where carriages were in waiting to convey the excursionist to the Iroquois House, which was made the headquarters for the day. After arrangements had been made for the collections and the

day's programme generally, the excursionists dispersed in small parties, some to make collections and others to enjoy themselves in various ways. They most of them ultimately reached the summit of Belœil mountain, where lunch was partaken of, after which the Very Rev. Dean Carmichael delivered a short address, in the course of which he alluded to the peculiar associations of the spot connected with the cross which was erected in 1841 by Bishop Forbin Jansen of Nancy, and to the interesting fact that on that occasion about ten thousand people assembled on the shores of the lake, and that the bishop entered a boat and from the waters of the lake preached a sermon to them. Dr. Edwards also made a few remarks, chiefly referring to the former excursion of the society in 1869, and calling attention to the address made by Sir William Dawson on that occasion, relating to the geology of the region.

The party returned to the hotel at three o'clock where they were provided with a hot lunch, after which the collections were examined and the prizes awarded. Dr. Hunt briefly addressed the party with reference to the peculiar geological features of the region. The mountain, he said, is of volcanic origin. It and its companion mountains were, so to speak, the roots of volcanoes that had been formed in a very early geological age. The mountains being of harder material than the strata which surrounded and covered them, resisted the action of the eroding agencies that levelled the plain and remained like bosses on its surface after the softer rocks had been worn and washed away. Their precise age could not be ascertained, but they were formed before there were any air breathing animals on the surface of the earth. By the slow and modifying action of the elements the beautiful region seen from the mountain's top was prepared for the habitation of man, who at last appeared upon the scene to enter into possession.

The prizes were awarded as follows:—

Named plants—1, Miss Van Horne.

Unnamed plants—1, Miss O. G. Ritchie; 2, Miss Burland.

Unnamed insects—1, Mr. R. C. Holden; 2, Miss Maud Brewster.

The following were deemed worthy of honorary mention for their collections:—Miss McLea, Miss Reid, Master Eric Harrington and Master W. H. Shearer.

Dr. Harrington took several readings of the barometer at the hotel and on the summit of the mountain, and from these it was estimated that the summit of the mountain was about 850 feet above the hotel, and nearly 1 300 above the railway at St. Hilaire station.

Miscellaneous.

Mineralogical Notes.—At the February meeting of the Natural History Society, Dr. Harrington called attention to a number of points in connection with the forms, mode of occurrence, &c., of certain Canadian minerals. One of the species noticed was beryl, a mineral of somewhat rare occurrence in Canada. It was first found by the late Dr. Bigsby at the east side of Rainy Lake, 230 miles north of Lake Superior, occurring in well defined, pale green crystals in a porphyritic granite. †

According to the Rev. Prof. Laflamme, crystals of beryl as much as twelve to fifteen inches long and three inches or more in diameter occur in the township of Jonquières, on the Saguenay. ‡

Another locality more recently discovered and which it is worth while putting upon record is on lots 1 and 2 of the second range of Maisonneuve, Berthier county, P. Q. The specimens from this place are irregular masses and rough crystals, sometimes of considerable size. They evidently occur in a coarse granite vein containing quartz, orthoclase, a trichinic feldspar which shows play of colour in places, muscovite, garnet, tourmaline and samarskite? The locality is said to be the same as that from which the samarskite, analysed by Mr. Hoffmann, was derived §. The muscovite is said to occur in plates of considerable size and in quantity sufficient to be available for economic purposes.

Attention was also called to the remarkably fine crystals of molybdenite obtained by Mr. R. H. G. Chapman from the township of Aldfield, in Pontiac county, P.Q. They are short hexagonal crystals which, if regarded as belonging to the hexagonal system, consist of a hexagonal pyramid and the end face sometimes also with faces of the hexagonal prism. The angle between the end

† Geol. of Can. 1863, p. 492.
‡ Rep. Geol. Survey, 1882-84, D. p. 9.
§ Rept. Geol. Survey, 1880-82. H. p. 1.

face and pyramid in the case of several crystals was found to be approximately 112°. One of the crystals exhibited at the meeting was four inches across.

A list of about twenty localities in Canada where molybdenite has been found was given, many of them being taken from the reports of the Geological Survey.

Remarks were also made concerning octahedral crystals of fluor spar from the township of Hull and crystals of quartz from the township of Portland, P. Q. Some of the latter are interesting on account of their being terminated at one end by a single rhombohedron while at the other end both the plus and minus rhombohedrons are well developed.

CHEMICAL—*Algin and Alginic Acid.*—After exposure to rain, the long fronds of *Laminaria stenophylla* are observed to be swollen and tumid, sacs of fluid being formed from endosmosis of water through the membrane, dissolving a peculiar glutinous body. If these sacs be cut, a neutral, glairy fluid escapes, which may be often seen partially evaporated on the frond as a colourless jelly. This substance, to which Mr. Ed. C. C. Stanford, F.C.S., has given the name *Algin*, contains calcium, magnesium, and sodium, in combination with a new acid which he has called *Alginic acid*.

Algin, when evaporated to dryness, becomes insoluble in water, but is very soluble in alkalies; it is so abundant in the plant that on maceration for twenty-four hours in cold sodium carbonate solution, the tissue is completely disintegrated, forming a thick solution having *fourteen times* the viscosity of starch and *thirty-seven times* that of gum arabic. It is coagulated by alcohol, acetone and collodion, but not by ether and precipitated by mineral acids, various salts, and by lime water and baryta water.

It differs from albumen in not being coagulated by heat and from gelose in not gelatizing on cooling, by containing nitrogen, by dissolving in weak alkaline solutions, and by its insolubility in boiling water. From gelatin it differs by not reacting with tannin, and from starch by giving no colour with iodine; whilst its insolubility in dilute alcohol and dilute mineral acids renders it unlike gum arabic, pectin, tragacanth, and dextrin. It precipitates the salt of the alkaline earths, with the exception of magnesium, and also the salts of the metals, but it gives no precipitates with mercuric chloride nor with potassic silicate.

The uses to which Mr. Stanford proposes to apply the Algin are, first—In sizing fabrics, a solution of sodium alginate imparting to cloth and paper an elastic feeling, without the stiffness of starch. 2nd. Containing about the same amount of nitrogen as Dutch cheese (3.77 per cent.), and having a pleasant, marine taste, it may

form a useful addition to the means of thickening soups, etc., in the kitchen. 3rd. By mixing $\frac{1}{10}$ per cent. with the water supplied to boilers, a calcium deposit is formed, which may be easily blown off, thereby preventing troublesome incrustations. 4th. Mixed with gelatine it may replace gum arabic in the manufacture of lozenges and jujubes.

Alginic acid may be separated from its sodium salt by means of hydrochloric acid; a little bleach will render it white, and it may be separated by filtration and pressure and obtained in the form of a cake, in which state it can be kept for any length of time in a cool, dry place.

Analysis of the alginates shows that the formula of the acid is $C_{76}\ H_{80}\ N_2\ O_{22}$ which may be written thus:—

$$N_2\begin{cases} H_2 \\ H_2 \\ C_{76}\ H_{76}\ O_{22} \end{cases}$$

as a diamide.

It is a nitrogenous acid, extremely retentive of water, taking up over 98 per cent. and it dries up to a horny substance resembling albumen, with a s. g. of 1.534 (the s. g. of ivory nut is only 1.376) in which state it can be turned and polished. It is easily obtained in thin transparent sheets, which possess considerable tenacity and in this form it is useful for tying over pots and jars. The sheets may be readily coloured blue, red, &c., resembling the coloured sheets of gelatine, but unlike them are not affected by water. Alginic acid is a moderately strong acid, displacing carbonic acid from the alkalies and earthy carbonates. The soluble alginates (sodium, potassium, ammonium, lithium and magnesium) have all an acid reaction. Some of the insoluble alginates are very soluble in ammonia, with which they seem to form double salts.

The aluminum alginate, for instance, is very soluble in ammonia, but becomes when dried again insoluble, and forms a cheap water varnish, and an efficient glaze for paper and cloth. It is quite neutral.

Shellac is dissolved by the alkaline alginates, the ammonium solution, when evaporated, forming a thin, tenaceous film, quite soluble in water, but which after being passed through a bath of dilute hydrochloric acid is insoluble. The compound then resembles sheet guttapercha, and it is thought might replace that substance for surgical dressings. Remembering the great brittleness of shellac, which destroys its value for many purposes, no one would suspect its presence in such quantity in this very pliable sheet.

Many other resinous bodies may also be incorporated in a similar manner with a soluble alginate and then rendered insoluble.

Alginic acid also combines with many alkaloids, forming soluble films, some of which may be useful in medicine, but none have as yet been fully investigated. Compounds have been obtained and exhibited by Mr. Stanford of alginic acid with quinine, chinoleine &c., about which he promises further reports.—*Journal Soc. Chem. Industry.*