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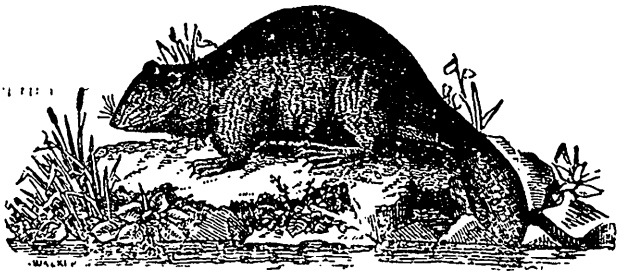

THE BEAVER *(Castor fiber.)*

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NOTES ON SIX LECTURES

DELIVERED BY ROBERT WARINGTON, F. R. S, ON THE

AGRICULTURAL INVESTIGATIONS AT ROTHAMSTED, ENGLAND.

PUBLISHED BY THE U. S. DEPARTMENT OF AGRICULTURE, WASHINGTON, 1892.

By Frank T. Shutt, M.A., F.I.C., F.C.S.

In the early years of the present century Sir John Bennet Lawes, associated with Dr. Gilbert, began those experiments, the results of which have been so potent in revolutionizing agriculture throughout the civilized world. Thoroughly practical and at the same time thoroughly scientific, these investigations and the deductions made therefrom have served not only to materially improve the system of agriculture by increased production at decreased cost, but also to elevate farming from an art overgrown with traditions, handed down from father to son through successive generations, to the ranks of science. Agriculture has now taken its place in our universities side by side with Classics, Mathematics and Natural Sciences It fills that place worthily ; and that this is so is largely due to the skilful and indefatigable labours of those English scientists, Sir John Lawes and Dr. Gilbert.

During the summer of 1888, the writer had great pleasure in visiting Sir John Lawes's estate at Harpenden in Hertfordshire, Dr. Gilbert very kindly acting as escort and explaining the many experiments then in progress. The grand old manor of Rothamsted, which has been in the Lawes family since 1623, was built in the fifteenth century, or as Mr. Warington remarks, before Columbus discovered America. Assisted by a young chemist of the name of Dobson, Sir (then Mr.) John Lawes began experimenting in 1837 on the effect of soluble phosphate. Although these trials were only carried on in pots, the results were so gratifying that Mr. Lawes took out a patent for manufacturing superphosphate from mineral phosphate and sulphuric acid. This marks the beginning of the manufacture of this fertilizer, an industry now grown to such gigantic proportions and of such great benefit to agriculture. In 1843 he was joined by Dr. Gilbert, a former pupil of Liebig, as chemist. For over half a century these two (Sir John himself being

a chemist of no mean repute) have worked together in agricultural investigation until now their names are inseparably linked in the history of modern agriculture.

With the exception of the Experiment Station founded by the eminent chemist Boussingault in Alsace, Rothamsted was the first place at which systematic experiments in agriculture were tried. Germany followed in the good work by the establishment of a Station at Möckern in 1852. It was there that the writer saw a few years ago Respiration Experiments in progress, involving the use of costly and elaborate apparatus and a great expenditure of skilled labour of the highest order. And it may be here remarked that the results of these investigations have done much towards putting the feeding of animals on an economic and scientific basis. On this continent the first agricultural experiment station was founded in Connecticut in 1875. Sir John Lawes could therefore very properly claim priority for Rothamsted in this noble and important work, and it is here but meagre justice to state that from this early date these investigations have been conducted at his sole expense.

With the large staff of chemists constantly engaged, it is easy to imagine the vast amount of data that from time to time has accumulated at Rothamsted. The published accounts of these are to be found in the transactions of the Royal Society (England,) of the Royal Agricultural, the Chemical and other scientific societies as well as in pamphlet form and in journals devoted to agriculture. If they were now collated they would fill many large volumes. Recognizing the tremendous importance of the work and wishful that it should continue after his lifetime, Sir J. B. Lawes in 1889 endowed the institution and entrusted its management to a board of trustees. With great generosity he made over to them the new chemical laboratories recently built, the experimental fields and £100,000 as an endowment fund. In this deed of trust, known as the Lawes Agricultural Trust, Sir John made provision for a course of lectures on the Rothamsted Experiments to be delivered biennially in the United States so "that Americans may share in any benefit that may arise" from the work there, past, present and future.

Mr. Robert Warington, F.R.S., so long an associate with Dr. Gilbert

in the chemical investigations at Rothamsted, was chosen to deliver the first course of lectures before the Association of American Agricultural Colleges and Experiment Stations at Washington in August of last year. The choice was a wise one. Mr. Warington being connected with Rothamsted more or less closely since 1859 was thoroughly conversant with the many lines of experiments carried on and the results obtained there. His own work there has been of a varied character. The analyses of the ash of plants and animals, the chemical examination of soils, rain, drainage and well-waters, a lengthy investigation into the process of nitrification in soils and the chemical action of certain soils and bacteria form a few of the most important subjects upon which Mr. Warington has been engaged.

It would be impossible with the space at our command to give an adequate account of all Mr Warington said at Washington. The lectures have recently been issued by the U. S. Department of Agriculture and form an octavo pamphlet of over 100 pages. They are well worthy of careful perusal by those interested in modern and progressive agriculture; it must suffice us here to do little more than indicate the subjects there expanded.

Lecture 1. Contains an historical account of the Rothamsted institution and enumerates many of the experiments conducted with animals and in the field. In this connection we must quote one experiment, as the result is both interesting and important. It proves that wheat as we know it is the outcome of artificial development and emphatically teaches the choking power of weeds. In 1882 a plot of wheat was not harvested, *i. e.* the grain was left to fall when ripe upon the ground and sow itself. "The first self-sown crop (1883) came up strong, but was so starved by the weeds that the produce of grain probably did not exceed a few pints per acre". Self-seeding was again allowed, but the end was near. "The last appearance of the wheat was in 1885." Sickly and stunted the wheat struggled for a few years against the choking weeds that grew and flourished so vigorously until its very existence became a thing of the past. Here is a lesson full of import to many a Canadian farmer.

Lecture 2. Agricultural chemists have determined that of all the elements of plant food, three may be termed essentials, since they must

be continually returned to the soil in order that its fertility may be maintained. These are Nitrogen, Phosphoric acid and Potash. In this lecture Mr. Warington discusses the character of the nitrogen-holding material in the soil under three heads, 1. Ammonia; 2. Nitrates; 3. Nitrogenous organic matter. The relative and absolute amounts in which they exist and the circumstances that control their increase and decrease are given at length. He shows that while the two former are the most readily available forms for plants, it is in the organic matter of a soil that the great bulk of the nitrogen is stored up. The accumulation of nitrogen in the surface soil takes place to a greater extent on prairie and pasture land than in arable soils; and further Mr. Warington says that "for the present we cannot, I think, affirm that soils are enriched by the free nitrogen of the air, except through the medium of a leguminous crop. A diminution of surface-soil nitrogen takes place when organic matter is in excess and air freely penetrates the soil, since the conditions are then most favourable to the growth of those organisms whose function it is to oxidise the nitrogenous organic matter. Hence, the richest soils are those most liable to waste and demand the greatest exercise of the farmer's skill to preserve their condition.

Lecture 3. Treats of a very important maker, viz. Nitrification, or the conversion of the nitrogen of the soil humus into the soluble nitrogenous food of plants. Schlösing and Müntz showed that this was due to the action of an organized ferment and Warington by experiments carried on simultaneously confirmed their conclusions. This living micro-organism has been succesfully isolated and studied by Dr. Frankland, Winogradsky and Mr. Warington. The most favourable conditions for this process of nitrification are here discussed at length. Briefly, they are the presence of phosphates, a slightly alkaline condition of the soil due to lime or other salifiable base, "a liberal supply of oxygen, the absence of strong light" and a temperature about 98° F. We here find the explanation of the fact so well known, viz., that the addition of marl or chalk (carbonate of lime) in moderate amounts to a soil and especially to one rich in humus, is of great value in increasing crop yields.

Lecture 4. NITRIFICATION AND DENITRIFICATION.—The conver-

sion of the organic matter of a soil into nitrates is the result of the life functions of two organisms—the one a purely nitrous ferment, *i.e.*, capable only of oxidizing ammonia and nitrogenous humus to nitrites and not to the fully oxidized form of nitrates, the other, known as the nitrite ferment, whose function it is to convert nitrites into nitrates. This nitric organism completes the useful work of nitrification. By an immence amount of bacteriological study Mr. Warington at last succeeded in isolating, growing and photographing this highly interesting plant. He says, "in soil, both organisms are present in enormous numbers and the action of both organisms proceeds together as the conditions are favourable to both." *Denitrification* or the destruction of nitrates takes place in water-logged soils from which the air is necessarily excluded. This is brought about through the agency of a third living organism, and the conditions most favourable for its development are an absence of oxygen, and an abundant supply of readily oxidizable organic matter. The practical lesson from this conclusion is the necessity of well-drained land, in order that the surplus water may be carried off and the air allowed to freely permeate the soil.

The nitrates are developed in the upper layers of a soil, but being extremely soluble are washed down by heavy rains to the subsoil. Ploughed land, well drained, loses nitrates when not cropped, and more so especially in wet seasons. Bare fallow does not, therefore, entail an unmixed good. In this connection Mr. Warington says, "If a farmer could ensure dry seasons, so that the nitrates produced by a bare fallow should remain in the soil available for the succeeding crop, it would pay him better to have an alternation of wheat and bare fallow rather than to grow wheat continuously. However, in the English climate no such favourable results can be expected," as the results of 30 years' experience at Rothamsted have shown that "wheat after fallow, except in some of the earliest years, has not given the double produce which should result from the presence of a double supply of nitrates." By a system of drain gauges Mr. Warington has been able to measure this loss of nitrates. He says, "The average quantity of nitrogen as nitrate discharged from the soil during thirteen years has been for the 20-inch gauge 37.3 lbs, for the 40-inch gauge 32.6 lbs., and for the 60-inch

gauge 35.6 lbs. per acre, equivalent respectively to 239, 209 and 228 lbs. of ordinary sodium nitrate. This, then, is the amount annually produced (and lost) in land left for many years unmanured, lying in its natural state of consolidation, and receiving no aëration from tillage. All vegetation that appears on these soils is removed."

Lecture 5. Deals with the "Nitrification of Soils and Manures." In it Mr. Warington points out by means of tables that the greatest loss of nitrogen as nitrates by drainage takes place during those months when the soil is not covered by a growing crop. "In June it is rare to find nitrates in this drainage water. Out of the twenty-five samples of drainage collected in June, July and August during twelve years, only three contained any nitric acid. In September, the crop being now removed, nitrates are always found in the drainage water. In a wet season the maximum amount of nitrates will occur in October. The proportion of nitrates will be maintained with little diminution during the winter months and begin to fall again in March." The crop, therefore, which has the longest growing season will be the best to conserve the nitrates in the soil. "From this point of view maize (Indian Corn) is a more economical crop than either wheat, oats or barley, its growing period extending during the whole of the summer." This lecture is brimful of practical information of a most valuable nature, and the inclination is strong to make very copious extracts, but a few more must suffice. The explanation why the cereals more especially respond to the application of soluble nitrogenous manures is given in the following words: "After a wet winter cereal crops begin to grow in a soil impoverished of its nitrates, and the growth of most cereals is over before the summer production of nitrates is half accomplished. Cereal crops are then especially benefitted by nitrogenous manures, and particularly by the application of nitrates, while for the reason already given, maize is more independent of such manuring than wheat or barley. The beneficial influence of a dry winter upon the crops of the ensuing year is now generally recognized." Mr. Warington gives scientific reasons for practicing rotation, and shows how a proper succession of crops tends to preserve and use the nitrates. This lecture proceeds to give the loss of nitrates in soils fertilized with different manures and cropped with wheat and barley. He summarizes his

conclusions in the following words: "The most striking results we observe are (1) that manuring with ash constituents alone increases the production of nitrates in the soil; (2) that the bigger crops grown by ammonium salts or sodium nitrate, with ash constituents, are followed by an increased production of nitrates; (3) that the use of an organic manure like rape cake or farmyard manure is attended with a large increase in the production of nitrate, even after the first active stage of nitrification is long past.

The concluding chapter is on the "Nitrification of manures." Salts of ammonium (chloride or sulphate) are of nitrogenous fertilizers the most readily nitrified in a soil Carbonate of lime assists most markedly in this process and Mr. Warington is of the opinion that lime or other salifiable base is deficient in those soils upon which ammonium salts do not act beneficially as a fertilizer. It would appear that guano is very easily nitrified. Müntz and Girard place it in this respect next to ammonium salts; "following guano come green manures (lucerne and lupines,) which compared with other forms of manures, appeared to be especially active in clay soils; the third class includes dried blood and meat and powdered horn; far below these stand poudrette, wool and leather."

Lecture 6. Drainage and well waters. This lecture has for its subject the consideration of the chemical composition of the drainage and deep well waters at Harpenden, as well as a detailed account of experiments on the movement of water in soils, with a discussion on the results obtained therefrom. As the wells are all sunk in the chalk, which lies comparatively close to the surface at Rothamsted, their waters will not be altogether comparable to those from wells on Canadian farms. A detailed account of this work will not therefore here be necessary. To the chemist however, if not to the practical agriculturist these data are intensely interesting and exceedingly valuable

We should very much like to see these lectures published in Canada in order that the agriculturists throughout the Dominion could obtain with facility copies for study. All progressive farmers must now make themselves conversant with these and kindred subjects, and those who wish to be thoroughly posted to date on the important question

of nitrification should carefully read this succint account by Mr. Warington of the classic researches at Rothamsted.

Next year the second course of lectures will be given, and I think that our agricultural authorities should well consider the advisability of asking from the trustees of the Lawes Agricultural Trust for their delivery, or at least their publication, in Canada. Ours is a British Colony, whose chief industry is agriculture, and I feel sure that Sir John Lawes and his co-workers would be wishful for his fellow country men in this way to participate in the results of their labours.

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EXCURSION III—TO NORTH WAKEFIELD, QUE.

SEPTEMBER 3RD, 1892.

Two hundred and twenty-eight members and friends of the Club left the Union Station on Saturday, the 3rd day of September to attend the third of the series of regular excursions for the present summer.

La Pêche Village, North Wakefield, was the place selected by the Excursion Committee and recommended to the Council of the Club. All arrangements having been completed, the party left the city at 10 a.m. and crossed the Ottawa River on the Ottawa & Gatineau Valley Railway, and then proceeded northward to Ironsides and Chelsea. Then plunging headlong into the picturesque country of the Laurentide hills, along the eastern edge of Table Mountain, Kirk's Ferry, the Cascades, and many other enchanting spots were passed in rapid succession. In less than an hour the excursionists were at North Wakefield, where a long line of dwellings, skirting the shore of the Gatineau River, form the village which is situated in the inner curve of a large circle which touches the round and crescentic hills, lending a peculiar aspect to the whole country.

Mr. F. T. Shutt, M.A., the Acting President, then addressed the gathering and gave out the programme, naming the leaders in the different branches and the most interesting spots to visit.

The time for *rendez-vous* was given for four o'clock at the School House near the bridge on the Pêche River. As the noon hour was

fast approaching the first thing discussed was the contents of the lunch baskets. Under the verdant boughs and in shady nooks of the beauteous and abundant vegetation, all around there could be seen many a group of Naturalists enjoying the mid-day meal in the open air, the blue canopy of a charmingly warm and delightful early September sky o'erhanging all.

At about one o'clock the different parties began to ascend the hillside, the botanists, geologists and entomologists vieing with one another as to who would get to the top first and would obtain most material of interest. Many a group of observant students of nature could be seen halted along the hillside and surrounding the leaders, who there on the spot, would examine and describe the plants or rocks and formations of the locality, and explain the interesting forms and phenomena visible. It was nearly five o'clock before the party had returned and gathered at the School House, where a number of addresses were given, as is the custom on these occasions.

The first to speak was Mr. J. Fletcher on "Insects and Insect Life." There were two kinds of insects noted and described—the *beneficial* and the *noxious* insects. These comprised many species and genera. Mr. Fletcher described many of these and gave ready rules whereby beneficial or noxious insects might be distinguished, pointing out the economic relations and significance of these creatures in the world. He exhibited several kinds of plant-galls and described the insects which caused them, he also spoke of the parasitic and guest insects which are found in large numbers in galls of all kinds. The great value of parasitic insects in the economy of nature was illustrated by an account of the good services performed during the past season in Western Ontario where almost every specimen of the Grape Vine Sphinx and the Tomato Sphinx was found to be parasitised by enormous numbers of a small enemy called *Apanteles congregatus*. No less than 207 of the latter having emerged from a single Caterpillar of the Tomato Sphinx. The egg parasites of insects, *Proctotrypidæ*, were also described, and an interesting account was given of the egg-parasite of the too-well known Currant worm, *Nematus ribesii*.

Then followed Mr. R. B. Whyte, leader in Botany. In his usual happy manner he described the plants that were observed and collected

during the day, mentioning the salient characters and peculiar habits of several of these, as also their usefulness to man and other creatures. He had observed that a very large proportion of our commonest plants in open places were introduced from Europe. Many of these, as the thistle for instance, had become very noxious weeds. The majority of plants met with during the day were common place specimens. Upwards of sixty different species were observed and noted in blossom. Of these the Golden-rods and Michaelmas Daisies formed a conspicuous lot. The following representatives of the Golden-rods (*Solidago*) and Michaelmas Daisies (*Aster*) were jotted down.

Solidago squarrosa.	Aster cordifolius.
" bicolor, v. concolor.	" diffusus
" rugosa.	" puniceus.
" Canadensis.	" macrophyllus.
" lanceolata.	" paniculatus.
" latifolia.	" Lindleyanus.

Epiphegus Virginiana and Rudbeckea hirta, one very humble and the other a very conspicuous flowering plant were also collected and are worthy of note. Of trees, the elm, linden, maple, oak and birch trees are conspicuous and beautiful at North Wakefield. It is expected that the list of species observed on this occasion will be greatly increased on some future visit by the Club to the locality.

Prof. Macoun was then called upon to address the gathering, and dwelt at length upon the relation of knowledge acquired from books and of that acquired from personal observation and contact with Nature. He also described the forest trees which were to be seen all about, and applied the principles he had laid down in determining these at a distance.

Dr. Henry M. Ami spoke next. In a rapid manner, as the time for re-assembling at the station was fast approaching, he gave a general sketch of the geology and physical geography or history of the district. The rocks consisted chiefly of a hard compact, more or less coarsely crystalline, syenite, or Hornblendic granite, with a tendency to lamination or foliation, resembling gneiss. This primitive or Laurentian rock —fundamental gneiss, sometimes called—was seen to be intersected by a small dyke of dark hornblendic material, resembling a dolerite,

fine grained and compact, rather tortuous in its course, but in a general north-east and south-west direction. From the summit of the mountain north-west of Wakefield Village, the valleys of the Gatineau and Pêche Rivers could be seen, and Table Mountain lay to the south some 8 or 10 miles distant. In the lower portion of the Pêche River valley the rocks were found to be glaciated, grooved and polished during the "Great Ice age," by the Pêche glacier which used to descend and meet a larger one in the present Gatineau River valley. It deposited morainic drift along both sides of the valley, but left little along the points and curves of this meandering valley. Whilst the summit of the mountain itself is rounded, but not grooved nor polished, the gneissoid rocks along the road and below the mills are beautifully polished, indicating the existence of a glacier.

In bringing the pleasant excursion to a close Mr Shutt congratulated those present on the charming outing they had all enjoyed. He said that this would probably be the last of the Summer excursions, but that Dr. George Dawson, the President, had now returned to Canada and doubtless he would be untiring in his efforts to assist the Soiree Committee in arranging a good programme, for the winter meetings, which would appear in the OTTAWA NATURALIST shortly. He trusted that the large attendance at the summer excursions might be taken as an earnest of what we should see at the winter meetings.

The city was reached at 7.30 after a rapid and pleasant journey.

A water-colour sketch of the bridge and Pêche River, made by Miss Lizzie Perkins, a member of the Club, was much admired by all who saw it Mrs. Chamberlin was also busily engaged in adding to her now extensive collection of paintings of native fungi, and secured some valuable specimens through the kind services of Prof. Macoun.

H. M. A.

———:o:———

ORNITHOLOGY.

EDITED BY A. G. KINGSTON.

ALBINISM IN THE "ENGLISH SPARROW" (*Passer domesticus*).—As time goes on and this introduced species comes more thoroughly under the influence of our dry climate with its extremes of temperature, the appearance of occasional individuals lacking the usual quantum of colouring matter in parts of the plumage seems to grow more frequent. From colonies planted in Boston and New York about thirty years ago, the sparrow made its first appearance in this northern latitude about 1872. Until recent years a sparrow showing white markings (apart from the normal pattern of the species) was looked upon as a rarity; now almost every large flock about the streets and gardens, if closely examined, will be found to contain at least one bird with here or there an odd white feather.

These marks are generally irregular, but occasionally a definite pattern is noticeable. The writer has in his possession a specimen, taken in May last, in which the secondary wing-quills are wholly white and the tail white with a slight bar of grey at the tip. Mr. Fletcher reports having seen one of somewhat similar plumage a few days ago in Ann Street. The following patterns have also been observed :—

(1) A male with the usual black patch on the throat surrounded with a border of white, which also extended as a white collar around the neck.

(2) One with white secondaries.

(3) One with two parallel white stripes between the shoulders.

(4) One with the whole crown white.

Any of the readers of the NATURALIST who may observe cases of albinism, or of the opposite peculiarity, melanism, an undue darkening of the plumage, in sparrows would confer a favour by sending a short note to either of the leaders of the Ornithological Section.

MIGRATION NOTES.—The migration of birds is to most persons one of those mysterious movements of nature which they are compelled to believe in, but whose processes can hardly be expected to be made evident to the senses. Our feathered visitors disappear in autumn and return to sight in spring, but the number of persons, even among those

most interested, who have ever seen a flock of migrants in their northward or southward flight is remarkably small. With the exception of some of the larger waterfowl and hawks, nearly all birds of passage pursue their journey at night, and generally at a great height in the air. From observations made a few years ago at an astronomical observatory near New York, upon migrants seen with a telescope passing across the face of the moon, it was calculated that these birds were flying at a height of from 1 to 4 miles above the earth. The theory now pretty generally accepted by those who have made these movements a study, is that the birds are guided in their course by rivers and the sea coast, the line of water being easily traceable by moonlight or starlight on a clear night, even at these great altitudes. When the weather is dull or stormy, however, and especially when a haze hangs low down, obscuring the landmarks, the travellers are forced to fly low. At these times, although it is not often possible to see them, their rallying calls may frequently be heard with great distinctness.

One of the best points about Ottawa for such observations is the Maria Street bridge over the Rideau Canal. The Gatineau River to the northward with the first stretch of the Rideau on this side, form an almost due north-and-south line for about 250 miles, and no doubt compose one link in the chain of landmarks followed by the birds in passing between the Hudson Bay region and the Atlantic coast of the Southern States. On almost any dull night during the season of migration—April and May for the northward movement and September and October for the southward—at an hour when the noises of the streets have somewhat quieted, the cries of the passing birds can be clearly heard. Very often too, the direction of the flight of certain individuals or small groups may be traced with reasonable certainty, showing the course at the former season to be "down" the canal, i.e. north-westerly at this point, and in the autumn months in the contrary direction. The identification of species in the darkness is a more difficult matter. The rallying cries of most birds differ considerably from the songs and calls which we know so well in the daylight. Still there are a few species whose voices are familiar enough to be recognized at any time. The cry of the Greater Yellow-leg Plover (*T. melanoleucus*) is at once striking and easy to imitate, as every sportsman knows. One night last fall this

call was heard, and on imitating it the writer had the satisfaction of eliciting an answer several times repeated as the bird passed on up the canal. This year the nights of the 15th and 18th September were marked by a great movement of birds. On the 15th at about 10.30 p.m. there was a fine rain driving before a south-westerly wind, and the birds flew unusually low. They seemed from their cries to be chiefly warblers and sparrows (native) though sometimes the cries of various shore-birds could be heard at a greater height. Frequently small birds of the warbler family, struggling with the storm, would almost dash against the electric lamp which stands upon the bridge, circle a number of times round it and then pass away into the darkness. The night of Sunday, the 18th, was more favourable for the identification of species. Shortly after midnight a thunderstorm came up from the south-west, and during the dull quiet period which preceded it the calls of the passing birds were so frequent and distinct as at times to become a positive clamour, attracting the notice of casual passers-by, who would stop and look up into the darkness in astonishment. The voices of the Robin, the Bluebird, the Goldfinch and the Greater Yellow-legs above mentioned could be recognized, and other calls, though not to be identified, were clearly assignable to the warbler family, the *limicolæ* (snipe and plover) and various native sparrows. The main column of this army of birds evidently confined itself to the immediate neighbourhood of the canal, for at a distance of a few blocks on either side, the cries became much less frequent, though once in a while a bird or two evidently confused by the multitude of lights, would fly out in wide circles over the city screaming distractedly. Probably another column might have been found following the parallel course of the Rideau River about a mile to the eastward until it and the canal converge and meet a few miles south of the city. In the city papers on the following Monday reference was made to some of these phenomena, and at least two birds (partridges) were reported to have been found, killed no doubt by striking electric wires or posts.

Several nights following this were clear, and no migrants came within "earshot." That of the 22nd was to all appearances similar to the 18th, but no movement was discernible. On the 24th the birds were again on the wing, though not in such numbers nor so clearly to be heard as on the previous occasion.

ENTOMOLOGY.

EDITED BY W. HAGUE HARRINGTON.

The cool nights and light frosts which occured in September have had a marked effect on the abundance of insect life. On bright days Clouded Yellows and White Cabbage Butterflies have been abundant, and towards the end of the month a third brood appeared of both the Nettle Butterfly (*Vanessa Milbertii*) and the Camberwell Beauty (*Vanessa Antiopa*). After a few trials of their newly gained wings, these gems of the summer landscape will seek some quiet nook in cave or hollow tree, and sink into a state of torpor from which they will only be aroused by the returning warmth of opening Spring. On Sept. 25th a single specimen of Peck's Skipper (*Pamphila Peckius*) was seen sipping the nectar from a stalwart Michaelmas Daisy (*Aster puniceus*).

Several caterpillars were sent to the leaders during the month. Hidden in a den made by catching together two or three leaves of *Salix cordata* or other rough-leaved willows, the solitary caterpillars of *Niso niades Icelus* were several times found. These have pale green slug-shaped bodies with large brown heads, separated from the body by a small neck. They apparently pass the winter in the caterpillar state.

The beautiful black, yellow and white Zebra caterpillars of *Mamestra picta* have been very abundant and destructive. Their numbers, however, have been much reduced by a minute parasite of the Proctotrypid genus (*Trichogramma*) which passes all its preparatory stages inside the egg. The moth which lays the egg from which the Zebra caterpillars hatch, deposits from 100 to 250 in a flat patch on the under side of a leaf. Of over twenty of these patches collected in the beginning of September, not a single egg produced the caterpillar, but instead the minute parasite above named. The same microscopic benefactor, or a closely allied species, did good service in destroying the egg of the Imported Currant Saw-fly, and of a new imported enemy of the willow which has only lately appeared in America in the shape of another Saw-fly (*Nematus pallidiventris*). The event of most importance in this line is the sudden and wide-spread appearance in Canada of the Cattle Horn-fly (*Hæmatobia serrata*). The habits and the best remedies for this pest are all given in the recently issued Bulletin 14 of the Central Experimental Farm.—J. F.

BOTANY.

EDITED BY WILLIAM SCOTT.

ASTER NOVÆ-ANGLIÆ, varietal forms (1).—The only station in the vicinity of Ottawa for this fine Michaelmas Daisy is Casselman, where some clumps bearing flowers of a beautiful pure white were found on Sept. 10, growing with the ordinary form.—W. S.

(2) Another beautiful form was brought from Toronto by Dr. J. E. White, bearing flowers which varied from pale mauve to deep lilac. The flowers which opened first were deepest in colour.—J. F.

GENTIANA SAPONARIA.—Dr. White also brought with him to Ottawa fine flowering specimens and living roots of this rare Gentian. The roots, with some other rare plants presented by Dr. White, are now planted in the herbaceous border of the Botanic Garden at the Central Experimental Farm.—J. F.

HELIANTHUS DECAPETALUS.—A noticeable feature of the Ottawa woods in Autumn is the absence of all species of wild sunflowers. *H. decapetalus*, however, occurs at Casselman and is apparently becoming more abundant there than formerly.—W. S.

GLYCERIA ELONGATA.—This is one of our most local grasses. It has been found sparingly at Kingsmere, but at Casselman it occurs in almost every damp gully.—W. S.

POTATO ROT.—A good object lesson demonstrating the value of scientific knowledge, is to be seen just now at the Experimental Farm. Some potato plants which were twice sprayed with Bordeaux Mixture to prevent the blight are now perfectly covered with green leaves, while all the others around them, and even in the same row, which were not treated, have been brown and dead for three weeks.—J. F.

UMBRELLA MUSHROOMS.—Those botanists of the Club who are lucky enough to know the gastronomic qualities of *Coprinus comatus* have lately enjoyed many dishes of this delicious mushroom. No other fungus resembles it. The shape is at first elongated oval or egg-shaped, but later like a half-closed umbrella, from 3 to 10 inches in height, white when young and covered outside with small brownish hairy tufts. When old it deliquesces into a black inky fluid.—J. F.

MINERALOGICAL NOTES.

MANGANESE ORES IN CANADA, by H. P. Brumell, Ottawa.—The August number of the *American Geologist* for 1892, contains an interesting as well as useful contribution regarding the distribution, origin and geological relations, as well as economic uses and value of the ores of manganese in Canada.

We are informed here that all the known workable deposits are located in New Brunswick and Nova Scotia, and belong chiefly to rocks of the lower carboniferous age, whilst the "bog ore deposits, being of recent formation, are found overlying rocks of any formation from the Cambrian upwards."

From the Markhamville deposit of crystalline ore, Mr. Brumell informs us, upwards of 20,000 tons have already been shipped. The analyses of this ore are also given, and reference made to another important deposit in the same (Sussex) County in New Brunswick, at Jordan Mountain, where some 400 tons of from 80 to 85 per cent. ore have been extracted from the western side of this mountain. At Quaco Head and Gowland Mountain crystalline ores of manganese also occur. At the latter locality it "consists principally of psilomelane and fills the interstices of a very much broken and partly decomposed granite of Pre-Cambrian age." Upham, Waterford, near Petitcodiac, Springfield, Tête-à Gauche Falls and Albert County. The Shepody Mountain deposits have been described by Dr. R. W. Ells in his report (1884) and shows that the ore "consists of pyrolusite and psilomelane, and occurring in the base of conglomerate in irregular pockets."

"Wad" is the common name which miners give to that ore of manganese which is found in swampy districts, and is of recent origin and still in process of formation in many places.

The most important deposits of "wad" occur at Dawson Settlement in Albert County, N. B, "where many acres of ore are found, the beds varying in extent and depth, and attaining in some places a thickness of over forty feet, to which point they have been proved." Analyses of this easily worked ore are then given by Mr. Brumell from the reports by Messrs. W. F. Best, of St. John, N. B., and John Burwash, showing the percentage of manganese binoxide "to vary from 35.5 to

vary from 73 6; the average being about 60 per cent. So much for New Brunswick ores.

In Nova Scotia the production of manganese is not so great, although the mode of occurrence and treatment of the ore is similar to that in New Brunswick. Pyrolusite—the high grade ore of manganese—is more widely distributed. "On the south shore of Minas Basin and midway between Noel and Walton, is situated the best-known and most important manganese mine in Nova Scotia, the Teny Cape mines, which, since its discovery in 1862, has been operated more or less continuously." Pyrolusite and manganite occur here, and assays are given of specimens from "Teny Cape," "Cheverie" and "Douglas" locations, made by Dr. Howe, E. Gilpin, Jr., and H. Poole respectively. These indicate 85.54, 90.15 and 84.62 per cent. of manganese oxides present in the ore.

On Cape Breton Island, the Hon. E. P. Moseley, of Sydney, C.B., has discovered and developed deposits of pyrolusite which promise well. they are situated near Loch Lomond, and Mr. Brumell adds the report made by Mr. Hugh Fletcher, of the Geological Survey staff, in his report, addressed to the Director, for 1882-83 84. Upwards of 91 per cent. of manganese dioxide occurred in this ore according to an analysis by Mr. Frank Adams.

Ontario and Quebec, etc., afford but small deposits of manganese ores. In Stanstead and Bolton Townships, in Quebec, and in the Magdalen Islands (teste J. Richardson in his report for 1879-80), as well as near Batchewaherung Bay, Lake Superior, in Ontario, together with a band of manganiferous spathic iron ore in the Nastapoka Istands off the east side of Hudson's Bay, appear to be the only places where ores of manganese are yet known outside of the Maritime Provinces.

Fossil Remains.—It might be added here that a number of fossil remains have been found in Nova Scotia and New Brunswick entirely filled and the hard parts replaced by pyrolusite. Amongst these is an interesting ann well-preserved specimen of a pteropode (Conulara allied to B. planpcostata, Dawsan) from the Lower Carboniferous of Springfield, where it was collected by Mr. A. E. Barlow in 1884.

H. M. A.

EDITORIAL NOTES.

THE PRESIDENT.—We are much pleased to welcome safely back again Dr. George M. Dawson, C.M.G., F.R.S., &c., our President, who has just returned from England where he has been engaged for five months in connection with the Behring Sea arbitration. We congratulate Dr. Dawson upon the important work which has been entrusted to him by the Imperial authorities, and also on the latest honour which it pleased Her Most Gracious Majesty the Queen to bestow upon him last May in recognition of his many services to science. This last distinction was Companion of the Order of St. Michael and St. George. (C.M.G.)

DR. ADAMS.—Mr. Frank D. Adams, M. App. Sc., and late of the Geological Survey Staff at Ottawa, spent the summer in Germany where the University of Heidelberg conferred upon him the well-earned title of Doctor of Philosophy (Ph. D.).

SCIENCE-TEACHING AT OTTAWA.—At the last general excursion of the Club to La Pêche, there were no less than 80 students from the Normal School. This speaks well indeed for the Science Master at this institution, and shows plainly that Mr. William Scott is not merely a teacher from text books, but leads his students out into the fields, where alone can be acquired a practical acquaintance with the objects which they have to study. No greater compliment than this, we think, could have been paid Mr. Scott by his pupils, and we feel sure that he must have been much encouraged by this practical and well-merited expression of approval of his method of teaching. We hope that at some future time the Science Master of the Collegiate Institute may also see the benefit of availing himself of the advantages offered at the Club meetings of furthering the important work with which he is entrusted.

AUTHORS' EXTRAS.— At a recent meeting of the Council of the Club it was decided to give to any member who contributed an article of more than two pages in length, ten copies of the number of the OTTAWA NATURALIST which contains his article, upon his making application to the Editor or the Librarian at the time of publication.

THE WINTER LECTURES.—The Soiree Committee will be pleased to receive from members, as soon as convenient, the titles of any papers which they may wish to read before the Club during the coming winter, and at the same time an intimation as to the time which will be most convenient.

CASTOROLOGIA.—The Editor begs to call the attention of readers of the OTTAWA NATURALIST to the advertisement of the above work on the last page of the cover. This work is by Mr. Horace T. Martin, of the Montreal Natural History Society, who gave us the pleasure of his company at our Spring Excursion to Butternut Grove in 1889, and spoke so acceptably to the members of the Club. Mr. Martin has made a most careful study of his subject, and has had peculiar facilities for getting information. He is a pleasing writer, and we feel sure that all who obtain his work will be satisfied.

THE GEOLOGICAL SOCIETY OF AMERICA.—Prof. H. L. Fairchild, of Rochester, N. Y., Secretary of the Geological Society of America, has sent the following notice to the Fellows of that society with reference to the next meeting:—"In response to a cordial invitation from the Royal Society of Canada and the Canadian Geological Society to this Society to hold its next meeting in Ottawa, the Council has determined that the fifth winter meeting shall be held in the City of Ottawa, beginning December 28th, 1892."

As a large number of the members of our Club take a deep interest in geological matters, professionally and otherwise, it is anticipated that the geologists from all parts of the North American Continent who will be present on that occasion will meet with a hearty reception at the hands of our members. Ottawa possesses sufficient attractions and interest in geology to make this meeting one of the most successful ever held.

Papers bearing on the geology and history of various parts of this Continent will be read, the discussions of which will doubtless be both profitable and interesting.

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SUMMARY

— OF —

Canadian Mining Regulations.

NOTICE.

THE following is a summary of the Regulations with respect to the manner of recording claims for *Mineral Lands*, other than Coal Lands, and the conditions governing the purchase of the same.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting, for mineral deposits, with a view to obtaining a mining location for the same, but no mining location shall be granted until actual discovery has been made of the vein, lode or deposit of mineral or metal within the limits of the location of claim.

A location for mining, except for *Iron* or *Petroleum*, shall not be more than 1500 feet in length, nor more than 600 feet in breadth. A location for mining *Iron* or *Petroleum* shall not exceed 160 acres in area.

On discovering a mineral deposit any person may obtain a mining location, upon marking out his location on the ground, in accordance with the regulations in that behalf, and filing with the Agent of Dominion Lands for the district, within sixty days from discovery, an affidavit in form prescribed by Mining Regulations, and paying at the same time an office fee of five dollars, which will entitle the person so recording his claim to enter into possession of the location applied for.

At any time before the expiration of five years from the date of recording his claim, the claimant may, upon filing proof with the Local Agent that he has expended $500.00 in actual mining operations on the claim, by paying to the Local Agent therefor $5 per acre cash and a further sum of $50 to cover the cost of survey, obtain a patent for said claim as provided in the said Mining Regulations.

Copies of the Regulations may be obtained upon application to the Department of the Interior.

A. M. BURGESS,
Deputy of the Minister of the Interior.

DEPARTMENT OF THE INTERIOR,
Ottawa, Canada, December 19th, 1887.