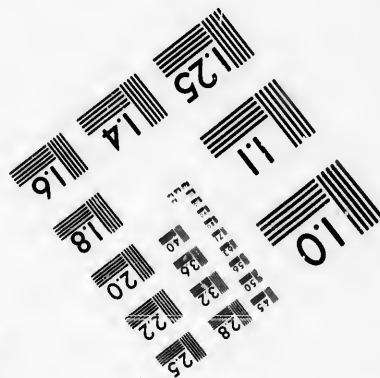
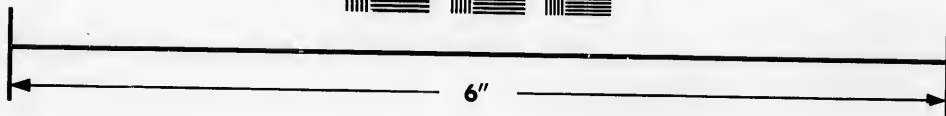
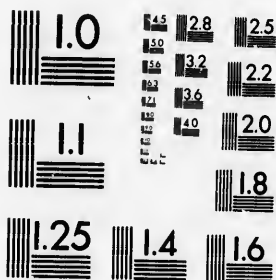


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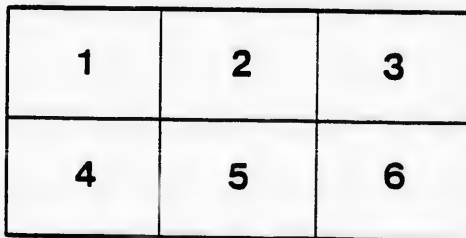
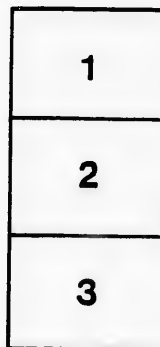
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GUELPH

Scientific Society

GUELPH, CANADA.



"A Society for the Advancement of Scientific Knowledge,  
Special Attention being given to our own Neighbourhood."

OFFICERS

- JAMES GOLDIE, Esq., President.
- PROF. PANTON, M. A., F. G. S., 1st Vice-President.
- VEN. ARCHDEACON DIXON, 2nd Vice-President.
- ROBERT GAUSBY, Esq., Corresponding Secretary.
- C. C. JAMES, M. A., Recording Secretary.
- D. McCRAE, Esq., Treasurer.

COUNCIL—REV'DS DR. TORRANCE & D. MCGREGOR, MESSRS.  
ARCH. GILCHRIST, W. TYTLER, M. A., W. NICOL, B. A.,  
W. MURTON, MISS VAIL, MRS. BUDD.

✻\*GUELPH\*✻

# SCIENTIFIC \* SOCIETY.



## CONSTITUTION



1. **NAME**—This Society shall be called the Guelph Scientific Society.
2. **OBJECT**—The object of the Society shall be the advancement of Scientific knowledge ; special attention being given to our own neighborhood.
3. **OFFICERS**—The officers of the Society shall consist of a President, first and second Vice-Presidents, Corresponding Secretary, Recording Secretary and Treasurer, who, together with eight other members of the Society, shall form a Council, all of whom shall be elected annually and who shall have the management of the business of the Society. In the event of any vacancy occurring in the Council during the year the same may be filled by the election of a successor at any of the Society's ordinary meetings.
4. **AUDITORS**—There shall be two Auditors elected annually to examine the Treasurer's accounts for the following year and report thereon at the next annual meeting.
5. **PRESIDENT AND VICE-PRESIDENTS**—The President shall preside at all meetings of the Society and Council : his duties, in the event of his absence, devolving on the Vice-Presidents in their order.
6. **SECRETARIES**—The Recording Secretary shall give previous notice to each member of the Council of every meeting of the Council ; shall make and keep a true record of the proceedings of all meetings of the Society and of the Council ; have custody of the Constitution, By-Laws and Records of the Society ; and the duty of the Corresponding Secretary shall be to conduct the general correspondence of the Society.
7. **TREASURER**—The Treasurer shall be charged with the collection and custody of the funds of the Society and keep a regular account thereof, which shall always be open to the inspection of the Council. He shall also submit at each annual meeting a statement shewing the financial condition of the Society.
8. **COUNCIL**—The Council shall, as business may require, meet from time to time at the call of the President, or of any two officers ; shall

control all matters affecting the welfare of the Society, subject to this Constitution ; shall have full control of the funds of the Society ; and shall report its proceedings to the members at the annual meeting.

9. **ANNUAL MEETING**—The annual meeting of the Society shall be held on the second Tuesday in March, at which, in addition to other business, the annual report of the Council shall be read ; and the Council and auditors for the following year elected by ballot, after nomination, by a majority of the members present.

10. **ELECTION OF OFFICERS**—The Council from among themselves shall elect the officers of the Society by ballot.

11. **SPECIAL MEETINGS**—A special general meeting of the Society may be called by the Council ; and shall be called on requisition of not less than ten members specifying the business they wish brought before the meeting. The Council shall call the meeting within fourteen days from the receipt of the requisition, giving one week's notice. No other business shall be transacted than that mentioned in the notice.

12. **CONDUCT OF MEETINGS**—The presence of ten members shall be required to constitute any general meeting of the Society, and of six members to constitute a meeting of the Council. All meetings shall be conducted under such By-Laws and Rules of Procedure as may from time to time be adopted.

13. **ORDINARY MEETINGS**—The ordinary meetings of the Society shall be held on the second Tuesday of each month.

14. **MEMBERS**—Any lady or gentleman desiring to join the Society shall send in their application to the Council, and, if approved, to be voted upon at an ordinary meeting.

15. **ANNUAL FEE**—The annual membership fee shall be One Dollar for gentlemen, and Fifty Cents for ladies, payable in advance ; due on the second Tuesday in March ; and no member in arrears shall be entitled to any of the privileges of the Society. New members to pay the fee for current year, upon election.

16. **AMENDMENTS**—This constitution may not be changed or amended except at the annual meeting of the Society after one month's notice previously given in writing, and by a two-third vote of the members present.



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## Report of Secretary

FIRST YEAR

EARLY in 1886 it occurred to a number of Guelph's citizens that a Society for the study of and enquiry into the different branches of Science would be a great benefit to the inhabitants of the city, and perhaps, in time, grow to be of considerable importance in unbounded limits. A meeting was called, through the daily papers, for Tuesday evening, 19th February, at which there was a good attendance, and at which it was resolved to form a Society to be known as the "Guelph Scientific Society," a committee being appointed to prepare By-laws, etc. This committee called a mass meeting for the 4th March, at which the constitution as prepared was considered and adopted. A council of fourteen members to conduct the affairs of the Society was also elected by ballot, and this council, on the 6th March, met and elected the officers for the year.

Regular monthly meetings have been held since that time, the different papers being furnished as follows:—

- March Meeting—Inaugural address, The President (Mr. Jas. Goldie).
- April Meeting—Prof. Panton, "Geology of Guelph and surroundings."
- May Meeting—President, Mr. James Goldie, "The Song Birds of our Country."
- June Meeting—Miss Vale (read by Prof. Panton), "Our Local Woods in May."
- July Meeting—Mr. R. Gausby, "The Frontier Between two Kingdoms."
- October Meeting—Mr. A. Gilchrist, "Ferns Growing in the Neighborhood of Guelph."
- November Meeting—Prof. James, "Bread, a chemical study."
- January Meeting—Mr. Tytler, M. A., "Dandelions."
- February Meeting.—Ven. Archdeacon Dixon, "Astronomical Wonders."

It will be noticed that there were no papers read in August, September, or December, the two first being holiday months amongst nearly all, and the latter being taken up almost entirely by political meetings on account of the Provincial elections.

It is a subject for congratulation that all papers were supplied without doubling up on any contributors, and the Society has thus demonstrated its ability to conduct a most successful Association.

The total number of members for 1886-7 was 112, and of these 83 had paid their annual fee, 29 neglecting so to do. The receipts from membership fees amounted to \$60.50, and the expenses for all purposes amounted to \$26.85, leaving a cash balance of \$33.65 at present to the credit of the Society. This is a most satisfactory showing for a commencement, and there is no doubt that the incoming season will see an advance in all the figures. The necessity of having separate rooms for meetings and classes is severely felt and arrangements for these are now in progress, there being a committee appointed by the Society's council to make enquiries and arrangements for suitable apartments. It is also hoped that there will be a grant made the Society by the Ontario Government, the same as given to similar societies in various parts of the Province.

During the spring and early summer Prof. Pantou gave a course of lectures on Botany in connection with the Society. Many members availed themselves of this opportunity to fit them for a proper study of the *flora* in the vicinity of Guelph. From the interest manifested by a regular attendance at the lectures we would infer they were well appreciated. In the fall and for a part of the winter the same gentleman gave a course of instruction on Geology. The only qualification required for attendance at these classes was that of being a member of the Guelph Scientific Society. We are glad to learn that such an opportunity was taken advantage of, and that so many were in regular attendance when these classes met. There is no doubt this course of instruction has done much to increase the membership of the Society, and Prof. Pantou deserves the warm thanks of the Society and of the community for offering his services freely for this work. The Society look forward to having during the coming year evening classes for the benefit of those who find it impossible to attend in the afternoon. It cannot of course be expected that these will be free of all charges to attendants, but the Society would earnestly ask the support of a large membership, so that the individual cost may be reduced as much as possible.

During the year several excursions have been made under the auspices of the Society for the purpose of studying Science practically :

May 8th.—Some members made a botanical trip to the woods in the vicinity of the residence of Thomas Goldie, Esq. A good collection of plants was made, and many interesting forms were obtained, embracing nine orders and twenty *genera*.

June 5th.—To Limchouse, where an excellent exposure of the rocks belonging to the Niagara and Clinton formation occur. This outcrop is of a very instructive character, and it is hoped that when another trip is made to that place there will be a large attendance to examine this excellent exposure of Silurian rocks.

July 2nd.—During the summer a very interesting visit was made to Elora by forty members. Unfortunately the day became unfavorable through rain commencing before Elora was reached. However, nothing daunted, after an examination of the museum in connection with the Elora High School, many of the members started out and made a very instructive examination of the excellent exposure of Silurian rocks belonging to the Guelph formation at this place. Thus we have within easy reach of Guelph admirable exposures of three formations—Guelph, Niagara and Clinton—of the Silurian system.

July 19th.—Several members of the class on this occasion made a botanical trip to Speedbank, the house of one of our members, who has done much to keep up the interest in the Society. An excellent field day was enjoyed, there being not less than thirty-four *genera* collected, representing seventeen orders.

August 7th.—Some twenty-five members visited an interesting swamp in Puslinch township, about seven miles from the city. There was found a vast bed of the common pitcher plant (*Sarracenia purpurea*), and associated with it the interesting Sundew (*Drosera Rotundifolia*). Other plants of an attractive nature were observed, and those present felt that they had enjoyed a great treat in this botanical excursion.



# Abstracts of Papers Read

AT REGULAR MEETINGS.



## THE SONG BIRDS OF WELLINGTON COUNTY.

BY JAMES GOLDIE, PRESIDENT.

It is a subject of frequent remark by many that the birds of America, although of fine and beautiful plumage, are very deficient in song, compared with those of Europe. I think there are few who are acquainted with our best songsters, and have listened to them in their native woods and groves, that will assent to this.

I propose to bring before you to-night, very briefly, the names of a few of our song birds, some of which cannot be surpassed by any in Europe—with the exception perhaps of the Skylark and the Nightingale. Let any one who doubts this spend a morning in the woods in the early summer and listen to the splendid song of the Rose-breasted Grosbeak, that from the topmost branch of some monarch of the forest is pouring out his melodious notes; or if the day be overcast, he may hear the clear, sweet, silvery notes of the Wood-Thrush; or perhaps the Brown Thrasher may treat him to a solo unsurpassed in the whole round of bird music. It is only those who are acquainted with bird-life in their haunts and homes that fully realize what a splendid lot of songsters are to be found in the woods and fields of Canada. In this respect I would earnestly appeal to every Christian heart to do everything possible to stop the infamous slaughter of innocent birds by those who make a business of it for personal gain. It is a fact well known to Ornithologists, that birds in their migration follow certain well defined routes, and in the season make their homes in certain favored haunts. They are always found plentiful there, while outside of these lines they may be comparatively scarce. I have frequently heard it asserted among professional collectors that all the birds that are killed make no difference in the aggregate, and that just as many will return the following year as if there had been none destroyed. This statement, so far as these favored haunts and lines of migration are concerned, seems to be true. A certain professional bird-catcher in a neighboring county has been in the habit for many years of trapping many hundreds of Rose-breasted Grosbeaks, Scarlet Tanagers, and other song-birds, and yet the supply never seems to be diminished in that locality. But what is the consequence outside of these favored spots where trapping and killing go on? Simply this: that hardly a bird can be found, where dozens were a few years ago. In this vicinity, for instance, the Baltimore Oriole, once so plentiful, is now almost extinct. Last year I saw only one, whereas formerly it was one of our commonest summer visitants. With these preliminary remarks I will proceed to name a few of our best known and most popular songsters.

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The first that I shall bring to your notice is the Mocking-bird (*Mimus Polyglottis*). This, although not, properly speaking, a resident of Canada, has been found, I believe, as an occasional visitor in the southern part of this Province. The Mocking Bird is a resident of Mexico, Central America, and the southern seaboard States. It extends its summer migration sometimes even into New England. Formerly, it was plentiful in New Jersey and Long Island, but now is seldom seen so far north. It, like all the Thrush family, is a soft-billed bird, feeding on insects and on fruits and berries in their season. In their native habitats they are very tame and lively, perching on a house-top or some tree near by, and pouring out their inimitable song. Baud and Ridgeway describe the vocal powers of the Mocking-bird as excelling, both in their imitative notes and in their natural song, those of any other species. Their voice is full, strong and musical—of an almost endless variation in modulation. The wild scream of the Eagle and the soft note of the Blue-bird are repeated with exactness, and apparently with equal facility, while both in force and sweetness the Mocking-bird will often improve on the original. The song of the Mocking-bird is not altogether imitative. Its natural notes are both rich and full, and are varied almost without limitation; its imitative notes are frequently interspersed, and both are uttered with a rapidity and emphasis that can hardly be equalled. The Mocking-bird readily becomes accustomed to confinement and loses little of the energy or variety of its song, but often, like most wild birds, loses much of its sweetness in a domesticated state. It is generally too quarrelsome to introduce into the aviary, especially if there are any of its own species there, but its splendid song makes it a general favorite as a cage-bird.

The *Harporychus Rufus*, or Brown Thrush, is a common species over most of the United States and Canada, and westward to Manitoba. It is not plentiful in the vicinity of Guelph, but in the southern part of the Province it is quite a common bird. This Thrush I consider one of the finest song birds of America. Its song is one of great beauty and sweetness, and of the liveliest type—long continued, clear, loud, and full of variety and charm. It is not imitative, like the Mocking Bird, but always keeps to its own notes, and never can be mistaken for any other bird. It often perches on the very topmost branch of some tall tree, and then, towards the close of day, pours out the richest and sweetest song, that charms every one who hears it.

The Brown Thrasher is a most affectionate and suitable cage bird. It is a strictly insectivorous feeder, but in the fruit season will also feed on the small fruits and berries of the fields and gardens. It frequents hedge rows, open woods, and fields where clumps of trees and bushes abound. They commonly build in low bushes, brush heaps, and sometimes on the ground, and are very bold in defending their nest or young ones, and will allow no intruders near them in the breeding season.

The Cat Bird (*Galeoscoptes Carolinensis*), formerly known as *Mimus Carolinensis*, is a near relation of the Mocking Bird. It is a summer visitant to Canada, and is found tolerably plentiful in Ontario. It has a wide distribution, ranging from Central America through most of the

United States and Canada, Bermuda, the Bahama Islands and Cuba. It arrives in this part of Canada early in the summer, and soon makes its presence amongst us known. From early dawn till late at eve its sweet and varied song is poured out from the top of some neighboring tree. Its capacity for imitation and mimicry is second only to that of the Mocking Bird, and its song, whether natural or imitative, is always varied and attractive. They build their nest on some low bush or tree, and, if in a garden or vicinity of a house, soon make themselves perfectly at home, and if not molested become quite tame, and the male bird will apparently delight to sing in the immediate presence of the occupants. The Cat Bird is a devoted parent, and it is most interesting to watch the old birds as they attend to the wants of their young brood, feeding them with the greatest assiduity, and accompanying them with parental care when they leave the nest. They will then attack intruders with the greatest boldness, attempting to drive away cats, dogs, or anything from which they apprehend danger. Their parental distress is painful to witness. They are most affectionate and devoted to each other, and both help in the construction of the nest. While incubation is taking place the female rarely leaves the nest, and is supplied with food by the male, and is cheered all through the day by his varied and beautiful song. It feeds principally on the larvæ of the larger insects, and also on raspberries and elderberries in their season. The Cat Bird makes an admirable pet for the aviary, becoming so tame as to readily feed from the hand. It sings freely in confinement, and well repays all the care bestowed upon it. I consider it among our first class songsters.

The Robin (*Turdus Migratorius*) is too common a bird to require any description here. It is a bird of very wide geographical distribution. From Labrador to Mexico, and from the Atlantic to the Pacific, the Robin is everywhere abundant. In this latitude he is one of the first harbingers of spring, and on that account is welcomed a little more warmly than he would be otherwise. Early in March, if the weather is moderate, the Robin makes his appearance, and the first mild morning, perched on the house top, he welcomes the early morn with a snatch of his loud and well known song. As a songster the Robin must be classed as a second or third rate bird. His song is loud, without much taste or sweetness. He is a very ravenous bird, and no doubt is of great use in the garden by destroying large quantities of worms and larvæ; but when fruit ripens he takes toll most liberally, and becomes a perfect nuisance. They become very tame when caged, but are large feeders, and, if not kept clean, are very unsatisfactory.

The Wood Thrush (*Turdus Mustelinus*) is pretty generally distributed all over Ontario, although not very plentiful. It inhabits the deep recesses of the primeval forest, damp, woody dells, and moist shady woods. Those acquainted with his habits know well in what part of the wood to look for him, and the bird-catcher often takes them by turning up the fresh earth in some moist spot and setting his net baited with meal-worms. Early in the month of June, after a shower of rain, or if the day is dull and overcast, the Wood Thrush is heard in perfection. The song of this bird is one of great sweetness, and no lover of music

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but must be charmed by it. Its melody is one of very great compass and power, and consists of several parts, the last notes resembling the silvery tinkling of a small bell and seeming to leave the conclusion suspended. Each part of the song seems sweeter and richer than the preceding. When heard in the quiet recesses of the forest the effect is most charming. Nuttall, who is particularly happy in his descriptions of bird songs, speaks of this as follows:—"The prelude to this song resembles the double-tonguing of the flute blended with a tinkling shrill and solemn warble, which recedes from his solitary retreat like the dirge of some sad recluse who shuns the busy haunts of life. The whole air consists usually of four parts or bars, which succeed in deliberate time, and blend together in impressive and soothing harmony, becoming more mellow and sweet at every repetition. Rival performers seem to challenge each other from various parts of the wood, vying for the favor of their mates with sympathetic responses and softer tones; and some waging a jealous strife, terminate the warm dispute by an appeal to combat and violence. Like the Robin and the Thrasher, in dark and gloomy weather, when other birds are sheltered and silent, the clear notes of the Wood Thrush are heard through the dripping woods from dawn to dusk—so that the sadder the day the sweeter and more constant is his song." His clear and interrupted whistle is likewise often nearly the only voice of melody heard by the traveller at mid-day in the heat of summer as he traverses the silent, dark, and wooded wilderness. This Thrush becomes very tame in confinement. I have frequently had it to come and feed from the hand, and it is a sweet and interesting pet.

There are several other Thrushes that frequent our woods, all of them having sweet and varied notes.

A very beautiful and sprightly songster is the Blue-bird (*Sialia Sialis*). This species is an early spring visitor, and soon makes his presence known by his well-known song and his bright blue and red plumage. He is a very sociable bird, building in holes in trees or in boxes which are often provided for him. The Blue-bird becomes very tame in confinement and is quite an ornament to the aviary. He is strictly insectivorous, except in fruit time, when he will sometimes feed on wild berries.

The Purple Finch (*Carpodacus Purpureus*) is an early spring visitor, and is quite common in Ontario. It is frequently found in gardens and orchards, and is sometimes destructive to the buds of fruit trees. Casual observers very frequently blame the damage done by this bird to the European sparrow—the two birds being very much alike. The Purple Finch is a very handsome bird, the breast of the male being of a fine purple color. They feed on seeds of all kinds, berries and insects, and are fond of buds and blossoms of the plum, cherry and apple trees. Among bird catchers it is commonly called the Linnet, and is much sought after by them, as it is in great demand as a cage bird and for the aviary. It is one of the sweetest, best and most constant songsters we have. They soon become accustomed to confinement, but do not continue in song as long as in their wild state. They are very pugnacious in the breeding season, and will not allow any of their fellows to come

near their domain. The song of the Purple Finch resembles somewhat that of the Canary, and, though not so varied, is softer, sweeter, and more touching and pleasing. During the month of May it is to be heard in great perfection, and it will, in the wild state, continue in song till the end of summer. In the long evenings of summer it will frequently be heard long after nightfall. It is interesting to watch one of these performers in the middle of his song. He appears perfectly absorbed in his work. His form dilates, his crest is erected, his throat expands, and he seems to be quite unconscious of all around him; but let an intruder of his own species approach, and the song instantly ceases, and in a violent fit of indignation he chases him away. This Finch is really a handsome bird, a fine songster, and in every way worthy of a place in any collection. There are several other species of *Carpodacus*, all fine songsters, but they are to be found in the Southwestern States and in California.

The *Chrysomitris Tristis*, or American Goldfinch, is one of the sweetest and most beautiful of our summer visitors. The Goldfinch, or yellow bird, as he is very commonly called, may be seen in his splendid plumage of yellow and black along with his more sober, colored mate, feeding on the ripening seed of the dandelion. He is then very tame, and will allow one to approach near enough to watch all his motions and graceful attitudes. The Goldfinch is found throughout a great portion of North America, from the Atlantic to the Pacific. In winter the plumage is a yellowish brown, and it is then difficult to distinguish the male from the female. They are to a large extent gregarious and nomadic in their habits, but separate into pairs for a short time during the breeding season. For three months of the year they associate in small flocks, and wander about in an irregular and uncertain manner in search of their food. In summer they feed largely on seeds of the thistle, various grasses and weeds. In gardens they are rather destructive to lettuce, cabbage and other garden seeds, but on the whole they do a vast amount of good in the destruction of seeds of troublesome weeds and small insects. For some reason or other it is usually well on in summer before they mate and raise their young. The true song of the Goldfinch is very sweet, brilliant and pleasing, most so, indeed, when given as a solo; with no other of its kind within hearing. Its notes are higher and its song more prolonged than those of the Purple Finch. Sometimes when large flocks are found in early summer, the males will often join in a very curious and remarkable concert. These concerts are now varied and pleasing, now ringing like the loud voice of the canary, and then sinking into a low, soft warble. In the warm summer weather they are very fond of bathing, and they may often be seen along the shallow margins of brooks and streams. On the whole there is no more joyous, light-hearted little songster in the whole circle of American song birds than the Goldfinch. It makes a nice pet for the cage, and gets exceedingly tame. In the Aviary it does well, and proves one of the most pleasing and interesting of the occupants. The nest of this species is a most interesting study; no more beautiful specimen of bird architecture can be found. It is symmetrical in shape, delicately woven, and ingeniously and firmly fastened around the forked twig, with which it is interlaced. It is an exquisite example of beauty and finish.

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Another pretty little songster, which is common all over most parts of Ontario during summer, is the Indigo Finch (*Cyanospiza Cyanea*). This bird, although its powers of song are not very great, is yet vigorous and pleasing. Its manners are active and sprightly, and its great beauty when in its summer plumage makes it greatly sought after by the bird-catcher. It frequents open woods, gardens and fields. It usually stations itself on the top of some tree or bush, when it chants its peculiar and charming song for quite a space of time. Its song consists of a few short notes, at first loud and rapid, but gradually less frequent and becoming less and less distinct. It sings with equal animation during most of the summer months, in the noonday heat as well as in the morning and evening. The Indigo Finch is most pugnacious in his disposition. Woe betide any of its kind that dares to invade its domain during the breeding season. In confinement, when being handled they bite and take hold of the finger or hand like a bull-dog. But they are quite reconciled and peaceable with their companions in the cage or aviary.

One of the most beautiful and interesting of the song birds of America is the Rose-breasted Grosbeak (*Guiraca Ludoviciana*). The Grosbeak is widely distributed over the more northerly and central parts of Ontario, and frequents shady woods and copses. It likes the vicinity of small brooks and streams, and feeds on various seeds, small fruits in their season, and is not averse to devouring a beetle or a spider. Of all the birds of the forest this is one of the very finest whether for beauty of plumage or for loud, varied and sweet song. In color, the upper parts with neck and head are a glossy black, a broad crescent across the upper part of the breast extending down towards and under the wing coverts very fine carmine. The rest of the underparts, rump and upper tail coverts, middle wing coverts, spots on the *tertaries* and inner great wing coverts, and a large patch on the ends of the inner webs of the three outer tail feathers pure white. When flying it has a beautiful and singular appearance, showing about an equal proportion of black and white, while its red breast shows off to great advantage. As a songster few birds can equal it, although when in full song its notes are loud and can be easily distinguished by the practised ear at fully half a mile distant, yet they are very soft and melodious. When first beginning to sing it starts with a low, sweet warble and is amongst the finest examples of bird music I know. As the season advances their song acquires full power and they then can be heard all over the forest. When in confinement they become very tame, and I have frequently seen one take a grain of hemp-seed, of which they are very fond, from between the lips of the person feeding them. In the aviary they thrive and sing well, but care must be taken not to overfeed them as they are gross feeders and soon become so fat as to endanger their lives.

*Dolichonyx Orizygorus*.—Of all the birds of North America none perhaps is a greater favorite than the well-known and familiar Bobolink. None perhaps has a wider geographical range. In its migrations it traverses all of the United States east of the high central plains to the Atlantic, and as far to the north as the 54th parallel. It is found over the greater part of Ontario, Quebec, New Brunswick and Nova Scotia,

frequenting low lying meadows and hay-fields. In its winter migration it extends to Central and South America and the West Indies. In its migrations northward the males arrive some days before the females, and this is the time the bird-catcher plies his trade amongst them. Like most other birds, if caught after they have paired, they nearly always die in confinement. Of all our unimitative and natural songsters the Bobolink is by far the most popular and attractive. Always original and peculiarly natural, the song is exquisitely musical. In the variety of its notes, in the rapidity in which they are uttered, and in the touching pathos, beauty and melody of their tone and expression its notes are not equalled by those of any other North-American bird. We know of none among our native feathered songsters whose song resembles or can be compared with it. An American writer thus describes its song: "Mounting and hovering on the wing at a small height above the field he chants out such a jingling medley of short variable notes uttered with such a seeming confusion and rapidity and continued for a considerable time, that it appears as if half-a-dozen birds of different kinds were all singing together. Some idea may be formed of this song by striking the high keys of a piano at random singly and quickly, making as many sudden contrasts of high and low notes as possible. Many of the tones are in themselves charming, but they succeed each other so rapidly that the ear can hardly separate them. Nevertheless the general effect is good, and when all are singing, ten or twelve at the same time, the concert is singularly pleasing." When the males first arrive in spring their gay colored livery of black and yellowish-white attracts general notice. When two or three male bobolinks decked out in their gayest spring apparel are paying attention to the drab-colored female, contrasting so strikingly in her sober brown dress, their performances are quite entertaining. Each male endeavors to outsing the other. The female appears coy and retiring, keeping close to the ground, but always attended by the several aspirants for her affection. After a contest quite exciting the rivalries are adjusted, the rejected ones are driven off by their more fortunate competitor, and the happy pair begin to prepare a new home. It is in their love quarrels that their song appears to the greatest advantage. They pour out incessantly their strains of quaint but charming music, now on the ground, now on the wing, now on the top of a fence, a low bush, or the swaying stalk of some plant that bends with their weight. The great length of their song, the immense number of short and variable notes of which it is composed, the volubility and confused rapidity with which they are poured forth, the eccentric breaks in the midst of which we detect the word "Bobolink" so distinctly enunciated, unite to form a general result to which we can find no parallel in any of the musical performances of our other song-birds. It is at once a unique and charming production when the mated pair take possession of their selected meadow and prepare to construct their nest and rear their family. Then we may find the male bird hovering in the air over the spot where his sombre-colored partner is brooding over her charge. All this while he is warbling forth his incessant and happy love-song, or else he is singing on some slender stalk or weed that bends under him, overflowing with song and melody. After the brood is hatched

his song becomes less frequent and after a time ceases altogether, and now there appears a remarkable change in the appearance of this gay songster. His showy plumage of black and white, so conspicuous and striking, changes with almost instantaneous rapidity into brown and drab until he is no longer distinguishable either by plumage or note from his mate or young. The Bobolink, if caught early or after the breeding season is over, makes a fine bird for the cage or aviary. It is interesting when in confinement to watch the change of color which takes place in their plumage in the fall and again in the spring. They are enormous feeders and if not restricted in their rations will become so fat as to cause their death. They sing well in confinement, but their song seems to lack that sweetness and variety which it has when heard in their favorite meadows.

The foregoing is only an imperfect list and condensed description of the most prominent of our song birds. Did time permit similar notices might be given of the song Sparrow, one of the earliest of our spring visitors; of several other varieties of Thrushes, the White-Throated Sparrow, a number of our summer warblers, the Baltimore Oriole, distinguished both for fine plumage and song, and a number of others. Enough has been said to show how rich we are in birds of song, and to draw attention to the free concerts provided by nature for the entertainment of man.



THE GEOLOGICAL RECORDS IN THE VICINITY OF  
GUELPH.

BY J. HOYES PANTON, M. A., F. G. S.

The writer introduced the subject matter of his paper by referring to some of the general principles in connection with geology, and reference to the interesting outcrops of rock in the neighborhood of Guelph. The various quarries near the city were referred to, and the general nature of the rock found in them, their economic values for building stone and manufacture of lime. The lithological and palæontological characters of the rocks were discussed at length, and a general outline of the distribution of the Guelph formation. In connection with the formation of fossils some interesting and instructive points were touched upon and the inferences from the presence of fossils explained. He remarked that when the Guelph rocks were deposited in the Silurian sea, which covered the present site of our city in these primeval days, life was represented by low forms and comparatively few species. It evidently was a time of great silence. No sound was heard but the lashing of the waves along shores of a nameless sea, or the winds sweeping unimpeded in their course across the bleak and solitary rocks. Taking the data collected from our quarries and reflecting upon the changes which have occurred since these rocks formed the floor of an ocean, the fragmentary records of the rocks become a source of intense interest to a contemplative mind.

The appearance of the Silurian rocks elsewhere was contrasted with that of the system represented in Guelph, and their position in the geological series clearly defined and illustrated by excellent diagrams. Having given a popular introduction to the subject, the remains of animal life as represented in the rocks of the neighborhood were discussed, and diagrams representing them explained.

Univalve shells are exceedingly common, there being no less than 14 species of the genus *Murchisonia* and 24 species of other genera in the division of mollusks. Among bivalves 6 species are represented, one of these, *Megalomus Canadensis*, is very characteristic of the Guelph rocks, and is among the first fossils you find. Some of these clamlike forms are very large, reaching even six inches in diameter.

The cuttlefish group is represented by 14 species, and the brachiopods (lamp shells) 11 different kinds. *Stromatopora*, a fossil whose position in the scale of life is somewhat difficult to locate, is represented by 2 species, both of which the writer has found in the quarries near the city.

Among corals the representatives are very common, and some very interesting specimens have been obtained by several members of the

Society—in all some 14 species. The group Crustacea is represented by 8 species, and it is but seldom you find any of these.

The following is a summary of the different genera found in the rocks of the Guelph formation, to which the writer referred to in his paper:

**PROTOZOA**

Stromatopora, 2 species.

**CŒLEENTERATA.**

- Favorites..... 5 species.
- Halysites..... 3 "
- Amplexus..... 2 "
- Heliolites..... 1 "
- Cystatoylus.... 1 "
- Pycnostylus.... 2 "

**ECHINODERMATA.**

Crinoid Stems, the only representatives of this sub-kingdom.

**VERMES.**

- Pentamerous.... 2 species.
- Charionella.... 1 "
- Trimerella..... 3 "
- Monomerella.... 2 "
- Spirifera..... 1 "
- Atrypa..... 1 "
- Rhynobolus.... 1 "

**MOLLUSCA.**

- Murchisonia... 14 "
- Subulites..... 2 "

**MOLLUSCA—(Continued.)**

- Cyclonema..... 2 species.
- Pleurotomaria.. 7 "
- Straparollus... 2 "
- Holopea..... 2 "
- Codoncheilus... 1 "
- Trochonema.... 1 "
- Scenella..... 1 "
- Tryblindum.... 1 "
- Enomphalus.... 2 "
- Bucania..... 1 "
- Eculiomphalus.. 1 "
- Tremanotus.... 1 "
- Megalomus..... 2 "
- Anodontopsis... 1 "
- Iliona..... 3 "
- Cyrtoceras..... 3 "
- Trochoceras.... 1 "
- Trocholites.... 1 "
- Orthoceras.... 5 "
- Phragmoceras... 3 "
- Ascoceras..... 1 "

**ARTHROPODA.**

Calymene, Ceraurus, Eurypterus, 1 species of each.

In this list we have 88 species, showing very conclusively that the rocks in the vicinity of Guelph afford an interesting geological hunting ground to a student of science.



## OUR LOCAL WOODS IN MAY.

BY MISS VAIL.

The love of flowers seems a naturally implanted passion in people of all ranks of life, from the millionaire who cultivates rare ferns and priceless orchids, to the laborer who has but one Geranium. But to many the wild flowers of our native woods possess many and great charms, especially in the spring, after the long cold months of winter. The best way to see what treasures the woods contain is to penetrate into their shady depths and see how the flowers grow in their native soil—in the shade and shelter wild flowers seem to need. The first thing that strikes us on entering the woods in early spring is the emptiness, if such a word may be used. There are no trailing vines, no whirling leaves as in autumn, but a general clearance. All so silent, the soft new leaves overhead are too young to rustle. The weight of the winter's snow has compressed last summer's leaves into a thick mat-like felt under our feet. On the ground, pushing up their little heads through the dead leaves, are thousands of little curious pointed leaves, blotched with red and green, but never two marked quite alike. Under the shelter of a fallen log we find two leaves growing together; from the centre rises a slender stem, with a graceful, nodding, yellow flower, its pointed petals turned back. It is the Dog's-Tooth Violet (*Erythronium Americanum*). Although the plant, commonly called Adder's tongue, is so plentiful, the flowers are rare.

In the friendly shelter of a brush-heap we find a large cluster of a beautiful little white flower resembling the Bleeding Heart of our own gardens, though a much smaller plant, more delicate foliage, white flowers, and possessing a fragrance unknown to its garden relative. We find there are two varieties—the Fly-flower (*Dicentra Cucullaria*) has spurred petals tipped with yellow, and finely dissected foliage; it is more rare than the Squirrel corn (*Dicentra Canadensis*), whose blunt petals are tipped with rosy purple. Coming to a stony, open space, the ground is covered with the Wild Strawberry (*Fragaria Virginia*), the plants are white with bloom, forerunner of fruit later in the season. Here in a shady corner is a clump of low-growing, large and rather coarse leaves; if a leaf or the root be broken a red juice exudes, hence it is called Bloodroot (*Sanguinaria Canadensis*). Indians use it for dyeing porcupine quills and wood for baskets. The flowers come up in early spring, each with a leaf folded tightly around it. Cold winds and frosts only fold this cloak the more snugly about the tiny flower within, but the first warm sunny day makes the little bud unfasten its wrap and open its whorl of snowy petals to the sun and air. Near by are some plants of a



pretty white and fragrant flower, the common Pepper-root or Toothwort (*Dentaria diphylla*). The root-stalk is white, jointed, looking like a bit of white coral, and is largely used by the Indians medicinally. We see plenty of violets—five distinct species—yellow, white, blue, a dark blue (*Viola pedata*), also the lovely Canadian Violet (*Viola Canadensis*), its large white petals pencilled with purple.

In the cleft of the roots of an elm we find a bunch of Liver-leaf (*Hepatica acutiloba*), the flower so well known is over, the dark evergreen leaves just springing up. As we advance into the deeper woods the flowers are more plentiful. Trilliums abound (*Trillium erectum*). These plants are so named because all their parts are in threes, even to the leaves. We find plenty of white ones (*Trillium Grandiflorum*), some tinged with rose, some with a green stripe down each petal, and some a rich dark Pompeian red. On a mossy bank growing together with ferns and lichens we find some Wood Sorrel (*Oxalis Stricta*), its tiny yellow flowers just opening. It resembles the Oxalis we use so much in window gardening and wrongly call Shamrock. The fragrant blue phlox is very plentiful just here, (*Phlox Divaricata*) a pretty showy flower for bouquets, also the Bishop's Cap (*Mitella Diphylla*). Though so small, these flowers are lovely, the tiny corolla so perfect in shape—like a bell,—the fringed edge turned back giving it a lace-like appearance—inside we can just see the little cluster of ten stamens. Though late for it, we find a few plants of the delicate pink and white beauty (*Claytonia Virginica*). On a damp bit of ground we come across a strange rush-like plant; the stem has no apparent leaves, is jointed, and looks as if it had been drawn out like a telescope. It is the Horse-Tail (*Equisetum Arvense*) and a relic of the Carboniferous age. A large tropical-looking plant now claims our attention, called Mandrake or May Apple (*Podophyllum Peltatum*). Turning homeward we come upon a curious flower, the Indian Turnip (*Arisema Triphyllum*), also called Jack-in-the-Pulpit. Jack is a handsome fellow in his purple-striped vest; his pretty cousin, whom we call Calla-Lily, wears a white cloak. They both belong to the Arum family. What seems to be the real flower is but a sheath that covers the tall spike thickly covered with tiny florets. In the Calla this sheath is white and open, like a large petal; in the Turnip it is dark purple, striped with pink, and folds over for the further protection of the flower within. In the autumn this spike bears a cluster of bright scarlet berries, the lower part of the stem is bulbous, has medicinal properties, and a strong, acrid, pungent juice. In looking over our collection of flowers we find we have—*Arisema*, *Phlox*, *Podophyllum*, *Oxalis*, *Erythronium*, *Mitella*, *Dentaria*, *Trillium*, *Fragaria*, *Dicentra* (two species), *Hepatica*, *Sanguinaria*, *Viola* (five species), *Claytonia*, and *Equisetum*—fifteen genera and twenty species.



## CANADIAN FERNS IN THE VICINITY OF GUELPH.

BY A. GILCHRIST.

In Canada the study of ferns is not so general as it should be. Such an interesting class of plants deserves more attention than it has yet received. Fern-hunting is a delightful recreation for the summer holidays. It is in summer that ferns can be collected intelligently by the young botanist. The classification of ferns is entirely different from flowering plants. They are classified by the golden spots (*sporangia*) upon the back of the frond. Ferns may be very unlike and yet belong to the same genus. - It is surprising the number of species in ferns that may be found in the neighborhood of Guelph. So far the writer has collected thirty species, and eight well marked varieties.

It may be possible to produce hybrids by mixing the spores of two nearly related species and sowing them together, but it can never be done with the same certainty that crossing is accomplished with flowering plants.

Slender Rock Brake (*Pillaa Gracilis*) is a graceful little fern as its name indicates—very rare, and found in but few places in Canada. It is found at Paradise, on the south side of the River Speed, growing firmly wedged in the crevices of the limestone rocks, where it is difficult to get it out in good condition. The fruit is in lines under the very edges of the frond. The fertile fronds are longer than the sterile fronds.

Purple Brake (*Pellaa Atropurpureus*) is another rock-fern, growing on the north side of the River Speed. The stems are dark purple, hence the name. It has a tufted root-stalk, while *Gracilis* has fine yellow thread-like creeping roots. It is a good fern for the case or pot culture. It is very rare.

Lady Fern (*Asplenium Filix-Femina*) two varieties. This name is well given, for it is the most elegant of our native ferns.

Green Spleen-Wort (*Asplenium Viride*) is found among the rocks at Elora. It is a northern fern, different from *Trichomanes* by its yellow mid-rib.

Narrow-fronded Spleen-Wort (*Asplenium Angustifolium*) is found near the Ontario Agricultural College.

Goldie's Shield Fern (*Aspedium Goldiana*). This fern is of more than usual interest to us, it having been named by Hooker in honor of the father of our worthy President, Mr. Goldie.

The Walking Fern (*Campptosorus Rhizophyllus*) is the most peculiar fern we have in Canada. Although a walking fern it is not a tramp, because it is never found where it is not wanted. It is very rare.

*Botrychium Ternatum* is a very rare fern, only one plant of it having been found near Guelph. The frond is very fleshy and deeply



cut. It remains green all winter till the new frond appears, then the old frond dies away.

THE FOLLOWING IS A LIST OF FERNS FOUND NEAR GUELPH :

<i>Adiantum Pedatum</i> .....	Maiden-hair.
<i>Asplenium Trichomanes</i> .....	Common Spleenwort.
“ <i>Viride</i> ... ..	Green Spleenwort.
“ <i>Thelypteroides</i> .....	Silvery Spleenwort.
“ <i>Filix—Fœmina</i> .....	Lady Fern.
“ <i>Angustifolium</i> .....	Narrow-fronded Spleenwort.
<i>Botrychium Virginicum</i> .....	Grape Fern.
“ <i>Ternatum</i> .....	
<i>Pellaea Atropurpurea</i> ... ..	Purple Rock Brake.
“ <i>Gracilis</i> .....	Slender Rock Brake.
<i>Cystopteris Bulbifera</i> .....	Common Bladder Fern.
“ <i>Fragilis</i> .....	Slender Bladder Fern.
<i>Camptosorus Rhizophyllus</i> .....	The Walking Fern.
<i>Aspidium Spinulosum</i> .....	Wood Fern.
“ <i>Dilatatum, Intermedium</i> and <i>Vulgare</i> .....	Three Varieties.
“ <i>Thelypteris</i> ... ..	Swamp Shield Fern.
“ <i>Cristata</i> .....	Crested Shield Fern.
“ <i>Marginalis</i> .....	Marginal Fruited Shield Fern.
“ <i>Goldianum</i> .....	Goldie's Shield Fern.
<i>Onoclea Sensibilis</i> .....	Sensitive Fern.
“ <i>Struthiopteris</i> .....	Ostrich Fern.
<i>Polypodium Vulgare</i> .....	Polypody.
“ <i>Dryopteris</i> .....	Three-branched Polypody.
“ <i>Hexagonoptera</i> .....	Winged Polypody.
<i>Pteris Aquilina</i> .....	Common Bracken.
<i>Aspidium Acrostichoides</i> .....	Christmas Fern.
<i>Osmunda Regalis</i> .....	Royal Flowering Fern.
“ <i>Claytoniana</i> ... ..	Interrupted Flowering Fern.
“ <i>Cinnamomea</i> .....	Cinnamon Flowering Fern.
<i>Assidium Filix-mas</i> .....	Male Fern.

These were collected in the neighborhood during the year 1886 ; further research will probably add to the number. Some of the species vary considerably, showing well marked varieties.



THE FRONTIER BETWEEN TWO KINGDOMS—A  
MICROSCOPICAL STUDY.

BY ROBERT GAUSBY.

This subject carries us down into a domain which we cannot enter with our own unaided vision, but with the help of the microscope we will take our stand on the frontier of two Kingdoms and see if we can learn some of the characteristics of the denizens of this border land. To the superficial observer it may seem a simple thing so to classify organic nature as to place any given object in its proper Kingdom. But, though the higher organisms may present no difficulty, it is very different with the microscopic forms of life; and, figuratively speaking, as many obstinate battles have been fought over this border line as on the frontiers of nations. It is scarcely within the scope of this paper to enter upon the question as to what is the ultimate test to determine an animal or vegetable. It would take us too far, for one by one, the supposed infallible landmarks have been swept away, till even such a master in science as Huxley has to confess in one of his lectures that the facts he brought forward "tend to the conclusion that the difference between animals and plants is one of degree rather than of kind, and that the problem whether, in a given case, an organism is an animal or a plant may be essentially insoluble." Examining one drop of water we see a multitude of moving forms belonging to the Diatomaceæ or Brittleworts. These are remarkable from their possession of a silicious coat which is an object of singular beauty, and some species are used as tests to determine the working power of microscope objectives. The species of these organisms are very numerous. Their forms are almost endless in variety and they are distributed over the whole globe. The rocks also bear witness to their existence in the waters of the geological past. The city of Richmond, Virginia, is built over a stratum of diatomaceous earth eighteen feet in thickness and of unknown area. Noticing for a moment the delicate filaments of the Spirogyra and Zygnema we come to the Desmidiaceæ, one most elegant form being the Closterium. The Volvox Globator is one of the most interesting of the Confervoid Algæ, and was for years claimed by both Kingdoms. It has been finally settled that it is a vegetable. The Oscillatoria, the Protococcus, the Vibriones, are all vegetable, though the active motions of most of them seemed to indicate animal life, and by early observers they were placed amongst the animalculæ, but active motion is not by any means an infallible indication. Passing here over the line we come to the lowest form of animal life, and as the lowest vegetable seems to be the simple cell, so the lowest animal is represented by a particle of jelly-like matter, technically called

sarcode, and nothing more. The *Amœba Proteus* presents no structure except a vacuole and a few dark dots, yet it is a living being and feeds on other organisms. In the Foraminifera we have a group of similar jelly-like animals, but protected by calcareous or silicious shells, with numerous apertures through which the pseudopods protrude. To this group belongs the *Eozoon Canadense*, discovered by Sir Wm. Dawson, of Montreal, and remarkable as being supposed to be the earliest representative of animal life on the earth. One drop of water presents a very lively appearance owing to the presence in great numbers, of the *Paramecium* or Slipper Animalcule swimming swiftly and gracefully along with a corkscrew kind of motion. Here is the *Amphileptus* with neck-like extension—and several other allied forms come within our field of view. Other objects, we are sure to find, though they are farther removed from the frontier—the *Anguillula Fluvialis*, one of the nematoid worms; the *Hydra Viridis*, an animal of great interest owing to its remarkable tenacity of life under the most violent mutilation; the *Rotatoria* or Wheel Animalcules. The *Cyclops Quadricornis* and *Daphnea Pulex* are of the Entomostracous Crustaceans. A mere sketch has been presented of the inhabitants of this border-land, the study of which, once begun, will prove a source of inexhaustible delight and profit.

The paper outlined above was illustrated by living specimens of many of the objects described, and colored drawings of the others.



## THE CHEMISTRY OF BREAD.

BY C. C. JAMES, M. A., PROFESSOR OF CHEMISTRY, ONTARIO  
AGRICULTURAL COLLEGE.

In introducing the subject reference was made to the magnitude of the flouring industry. Minneapolis was especially noted—turning out daily 34,000 barrels of flour, and having capacity for 35,000,000 bushels of wheat yearly. Wheat, for the most part, is used with us; but rice, potatoes, doorlia, rye, corn, and barley are also utilized by other peoples. The structure of the wheat-grain was shown by illustration, consisting of five husk or bran coatings—the *epicarp*, *mesocarp*, *endocarp*, *episperm*, and *tegmen*; then the *perisperm*, containing the gluten cells, richest in nitrogenous or albuminoid material; then the *endosperm*, containing most of the starch or white flour; and last of all, the *chit* or *germ*. The relation of the foods to digestion, and the needs of man were next referred to. An average 150-lb. man consists about as follows: Water, 93.0 lbs.; nitrogen compounds, 22.5 lbs.; fat, 23.5 lbs.; carbohydrates (sugar), 0.2 lbs.; mineral matters, 10.8 lbs.

The gluten of wheat serves to build up muscle and flesh; the fat and starch to supply heat and force and a surplus of fat; the mineral matters, to build up bones; and the water to act as a solvent and to regulate the temperature.

Tables were then produced, shewing the chemical composition of potatoes, rice, barley, corn, buckwheat, wheat-flour and bread.

The cooking of the starch into dextien, the production of carbon dioxide and alcohol by the yeast plant, the digestion of the starch by the *ptyalin* of the saliva, and of the gluten by the gastric juice, were all touched upon. The action of baking powders was explained and also the use of adulterants.

In closing this short summary dealing with one department of "The Science and Art of Cooking," it may not be out of place to add some of the analyses used in elaborating the subject:—

	WHEAT.	FLOUR.	BRAN.	WHITE BREAD.	GRAHAM BREAD.	SODA CRACKERS.	MAINTENANCE DIET FOR MAN.	MAN.
WATER.....	10.9	13.0	14.0	32.7	34.2	8.0	73.	62.0
NITROGENOUS MATTERS...	11.7	10.0	14.2	8.9	9.5	10.3	4.5	15.0
FATS.....		1.0	4.2	1.9	1.4	9.4	2.0	15.6
SUGAR.....	75.7							
STARCH.....		75.0	61.5	55.5	53.3	70.5	19.5	0.2
MINERAL MATTERS.....	1.7	1.0	6.1	1.	1.6	1.8	1.0	7.2

## DANDELIONS.

BY W. TYTLER, B. A., COLLEGIATE INSTITUTE, GUELPH.

The writer traces the history of the Dandelion from the first appearance of the leaves in spring, pointing out the rapid and luxuriant growth of foliage as the result of the large store of food stored up the previous season in the thick and fleshy roots. The large supply of flower-buds is noticed, and especially the reserve force which is rapidly pushed forward, if through any accident, the first crop is destroyed. In this connection he shows how it is that even when the plant is cut off close to the surface of the ground, in efforts to exterminate it, the embryo blossoms escape injury, from the fact that the junction of the leaves with the crown of the root is really some distance below the surface. Various experiments are alluded to, showing the rapidity with which ravages are repaired, and the plant placed again in a vigorous and healthy condition.

Special attention is directed to the flower. The writer describes minutely the structure of the flower in the composite order, and by means of diagrams illustrates the special forms of the Dandelion blossom. A single flower is closely examined at the various stages of its growth, and its various organs, essential and otherwise, are clearly described. The question of fertilization is next taken up, and a brief account is given of the various ways in which the pollination of flowers is effected. Attention is called to the fact that the stigma closely occupying the interior of the calyx-tube, and being pushed upward through this as it grows, must from its position in contact with the ripened anthers in the inner surface of the tube sweep with it the pollen grains which have escaped from the anthers, and carry these with them when they appear above. If self-fertilization does not take place it must be because the stigmatic surface of the style is not in a receptive condition, and this is found for the most part to be the case. The pollen dust which is found in the stigmas is only lying loosely on them and is not adherent as it would be if the stigmas were moist and ready for fertilization. This pollen is easily removable by various agencies, chiefly insects, and the shaking of the blossoms by the wind or other agents. Insects, no doubt, convey the pollen to other flowers, whose pistils are ready for pollination, and in this way cross-fertilization is effected.

Attention is called to the various changes that take place in the form of the receptacle, and consequently in the position of the involucre of bracts attached to its margin. As the head of flowers opens, the receptacle, which is at first slightly concave, becomes flatter, and afterwards a little convex, and the bracts project radially from its edge. After fertilization, the blossom withers and the bracts again close in,

forming a cone-shaped head, this change in the position of the bracts resulting from a hollowing of the centre of the receptacle and a raising of its edges. When the seed has become nearly ripe and ready for dispersion, the receptacle again becomes convex, while the edges are strongly bent downwards, causing the bracts to be recurved till they lie closely against the scape. This position is necessary to enable every seed with its accompanying radiating crown of pappus to occupy its proper position in this globular head seen when the seed is ripe. Somewhat allied with these changes is the rapid elongation of the tubular scape after the seed is fertilized, especially when the plant grows in long grass, to enable it to raise its head of ripened seed above the surface of the surrounding vegetation so that the wind may reach it, and give free dispersion to its seeds. Scapes over thirty inches in length have been measured by the writer. When the seeds have been scattered the stalk loses its elasticity and withers away; the bracts again rise, but in an irregular way, and the receptacle becomes flaccid and lifeless. The remaining portion of the dandelion life during the year is devoted chiefly to the accumulation of a store of food for the next season, but, occasionally, a few weak and imperfect heads are produced far into the autumn and even winter, and the dandelion may be found blooming in sheltered localities in the latter days of November, or even in the beginning of December.



## ASTRONOMICAL WONDERS.

BY VEN. ARCHDEACON DIXON.

In commencing, the Archdeacon said that he wished to define his position in respect to the subject matter of his lecture. He did not pretend to high scientific attainments in physical astronomy, but was merely an amateur, who, at college, went through the ordinary outline of the subject, and afterwards had his attention turned more closely to the wonders of the heavens through having become the possessor of a large and powerful telescope. He then proceeded to dwell on the grandeur and regularity of movement of the immense bodies occupying the unlimited space around us, and defined astronomy as the science which treats of all these heavenly bodies. It may be divided into three parts—descriptive, physical and practical. The first named concerns facts, the second causes, and practical astronomy the means of investigating the facts, whether by instruments or calculations. The doctrine of gravitation is the key which unlocks the mysteries of the universe, and it is simply this, that every portion of matter in the universe tends to every other. It is an invisible power permeating space that links the planets to the sun which, like a hand, grasps the sling that revolves in a circle around it. The earth on which we live forms rather an insignificant member in the grand processions of the heavenly bodies, both as regards size and splendor of adornment. Alluding to Jupiter, he said:—It is 88,000 miles in diameter, against the 8,000 of our world, and it has four moons to illuminate it at night, whilst we have only one, and it is necessarily off duty for us fully half the time. The days and nights of Jupiter are only five hours long each, so that it would be a grand place for short hours of labor advocates to migrate to. A month there equals in length our year, and their year is equal to twelve of ours. This huge planet moves too fast for ordinary people to regard with complacency, travelling with its moons eight miles every second. He next considered Saturn, the ringed planet, which, though in appearance dull and insignificant to the naked eye, is revealed by the telescope to be the most beautiful and complex in construction of all the members of the solar system. Galileo was the discoverer of the brilliant rings surrounding this planet, but he dare say little about them in his time for scientific discovery was then rank heresy. It has eight moons, one only lately discovered; its diameter is 79,000 miles; its day about the same length as that of Jupiter, and its year equal to thirty of ours. Taking it altogether it presents to us more magnificent and diversified celestial phenomena than any other planet in our system. The next planet alluded to was Uranus, with its six moons, and its year equal to eighty-four of ours. It was through occa-

sional irregularities and eccentricities in the course of this planet, and through astronomers wishing to get at the cause of these perturbations, that the great planet Neptune was discovered, England losing the credit of this discovery through the incredulity of Professor Airey, the Astronomer Royal, although Mr. Adams, an English astronomer, had long before called his attention to his observations and placed on record his firm belief that such a planet must exist in almost exactly the same spot as that in which Neptune was discovered. This is regarded as one of the most marvellous illustrations of the power of the human intellect in the annals of science. Adams and Leverrier pointed out the place in the heavens where a hitherto unknown world existed, from the supposed influence of such a body in producing at long intervals, eccentricities of motion in another planet nine hundred millions of miles distant from its orbit. The discovery of the spectroscope enabled astronomers to ascertain the formation and character of all the heavenly bodies they brought within their gaze, and was one of the grandest inventions of the age. Through it Professor Huggins, a few years since, proved beyond a doubt that there were seas on Mars. The lecturer here described the manner in which it did its work and the certainty of its correctness. The sun was then spoken of as the centre of our system, holding the other bodies in their regular courses. It is hard to realize its immense size, one million, four hundred thousand times that of the earth, and 95,000,000 miles from us. It will give us an idea of its enormous bulk were we to suppose it hollowed out, leaving only the outer shell. Place the earth in its centre, and the moon revolving round it, its diameter of orbit being 274,000 miles, and yet from that orbit to the external shell of the sun there would still be 204,000 miles. This enormous globe is the scene of tremendous convulsions. There are volcanic eruptions when vast columns of flame flash upwards from thirty to eighty thousand miles in height, and raging cyclones of fire sweep over it with inconceivable rapidity. But still there are other suns known as fixed stars, far larger and grander than ours, surrounded by satellites like our own, these being arranged in divisions known as constellations. Our sun is only as one to fourteen when compared with Sirius, it being 12,000,000 miles in diameter, and these fixed stars are at such distances that no telescopes, however powerful, increase their apparent size, even when viewed through glasses that magnify several thousand times. The Pleiades were next described, containing to the naked eye seven stars, but the telescope revealing over seventy. These are alluded to in the book of Job by the same name, the original Hebrew word meaning an axle or point which turns round and also moves other bodies, and it has been lately declared by Professor Madler that Alcyone, the central figure of the Pleiades, was the centre of that tremendous attraction that drew all the systems of the Heavens in an orbit at the rate of 422,000 miles a day, and which it will take thousands of years to travel round. The lecturer alluded to a correspondence he had a few years since with the Metropolitan of Canada on this point. In his admirable translation of the book of Job he puts for "sweet influences," "the bands" or chains. This gives a far loftier significance to the question of the Almighty—



"Canst thou arrest that attractive influence which the Pleiades exercise over the countless suns and planetary worlds whirling around them," seems to be the true force of the enquiry. He concluded by showing that amid all the grandeur of the worlds around, man seemed insignificant, but what gave him his great glory in the scale of created things was his immortality—

"The spirit shall return to Him  
Who gave its Heavenly spark;  
Yet, think not Sun, it shall be dim  
When thou, thyself, art dark!  
No, it shall live again and shine  
In bliss unknown to beams of thine.  
By Him recalled to breath,  
Who, captive, led captivity—  
Who robbed the grave of victory,  
And took the sting from death."

