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PROCEEDINGS

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PROCEEDINGS
OF
THE CANADIAN INSTITUTE,

SESSION 1884-'85.

NINTH ORDINARY MEETING.

The Ninth Ordinary meeting of the Session 1884-'85, was held on Saturday, January 10th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following gentlemen were elected members of the Institute :

George Ritchie, B.A., B.Sc.; Charles Ridout, Esq.; Alexander Macfarlane, M.A. D. Sc., F.R.S.E.

The following list of donations and exchanges received since last meeting was read :

I.—CANADA.

1. Report of Progress, 1874-75. From the Geological Survey of Canada.
2. Figures and Descriptions of Canadian Organic Remains. Decade II. Graptolites of the Quebec Group, by James Hall, 1865.
3. Atlas of Maps and Sections to Report of Progress from the Commencement to 1863.
4. Geology of Canada. Palaeozoic Fossils, Vol. I., by E. Billings.
5. Palaeozoic Fossils, Vol. II., Part I., by E. Billings.
6. Palaeozoic Fossils, Vol. III., Part I., by J. F. Whiteaves.
7. Mesozoic Fossils, Vol. I., Part I.
Mesozoic Fossils, Vol. I., Part III.
8. Report on the Polyzoa of the Queen Charlotte Islands, by Rev. Thomas Hincks.
9. The Fossil Plants of the Devonian and Upper Silurian Formations of Canada, by Sir J. W. Dawson.
10. Report of the Fossil Plants of the Lower Carboniferous and Millstone Grit Formation of Canada, by Sir J. W. Dawson.

11. The Fossil Plants of the Erian (Devonian) and Upper Silurian Formations of Canada, by Sir J. W. Dawson, Part II.
12. Preliminary Note on the Geology of the Bow and Belly River Districts, N. W. Territory, by George M. Dawson, 1882.
13. Descriptive Sketch of the Physical Geography and Geology of the Dominion of Canada, by Alfred R. C. Selwyn and G. M. Dawson, 1884.
14. Comparative Vocabularies of the Indian Tribes of British Columbia, by W. Fraser Tolmie and George M. Dawson, 1884.
15. Map of the Dominion of Canada, Geologically Coloured, from Survey, made by the Geological Corps, from 1842-1882
16. The Canadian Entomologist, Vol. XVI., No. 11.

II.—UNITED STATES EXCHANGES.

1. Science, Vol. IV., Nos. 98 and 99, Dec. 19 and 26, 1884.
2. Proceedings of the Academy of Natural Sciences of Philadelphia, Part II., May to October, 1884.
3. An Account of the Discovery of a Mastodon's Remains in Northborough, Worcester County, Mass., by Franklin P. Rice.
4. Bulletins of the Minnesota Academy of Natural Sciences, Vol. II., No. 4.
5. Proceedings of the Boston Society of Natural History, Vol. XXII., Part IV., Oct. 1883, Dec. 1883.
6. The American Journal of Science for January, 1885.
7. Journal of the Franklin Institute, January, 1885.

III.—BRITISH EXCHANGES.

1. Proceedings of the Royal Geographical Society, Vol. VI., No. 12, December, 1884.
2. Archaeologia Aeliana, Vol. X., No. 2, from the Society of Antiquaries of Newcastle upon Tyne.
3. Monthly Notices of the Royal Astronomical Society, Vol. XLV., No. 1, November, 1884.
4. Journal of the Royal Microscopical Society, Series II., Vol. IV., Part VI., December, 1884.
5. Journal of the Transactions of the Victoria Institute, Vol. XVIII., No. 71.

IV.—BRITISH COLONIES (EXCLUSIVE OF CANADA).

1. Proceedings of the Asiatic Society of Bengal, Nos. 8 and 9, August and September, 1884.
2. Records of the Geological Survey of India, Vol. XVII., Part IV., 1884, From the Colonial Museum, Wellington, New Zealand.
3. Geological Reports, 1879-80, 1881, 1882, 1883, 1884.
4. Fossil Corals.
5. Museum and Laboratory Reports, 8-18.
6. Fishes of New Zealand.
7. Meteorological Reports, 1873, 1875, 1877, 1880, 1883.
8. Tertiary Mollusca.
9. Manual of New Zealand Mollusca.
10. Manual of New Zealand Grasses.
11. Manual of New Zealand Coleoptera, Parts I. and II.

12. Diptera.
13. Biological Exercises, Parts I. and II.
14. Handbook of New Zealand.
15. Catalogue of International Exhibition, 1879 (New Zealand Court).

V.—FOREIGN.

1. Correspondenz-Blatt der deutschen Gesellschaft für Anthropologie, Ethnologie and Urgeschichte, XV. Jahrgang, No. 10, October, 1884.
2. Tesis leida en el Examen Profesional de Ingeniero Geografe, per Joaquin de Mendezabal Tamborrel.

Total 66 numbers.

Dr. Macfarlane read a paper entitled :

NOTATION FOR PHYSICAL UNITS.

The late Professor Clerk-Maxwell in his treatise on Heat says, "Every quantity is expressed by a phrase consisting of two components, one of these being the name of a number and the other the name of a thing of the same kind as the quantity to be expressed, but of a certain magnitude agreed on among men as a standard or unit." Heat, p. 75. When we apply this analysis to the expressions of quantities, we find that in many cases there is no notation for the latter component—the unit. The general expression for a velocity is v ; what does this single letter denote? It must be viewed either as denoting both components, or else as denoting the numerical phrase and leaving the unit to be understood. When a particular velocity is expressed, both components are expressed, as for instance 123 feet per second. Now if v is the general symbol corresponding to 123, what is the general expression corresponding to *feet per second*? But further it is only in the simplest cases that we have a notation for the special unit; and the consequence is that in the specification of quantities, as in tables of constants, there is considerable trouble in ascertaining from the context what special unit is understood.

If we look into text-books on arithmetic and examine the rules given for the application of arithmetic, such as the Rule of Three, or the unitary method, we find that the difficulty which is met but not overcome, is to express the dependence of one quantity upon one or more other quantities. It may be objected that the *formula* meets the difficulty. Only partly, I reply, for the formula expresses only the numerical component, not the unit component. It is well known

that a formula leaves much to be understood or to be discovered about the units involved. Besides, it is difficult to an elementary arithmetician to understand it so well as to be able to use it with intelligence.

These defects appear to me to be due to the want of a systematic notation for units. By a notation for a unit I mean something different from a name; the latter merely designates, the former shows the dependence of the unit upon more fundamental units. The chemical notation for a substance expresses the manner in which the substance is made up of the elementary substances; while its name, however derived, serves merely as a distinguishing mark. And just as the chemical notation for a substance may be used as a name for the substance, so the notation for a physical unit may serve as a name for that unit.

In a work, about to be published, on *Physical Arithmetic*, I make use of a notation for units, and I show how the notation can be applied in the reasoning out of problems. The analysis of a quantity upon which I proceed is threefold, namely, numerical value, unit, and, when necessary, descriptive phrase. For example, the letter x as used in geometry, denotes not only a number and a unit, but also a particular direction.

The progress of physical science has made us familiar with the idea of a system of units, and as specimens we have the centimetre-gramme-second system, and the foot-pound-second system. There is however no systematic notation for the units whether of the general system or of the particular systems. The notation which I propose is the logical extension of existing notation, and is in harmony with both the English language and the established notation of mathematics. The nature of the notation will be seen from the table appended.

We require letters to denote the fundamental units of length, time, mass, and temperature. Let L denote any unit of length, T any unit of time, M any unit of mass, and θ any unit of temperature. They are the units corresponding to the numerical values l , t , m , θ . The letters S , V , F , W , P , Q in the same manner stand for names.

When a unit depends directly upon two units, as S upon L long and L broad, the relation of the independent units is expressed by means of *by*. When a unit depends directly upon one unit and

inversely upon another unit, the relation of the two independent units is expressed by *per*; for instance, the unit of velocity is expressed by L per T. The words *by* and *per* correspond to the signs \times and \div , or rather now used by scientific men instead of the cumbersome \div .

Sometimes, as in the unit for conductivity, a bracket is required after *per* (just as in the case of a numerical expression a bracket is sometimes required after —), to show that the sign attaches to the whole of the unit included within the bracket. And as — followed by — is equivalent to +, so *per* followed by *per* is equivalent to *by*.

A rate of exchange may be expressed either by means of *per*, or by means of =. For example, 4.85 dollars per pound, and 4.85 dollars = pound. Here the sign = is read 'for every.' In the same way a velocity may be written v L per T, or v L = T. Again a conductivity can be expressed as

$$k \text{ H per T per S per } (\theta \text{ per L}),$$

$$\text{or, } k \text{ H per T per S} = \theta \text{ per L.}$$

A velocity has only one reciprocal, namely

$$1/v \text{ T per L};$$

but a conductivity has several, as

$$1/k \theta \text{ per L} = \text{H per T per S,}$$

$$\text{and } 1/k \text{ H per T per } \theta = \text{S per L.}$$

Equations of the kind which occur in exchange have not, so far as I know, been adequately treated. They are more properly termed equivalences. In ordinary equations the units of the two sides are identical; in equivalences they are either different in nature or different in description. The equations of exchange are combined by what is called the *Chain Rule*; and in the work referred to I show that a development of that rule is the method corresponding to the analytical expression of a quantity. For example, to express a speed of 60 miles per hour in terms of kilometres per second:

1 kilometre	=	1,000 metres.
1 metre	=	39.37 inches.
36 inches	=	yard.
1,760 yards	=	mile.
60 miles	=	hour.
1 hour	=	3,600 seconds.

$$\therefore \frac{36 \times 176 \times 6}{3937 \times 360} \text{ kilometres} = \text{sec.}$$

i.e. .0268 kilometres per second.

The C. G. S. system is obtained by substituting *centimetre* for L, *second* for T, and *gramme* for M. For θ the *degree centigrade* is used. Thus the unit of velocity is centimetre per second, and that of acceleration is centimetre per second per second. Many of those who study dynamics to pass examinations never attain to the idea of acceleration; they can grasp the idea of velocity, but they cannot discriminate the idea of velocity from it. Even some of those who write on dynamics show by their use of centimetre per second or foot per second as a unit for expressing an acceleration, either that they have not grasped the distinction, or that they do not see the importance of a distinctive notation. It must, however, be admitted that the author has the printer to reckon with; and the latter supposes, not unnaturally, that the repetition of the *per second* is a mistake.

In the C. G. S. System F is the *dyne* and W the *erg*. The notation for the unit of heat is *gramme of water by degree centigrade*; it is sometimes called the *gramme-degree*. The latter is a name formed after the manner of compounds, while the former is a notation expressing the nature of the dependence.

From the notation for a unit we can derive its dimensions, or the multiplier for changing from one set of fundamental units to another. Take for example the unit of force. Let $l L_{\text{new}} = L_{\text{old}}$, $m M_{\text{new}} = M_{\text{old}}$, and $t T_{\text{new}} = T_{\text{old}}$. From an inspection of the manner in which the units enter into the notation for the unit of force, we derive

$$m l t^{-2} F_{\text{new}} = F_{\text{old}}.$$

Properly speaking, the dimensions are the indices of $m l t$; in the above case 1, 1, and -2 , while $m l t^{-2}$ is the multiplier for changing from one unit to another. From the notation for a unit we can infer the multiplier; but from the multiplier we cannot infer the notation.

By means of the notation we readily see what ideas or units are equivalent to one another. For example,

$$1 \text{ erg} = \text{gm by cm. per sec. per sec. by cm.};$$

therefore $1 \text{ erg per cm} = \text{gm by cm per sec per sec}$, and $1 \text{ erg per gm} = \text{cm. per sec. per sec. by cm.}$ Thus the unit of force is equivalent to erg per cm , and erg per gm expresses the idea of potential. The rule is to change *by* into *per*, or *per* into *by*, when removing a unit from one side to the other.

The units encountered in electrical science are the most complex of all; and the labours of scientific men in overcoming them have had an indirect effect in advancing the methods of elementary calculation. It is, however, only the notation for the principal units P and Q in terms of L, M, T that is complex. Given P and Q the notation for the remaining units is simple enough. Of the two units of electric quantity the notation for the electrostatic unit is the same as that for the unit of magnetic pole, while the notation for the electromagnetic unit involves that for the magnetic pole.

General symbols for a unit such as M and V are of great service in elementary calculations apart from the use in a notation for derived units. The chemist is always using the phrases 'part by weight,' and 'part by volume;' these ideas are expressed by M and V.

NOTATION FOR GENERAL UNITS.

I.—Geometrical.

QUANTITY.	NOTATION.	DIMENSIONS.
Length	L	l
Surface	L by L, S	l ²
Volume	L by L by L, V	l ³
Angle	L arc per L radius	l ⁰
Sine	L opposite per L along	l ⁰
Curvature	Radian per L	l ⁻¹

II.—Kinematical.

Time	T	t
Velocity	L per T	l t ⁻¹
Acceleration	L per T per T	l t ⁻²
Angular Velocity	L arc per L radius per T	t ⁻¹

III.—Dynamical.

Mass	M	m
Density	M per V	m l ⁻³
Mass-vector	M by L	m l
Momentum	M by L per T	m l t ⁻¹
Force	M by L per T per T, F	m l t ⁻²
Pressure	F per S	m l ⁻¹ t ⁻²
Work	M by L per T per T by L, W	m l ² t ⁻²
Activity	W per T	m l ² t ⁻³

IV.—Thermal.

Temperature	Θ	θ
Heat	M of water by Θ, H	m θ
Thermal capacity	M of water by Θ per M	θ

IV.—*Thermal (Continued).*

Specific heat	M of water = M of substance	1
Latent heat	M of water by Θ per M	θ
Rate of expansion, linear.	L increment per L original per Θ increment	θ^{-1}
“ “ cubical.	V increment per V original per Θ increment	θ^{-1}
Conductivity	H per T per S per (θ per L)	$m^{-1} t^{-1}$

V.—*Electrical.*

QUANTITY.	NOTATION.	DIMENSIONS.	
		Electro- static.	Electro- magnetic.
Magnetic pole	\sqrt{F} by L, P		$m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-1}$
Intensity of field.	F per P		$m^{\frac{1}{2}} l^{-1} t^{-1}$
Magnetic potential.	W per P		$m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}$
Magnetic moment	P by L		$m^{\frac{1}{2}} l^{\frac{5}{2}} t^{-1}$
Quantity of electricity	\sqrt{F} by L, Q electrostatic..	$m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-1}$..	
“ “	F per P by (L rad.) ² per L arc by T, Q electro- magnetic		$m^{\frac{1}{2}} l^{\frac{1}{2}}$
Intensity of electric field ...	F per Q	$m^{\frac{1}{2}} l^{-1} t^{-1}$..	$m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}$
Electric potential	W per Q	$m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}$..	$m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2}$
Electric density	Q per S	$m^{\frac{1}{2}} l^{-1} t^{-1}$..	$m^{\frac{1}{2}} l^{-\frac{3}{2}}$
Electric Capacity	Q per (W per Q)	1 ..	$l^{-1} t^2$
Current	Q per T	$m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2}$..	$m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}$
Resistance	W per Q per (Q per T) ..	$l^{-1} t$..	$l t^{-1}$
Conductivity of a substance. Q per T per S per (W per Q per L)			$l^{-2} t$

Messrs. Livingstone and Macdougall made some remarks and the President noted the small attendance of those able to discuss the subject of the paper as a reason for dividing the Institute into sections.

TENTH ORDINARY MEETING.

The Tenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, January 17th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of Donations and Exchanges received since last meeting was read:—

1. Catalogue of Canadian Plants, Part II., Gamopetalae, by John Macoun, M. A.

2. The Canadian Practitioner for January, 1885.
3. Science, Vol. V., Nos. 100 and 101, Jan. 2nd and 9th, 1885.
4. Journal of the Asiatic Society of Bengal, Vol. LIII., Part I., No. 2, 1884.

Prof. Loudon read a paper on "The Spherical Aberration of Mirrors." This paper has been incorporated with a former paper by Prof. Loudon. (See *ante*, page 16).

The Hon. G. W. Allan then read the following paper on

SOME OF OUR MIGRATORY BIRDS.

There are few subjects connected with bird life, more interesting than the migration of these denizens of the woods and fields, as they come to us in Spring after many months of absence — or leave us again at the approach of autumn or the keen air of early winter to wend their way back to milder and more genial climates. To an observant lover of nature there is an especial charm in the recognition of the first notes of each winged visitant, heard almost before they are seen, and bringing back life and melody to our woods and fields after the long silence of winter; and so again in autumn, there seems to be a peculiar plaintiveness in the call-notes of the gathering flocks, as if bidding us farewell before setting out on their long journey.

Even winter, however, with its frosts and snows has its visitors, coming from still colder latitudes, spending a few brief weeks with us, and at the first approach of the sunny days and soft airs of Spring, wending their way back to the far North.

In the limits of a paper such as this I shall not attempt to offer anything like an exhaustive list of our birds of passage, I shall confine myself to giving, as it were, a rough sketch of the ornithological characteristics of each month as marked by the arrival or departure of some of the various species of our land birds.

To begin with the year, for winter, as I have said, has its visitors as well as summer, and from the icy shores of Greenland, and the frozen north, comes to us that beautiful little bird, the Snow Bunting *Plectrophanes Nivalis*, the harbinger of cold and stormy weather. Flying generally in large flocks, as their bodies are seen against the blue sky, they look almost like large snow flakes drifting before the wind.

So associated are they with storm and cold that in northern

Europe where they are also found in great numbers in winter, they go by the name, among the Swedes, of "Illwarsfogel" or bad weather birds!

The time of their arrival here varies with the character of the weather. In very cold winters I have seen them as early as 10th and 15th of December, and I have known them to remain in some seasons as late as the first week in March. They are said to make their appearance in Hudson's Bay at the end of March or early in April remaining there for a few weeks and then wending their way still further north to breed on the shores of Greenland or even desolate Spitzbergen! As the food of these birds consists almost entirely of seeds of various wild plants, their means of subsistence amidst the deep snows of winter would seem to be precarious enough. Nevertheless they become very fat, and in the Province of Quebec, where they are found in much greater numbers than here, they are slaughtered most mercilessly for the market, and among our French friends "snowbirds on toast," I am sorry to say, form a standing entree in the bill of fare of a fashionable dinner.

The snowy owl, *Nyctea Scandiacæ*, one of the most beautiful of our rapacious birds, is another winter visitor, at one time very common even in this neighborhood. I have seen them in considerable numbers on the Island on the other side of our Toronto Bay in the months of December and January. Nothing can exceed the exquisite softness and beauty of their thick, warm plumage, which enables them to bid defiance to the severest cold, and as they are not over-nice in their choice of food, rats, mice, fish and small birds, all seeming to come alike, they are in no danger of starving even in the most wintry weather.

During this and the next month when strolling through the park or even through some of our streets, where bordered by trees or gardens, the attention of the passer-by may sometimes be attracted by the very sweet and melodious call-notes of two or three handsome birds, busily engaged in feeding upon the tender buds of a maple or stripping off the berries of the mountain ash, and if his curiosity induces him to approach them more closely (and they are often extremely tame and fearless) he cannot but be struck with the beauty of the plumage of some of the number, the head and upper part of the breast and back of the male birds more especially being beautifully marked with delicate shades of orange and crimson. These

birds are the Pine Grosbeak (*Pinicola Enucleator*), a rare visitor in some years, but in severe winters it comes to us in considerable numbers, being met with, not only in our woods, but sometimes venturing fearlessly, as I have said, into the streets and squares of our towns. They occasionally do a good deal of mischief to the young buds of both fruit and ornamental trees.

During a very severe winter many years ago these birds came into my own grounds in great numbers. Observing that wherever any withered apples were left hanging on the trees in the orchard they were eagerly attacked and torn to pieces by the Grosbeaks, apparently for the sake of the seeds, I had a quantity of apples cut up and strewn on the steps of the verandah of the house, and before long I had as many as ten or a dozen of these beautiful birds feeding at the same time, and so tame and fearless did they become, that they would allow the members of the family to watch them from the windows. They did not, however, always content themselves with the food thus provided for them, but did a good deal of mischief that winter to the young buds of the cherry and apple as well as many of the ornamental trees. They leave us generally about the end of March.

The Bohemian Wax-Wing (*Ampelis Garrulus*), is another rare winter visitor only appearing in seasons when extreme cold has driven it down from more northern latitudes. In plumage it resembles very closely the *Ampelis Cedrorum*, the Cedar Bird, common Wax-wing, or Cherry Bird, so well known, as an active depredator in our gardens and orchards. The Bohemian Wax-Wing, however, is considerably larger and the colouring of the plumage, though very similar, is richer and deeper. It has the same curious horny tips like red sealing wax on the secondaries of the wings.

The Crossbills, both the Red Crossbill (*Loxia Curvicostra Americana*), and the White-winged (*Loxia Leucoptera*), have been classed as winter visitors only in Ontario, and so has that elegant little bird the Pine Finch (*Chrysomitris Pinus*). I have met with all three, however, in the neighbourhood of Lake Simcoe during the summer, and the Crossbills undoubtedly breed in the pine and Hemlock woods and may be seen there all throughout the year.

The last of our winter visitors that I shall notice is the Shore Lark, *Eremophila Alpestris*. Speaking from my own experience, it is not often met with in this part of Ontario, though it is found

occasionally and in low and marshy grounds on the shores of this lake, and I have also seen it frequently in the neighbourhood of Ottawa.

It feeds on the seeds of various grasses and weeds, and such insects as it can obtain at the season. Its call note is very soft and melodious, and I have heard the male bird in the early days of March utter a short but very sweet song. It is then just on the point of setting off on its migration northward and its plumage has begun to assume something of its summer brightness, the black tufts of feathers on the head and the crescent shaped patch of black on the throat of the male bird are then very conspicuous.

Sometimes as early as the last week of February, though generally in the first warm days in March the cawing of the crows is heard for the first time, and their harsh voices sound pleasantly to our ears because they are associated with the commencing spring.

It is true that occasionally in very mild winters one or two individuals do sometimes remain in particular localities, but these are exceptions to the general rule and they may fairly be classed among our migratory birds.

I have said that their voices sound pleasantly because they are associated with the coming spring, but for my own part, I confess, it is only at that particular season that I can listen to them with any degree of complacency. They are then doing good service in feeding upon noxious insects and vermin of many kinds, but as the spring advances and the various small birds begin to lay their eggs and hatch their young, the crow becomes the ruthless destroyer of both eggs and young, and scores of the eggs or young of our Song Sparrows, Warblers, Thrushes and various other birds fall a prey to its voracious appetite.

First among the arrivals in March of our smaller migratory birds is the Song Sparrow, *Melospiza Fasciata*, and its short but sweet song is the first to proclaim "that the winter is over and gone, and the time of the singing of birds is come." The time of its arrival, as I have noted it in various years, varies from the 16th to the 23rd of March, sometimes, in very backward springs, not until the first week in April.

Almost at the same time with the Song Sparrow comes the Robin (*Turdus Migratorius*), its cheery notes, whether heard from the top of some tall maple, or as it scuttles through the bushes of the shrub.

bery, or pipes its evening song from the roof of some lofty building, is one of the most welcome sounds in Spring. Indeed I know of none among all our feathered visitors so worthy of being cherished and protected. It comes about our lawns and dwellings, and if only unmolested will build its nest and lay its eggs and hatch its young under the very eyes of the household. Its cheerful notes are the first we hear on waking, for the Robin is abroad at early dawn, and through the live long day it is going and coming in quest of food for itself or its young, stopping every now and again for a short snatch of cheery song, and then, as the sun goes down, perched on some tree, or it may be high up on the gable of some lofty building, it will pour forth its sweet notes continuously—sometimes for half an hour or more; the last of all the grove to relapse into silence. The quantities of grubs, caterpillars, cutworms, crickets and grasshoppers which are captured and devoured by the Robin and other thrushes is something marvellous; and as the Robin not unfrequently raises three broods in the year, his species must destroy more of these insects than almost all other birds put together. Notwithstanding all this because the Robin occasionally treats itself to a few strawberries or cherries or grapes by way of desert, it has been proscribed in some places by the fruit growers, who have had influence enough to persuade our local legislature to take it out of the list of insectivorous birds protected by law, and allow, in the words of the act, “Any person during the fruit season to shoot and destroy the Birds known as the Robin and the Cherry Bird.” It is scarcely fair to the Robin to put it in such company, though even the Cherry Bird, with all its fondness for fruit, assists in ridding our fruit trees of a host of insect enemies which infest them. In the case of the Robin, however, I have repeatedly, again and again, watched it while feeding its young—earth-worms, grubs, vine-worms, caterpillars and other insect food were being brought all day long, and on these the young birds were fed exclusively, and when it is borne in mind that the Robin, as I have already stated, not unfrequently raises three broods in the year, their services in the destruction of insect pests must more than pay three times over for all the fruit they devour.

Quickly following upon the arrival of the Robins comes the Blue Bird (*Sialia Sialis*). Not so bold and fearless as the Robin, it does not come about our dwellings and grounds in quite the same

familiar way; nevertheless, it is a sociable, gentle bird, and if unmolested will build and rear its young in the same spot, under the eaves of some out-building, or in a deserted Martin's box or even a knothole in a fence post.

For several years when the large rustic pavilion was standing in the centre of the Horticultural Society's Gardens the Blue Birds used to build regularly every season among the rafters of the roof, and their soft warbling notes could be heard all through the summer as, perched on the ridge, they dressed and plumed their feathers after returning from the capture of some moth or grasshopper or other insect prey.

Sometimes in the last days of March, though generally not until the 3rd, 6th or 7th of April, comes an old friend, familiar to most of us from boyhood, the Pee-wee, Fly-Catcher, *Sayornis Fusca*. Although it has but the one plaintive note, *pee-wee*, sometimes long-drawn out, and then changing into a little tremulous, murmuring twitter, as flying down from its perch on the housetop, or the gable of some old barn, it snaps up a passing insect, yet few sounds of bird voices are pleasanter to the lover of nature, for it is suggestive of warmth and sunshine, the waking up of insect life and all the gladness and freshness of spring. What should render this Fly-Catcher a special favourite with us is the tameness and familiarity with which it harbours about our dwellings, and its attachment to the same spot wherein to build its nest year after year; it may be under the eaves of the barn or stable, or, as if boldly claiming our protection, it will attach its fabric of mud and moss, and fine grasses, to some convenient ledge under the roof of our verandahs, where its proceedings may be watched day by day by all the inmates of the house.

By the 5th or 10th of April the Tree Sparrow, *Spizella Monticola*, and the Chipping Sparrow, *Spizella Domestica*, have made their appearance. The latter well merits its epithet of *Domestica*, for it is one of the tamest and most sociable of our feathered friends, and under the name of "grey bird" is known to almost every child in the country. No sweeter song is heard at this season of the year than the warbling of that handsome bird, the Purple Finch, *Carpodacus Purpureus*, which, although it may occasionally be seen in a very mild winter in company with the Siskin, or Crossbills, yet is a sufficiently rare winter bird to make its advent the more marked

when April comes, and we catch sight of the handsome cock-bird on some bright morning in his full livery of shaded crimson, perched on the topmost bough of an apple tree, and pouring forth a succession of sweet, warbling notes, sometimes for half an hour together. Like the Pine Grosbeak, the Purple Finch occasionally commits great depredations on the buds of our fruit trees; and later in the season, when the cherries are ripe, it rivals the Waxed Chatterer in its devotion to that fruit. The plumage of the adult male is very handsome: The head, neck, breast, back, and upper tail coverts are a rich, deep lake, approaching to purplish crimson on the head and neck, and fading into rose colour on the belly. The quills and larger wing coverts are deep brown, edged with purplish red; and the tail feathers are deep brown, similarly margined.

That curious bird, the Towee Bunting, or Ground Robin, as it is sometimes called, *Pipilo Erythrophthalmus*, reaches us early in April. I have generally found it in clearings on sandy tracts, such as the Humber plains, partly overgrown with scrub oak and pine, where, among the withered leaves and underbrush, it passes much of its time searching for worms, the larva of different insects and uttering the peculiar note of Towee-towee.

As the power of the sun becomes sensibly felt, and in spite of cold winds and an occasional night's frost, there is an increasing mildness and softness in the atmosphere, and on some bright morning we unexpectedly hear a cheery twittering note above our heads, the Swallows have come! and despite of the old adage, we are ready to welcome the arrival of these harbingers of summer as a sure pledge that all frost and cold are over, and warmth and sunshine will now be ours.

The first to make their appearance of the swallow tribe are the White-bellied Swallow, *Irotoprocne Bicolor*, and the Sand Martin, *Cotile Riparia*. They both arrive nearly at the same time, about the 9th or 10th of April, though I have the arrival of the White-bellied Swallow noted in my diary one year on the 30th of March.

The Barn Swallow, *Hirundo Erythrogastra Horreorum*, comes next, about 15th of April. The purple Martin, *Progne Subis*, and the Swift or Chimney Swallow, *Chetura Pelasgica*, are generally the last to arrive, about the 20th of April, sometimes not until the very end of the month, though again I have the Purple Martin down one year as reaching us on the 9th of April.

The Purple Martin is a bold, fearless bird, attacking even hawks and crows when they come in his way. Its flight unites in it, all the swiftness, ease, rapidity of turning and gracefulness of motion of its tribe. It is well known or used to be well known to all dwellers in town and country as the constant tenant of the numerous bird boxes, or swallow-houses which are erected, sometimes on the sign board of the Village Inn, or on some out-building in the farm yard, or even in the streets of the town. Of late years, however, I fear that the English Sparrow has to some extent ousted the Martin from its old quarters in the towns, for, though no match individually, the sparrows by their numbers and pertinacity so worry and disgust the bigger bird as ultimately to drive it away. A few years ago a pair of Martins occupied a two story bird house in the yard attached to the Canada Company's office. There were many battles at first between the Sparrows and the Martins, but at last they seemed to come to a compromise, and the Sparrows occupied one story and the Martins the other, and brought up their respective broods without further fighting. Since then, however, the Martins have never returned and I cannot help suspecting that the same results may have followed in other places, for the bird certainly seems to be less numerous than in former years.

The Blackbirds and Grakles now make their appearance, and the reedy borders of our ponds and marshes, and the neighbouring woods are filled with these noisy birds. The Cow Blackbird, *Molothrus ater*, arrives first. The Swamp Blackbird or Red Wing Blackbird, *Agelaius Phœniceus*, sometimes in the last days in March, but more frequently about the 9th or 10th of April, and the Grackle or Crow Blackbird a little later. Little parties of the Cow Blackbird may be seen on fine mornings visiting the pasture fields and lawns, running about the grass in search of insects larvæ and worms, and betaking themselves at nightfall, to roost among the tall reeds and sedges on the margin of some swamp or river. This bird like the Cuckoo of Europe follows the singular custom of not making a nest of its own, but deposits its eggs, one at a time, in the nest of some other bird, leaving them to the care of a foster parent. When the female is about to deposit her eggs, she moves about uneasily from tree to tree until she discovers a nest from which the rightful owner is absent at the moment, and then quietly drops in her egg and flies off. It never deposits more than one egg in the same nest,

although it is probable it thus leaves several in different nests. The birds employed as foster parents are all smaller than the Cow Blackbird—the Chipping Sparrow, the Maryland Yellow Throat, and some of the smaller species of Fly Catcher are among those most favoured, the Chipping Sparrow perhaps most frequently with us. As the young blackbird grows up it is provided for by its foster parents with all the care and assiduity that would be displayed towards their own offspring, and long after it has left the nest it continues to be fed by its affectionate guardians.

Frequently where the Chipping Sparrow has been the foster mother I have seen the tiny little bird carefully placing some choice worm or dainty insect in the open mouth of its great clumsy fluttering nursling, nearly half as big again as itself, whose sooty brown colour, as well as its size, offered a curious contrast to the delicately marked plumage and pretty slender form of its foster mother.

The Marsh Blackbird is well known to all by the extremely handsome plumage of the male bird, and any visitor to the meadows or marshes in the neighborhood of the Humber or the Don must be familiar with the peculiar song, if song it can be called, of “quonk-aree,” sometimes uttered by half a dozen birds at a time from early dawn to midnight.

The Crow Blackbird or Purple Grackle, *Quiscalus purpureus*, although its food consists at some seasons of larvæ, caterpillars, moths and beetles, is the most mischievous to the farmers' crops of all the blackbirds, and is a serious nuisance in some of the localities in which they abound.

About the 10th or 15th of April, sometimes a few days earlier, if the season is favourable, the Grass Finch or Bay-winged Bunting, *Poæcetes Gramineus*, arrives, and soon makes its presence known by its deliciously sweet song, which may be heard all through this and the next month in our fields and open pastures and the borders of our woods, from “morn till dewy eve,” being like the robin fond of pouring out a last farewell to the closing day. Its neatly built nest placed usually under a tussock of grass, constructed of fine grasses and roots bent and twined together, and the whole lined with hair-like roots and grass, may be met with in the open pastures or fields, sometimes as early as the end of April or the first week in May.

As the month advances fresh notes from new arrivals continually

strike upon the ear. Strolling through the garden or the orchard we may hear a low, sweet, soft call-note like that of a tame Canary, followed immediately by a rapid joyous warbling, it is the American Gold Finch, *Astragalinus tristis*. This pretty, elegant, little creature, like the Purple Finch, sometimes, though rarely, lingers with us through a very mild winter, but generally they move off in large flocks to the south at the approach of autumn and do not return to us until towards the middle or end of April. The cock bird when in full plumage is one of the handsomest of our songsters, and unlike many others of our more gaily plumaged birds sings with great sweetness.

As April draws to a close and we pass into May, if the weather be warm and genial, not only the woods but our gardens and shrubberies are suddenly full of a host of charming little visitors, most of whom tarry for a very brief space disappearing again in a week or two, journeying on towards their northern breeding places. I allude to that large family the *Sylvicolidae* or "Warblers," some of which remain with us all through the summer, but large numbers of them merely pass through on their way northward in spring, and again on their return journey to the south in autumn.

Among the latter I may refer to a few which I have observed both in this neighbourhood and in the woods about Lake Simcoe. The Black Throated Green Warbler, *Dendræca Virens*, and the Yellow Rumped or Golden Crowned Warbler, *Dendræca Coronata*, are two most frequently seen and both remarkable for the beauty of their plumage, though in this latter respect, that lovely little bird the Blackburnian Warbler, *Dendræca Blackburniæ*, surpasses them all.

The pretty little Blue-Yellow backed warbler, *Parula Americana*, is said to breed in Canada, probably in the more northern parts of Ontario and Quebec, but I have never met with its nest, nor do I remember ever seeing it during the summer months. Two species, the Canadian Fly-Catching Warbler, *Myæodivetes Canadensis*, and the Black and White Creeping Warbler, *Minotilla Varia*, frequently breed in our northern woods. Of those who take up their abode with us for the summer the best known and most familiar to most of us from its short but sweet and cheery song and its social confiding disposition is the Yellow Warbler, *Dendræca Aestiva*.

It has little fear of man allowing itself to be approached quite closely, but during the breeding season the little bird shows great

anxiety for the protection of its eggs or young, flying in front of the prying visitor or tumbling along the ground as if wounded after the manner of the partridge with wings and tail outspread, it endeavours by every artifice to attract the unwelcome intruder from the neighbourhood.

It is one of those birds occasionally selected by the Crow Bunting as a foster mother for its young, and not unfrequently the single egg of the latter may be found deposited among the five or six eggs of the Warbler.

Of all our summer visitors the most brilliant in plumage, almost tropical in its character is the Scarlet Tanager, *Pyrranga Rubra*, which arrives from the south from the 10th to the 15th of May. The male bird is too well known to require description, but it may not be generally known that the female has none of the gorgeous colouring of the cock bird, but is olive green above and yellowish beneath, wings and tail brown, edged with olive colour, and the young males for the first season are colored like the females, but generally exhibit more or less of red feathers among the greenish ones. I have met with the nest and young of this handsome bird in the woods about Lake Simcoe, but only occasionally, and as a general rule they seem to disappear from this part of Ontario like so many of their companions, the Warblers, after a very brief stay in the early part of May.

Following close upon the arrival of the Scarlet Tanager, and often seen with it, comes that beautiful bird, the Crimson-breasted Grosbeak, *Zamelodia Ludoviciana*. In general it is a shy bird, keeping much in the forest, where it feeds mostly upon the seeds of the birch and alder, the tender buds and blossoms of the trees, and upon insects which it catches on the wing; but when the cherries are ripe in the gardens and orchards, it often approaches our dwellings, and certainly repays us for the little fruit it consumes by the delicious softness and melody of its notes. They are very numerous in the woods at Lake Simcoe, breeding there, and remaining with us until the middle of September.

Yet another visitor, whose gorgeous plumage quickly attracts attention to its arrival following the Tanagers and Grosbeaks, is the beautiful Baltimore Oriole, *Icterus Galbula*. Gliding from branch to branch in search of insects, the brilliant livery of the male renders him a conspicuous object, even if his clear, mellow whistling notes,

which may be heard at a long distance, did not attract attention. In the woods, the Oriole generally builds in some tall elm or gigantic button-wood tree; but their singular nests are occasionally found in our orchards, suspended from the extremities of the branches of the apple or the pear. The nest is woven, as you all probably know, in the shape of a purse or bag, and is generally attached to two or more forked twigs by threads of the silk weed, or fibres of other wild plants, and not unfrequently when they can obtain them by pieces of string or thread, which the bird picks up near the neighbouring houses. With the same materials mixed with hair, wool or tow, it interweaves a warm and substantial fabric of nearly six or seven inches in depth, the bottom part being lined with horse hair.

The White Browed Crown Sparrow, *Zonotrichia Leucophrys*, and the White Throated Crown Sparrow, *Zonotrichia Albicollis*, both arrive in May. The singularly sweet notes of the latter bird must be well known to all observers. I have observed that they are generally most musical immediately before rain or during the frequent showers of the early part of the season.

Any one strolling through the meadows or near the margin of some stream or reedy pond during the latter part of May, will often hear an outburst of the most curious, jingling, joyous, laughable medley of a song that any bird throat ever uttered, and if he catches sight of the singer he will see it nodding its head, quivering its wings and with open mouth rattling out its curious notes as if its very life depended on it; this is the Bobolink Reed Bird or Rice Bunting, *Dolichonyx Oryzivorus*. Its plumage is almost as curious as its song, a mixture of black, white and yellow, disposed in a sort of piebald fashion over the body.

Much about the same period of the month a very different song may be heard, no one who has listened to it as from the topmost twig of some tall oak on some fine May morning, the singer pours forth its sweet cadences so full of melody, but will forever scout the assertion so often made by those who know little of our Canadian birds that they are destitute of song. It is the Ferruginous Thrush or Brown Thrasher as it is sometimes called *Harporynchus Rufus*, that is filling the air with melody, and in my judgment, except the Skylark and Nightingale of Europe, there are few birds whose vocal powers can compare with this thrush. If we desire a strong contrast we can have it in the harsh cry of another summer visitor

often seen with the Thrush and other fruit loving birds in our gardens later in the year—the Cat Bird, *Mimus Carolinensis*. Its curious harsh mewling like a cat, which it utters when alarmed, has earned for it the specific name of *Felivox* from some authors, which is certainly much more appropriate than *Carolinensis*. Nevertheless the Cat Bird is possessed of vocal powers which entitle it almost to be called the Canadian Mocking bird, for I have heard it imitate the notes of the Thrush and a host of other birds, and it will sometimes pour forth its “mocking” song until long after the sun has gone down.

Before the end of May the Wood Thrush, *Turdus Mustelinus*, and Wilson’s Thrush, (Veery) *Turdus Fuscescens*, have arrived and their song may be heard in the woods at break of day and the last thing towards evening; and in the fields the sweet notes of the Meadow Lark, *Sturnella Magna*, are now mingled with the voices of the Song Sparrow and Baywing.

That bold and handsome bird the King Bird, *Tyrannus Carolinensis*, may be seen perched on some fence post, or outbuilding, or tall tree, ready to give battle to birds twice his own size, and especially to the Crow, to which he seems to have a special dislike. The various species of Fly Catcher, which come to us in summer, have now all arrived, and the Wood Pecker tribe, Golden wing and scarlet headed and others, are to be met everywhere as you pass through the fields and woods; but I must not go on with my catalogue any further, for I have already exceeded my proper limits in this paper, and I shall conclude with noticing a bird that may not be so familiar to many of you, which is always associated with the glowing heat of summer, when except in the early freshness of the morning the songsters of the grove are comparatively silent. It is then that from the deep shade of the woods, or from some cool thicket near our gardens, even during the hottest hours of the day, comes the soft but monotonous Coo-coo of the *Coccygus Americanus*, the yellow billed Cuckoo. It and the black billed Cuckoo, *Coccygus Erythrophthalmus*, which is very similar in its habits, though the latter is, perhaps, not quite such a shy bird as the yellow billed, frequents our woods all through the summer, and unlike the European bird, show much care and affection in bringing up their young, although their nest is rather a careless fabric, being composed of a few dry twigs, mixed with weeds and grass, and with so little concavity as sometimes to endanger the safety of its young.

I have thus only just faintly outlined, as it were, some of the "ornithological characteristics" of a *part* of the year. The details, if properly filled in, would occupy far too much of your time on the present occasion, even if I confined myself to the birds arriving in the spring and early summer. I must, therefore, defer any further notices of our "migrants" to another opportunity.

The paper was illustrated by specimens.

Remarks on some of the birds referred to were made by Messrs. Murray, Vandersmissen, Keys, Squier, McKenzie, Livingstone, Bain, Brodie, and Dr. Scadding.

ELEVENTH ORDINARY MEETING.

The Eleventh Ordinary Meeting of the Session 1884-'85, was held on Saturday, January, 24th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The Hon. G. W. Ross, Minister of Education, and David B. Dick, Esq., Architect, were elected members of the Institute.

The following list of donations and exchanges was read :

1. Monthly Weather Review, Dominion of Canada, for December, 1884.
 2. Science, Vol V., No. 102, January 16th, 1885.
 3. The American Journal of Science, for 1884, Vols. XXVII. and XXVIII.
 4. Report of the Observatory of Yale College for 1883-'84.
 5. Transactions of the Manchester Geological Society, Vol. XVIII., Part III., Session 1884-'85.
 6. Proceedings of the Royal Geographical Society, N.S., Vol. VII., No. 1, for January, 1885.
 7. Quaritch's Catalogue of Spanish Literature, No. 361.
 8. Proceedings of the London Mathematical Society, Nos. 195 to 230, forming Vol. XIV. and part of XV.
- List of Members of the London Mathematical Society, November 13th, 1884.
9. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, 4 e Série, 37 e Année, 10 e Cahier, October, 1884.

Donation of \$50 to the Funds of the Institute, by Sandford Fleming, Esq., C. M. G.

On motion of Dr. Kennedy, seconded by Mr. George Murray, it was resolved that the thanks of the Institute be tendered to Mr. Sandford Fleming, C. M. G., for his generous donation.

D. A. O'Sullivan, M.A., LL.B., read a paper entitled

SYSTEMATIC CHARITY.

Every large city in the world has a destitute population ranging probably about five per cent. of the whole number of its inhabitants. There are the poor who are unable to work, the poor who are unwilling to work, and the poor without work for them to do.

The first of these classes include the sick, the aged, the deformed, and those who, whatever their disposition may be, are unfit to support themselves. They form the great mass of any city's permanent poor, and they are the ones towards whom the energies of the charitable and the actions of the Legislature are directed.

The second—and an alarmingly increasing class—furnish the pauper and the tramp of modern civilization, and it is said on the authority of a very experienced writer that “the pauper, the imposter, and the fraud of every description carry off at least one-half of all charity, public and private, and hence there is a constant and deplorable waste in the alms-funds of every large city.”

The third class of poor, able and willing to work, but without work to do, is a fluctuating class, absent in one city and present in another, and varying also in seasons in the same city. They form the lower order of working classes; if work is provided for them they may arrive at a higher level, if not they become depauperized and are the scandal of society.

I have divided the poor whom the taxpayer and the charitable have to support into three classes, with reference to their capacity or inclination for work—for labor of some kind; but there are others with whom the public are concerned, such as the criminal of minor offences, who is kept in gaol or in prison at the public expense; the drunkard, who finds his way to the same institutions, and a large miscellaneous class who, by reason of vice that is a legal crime, or

vice that may not be such, are maintained in the hospitals and infirmaries and magdalen asylums, and whose children are to be found in the various institutions from the infants' and children's homes till they are ripe for a repetition of the vices and career of their parents.

The social and economic problems in regard to the poor are neither few nor simple of solution. What is to be done for the honest poor who desire to better their condition? and what remedies can be offered to repress the degrading process by which a poor man becomes a pauper? How, in fact, can the worthy poor be enabled to help themselves, and how can the pauper and the tramp be exterminated? The task of maintaining the helpless is a very small one compared with the tax to maintain the idle and the undeserving. The rate-payer and the charitable have to support not only themselves but the poor and destitute of every kind, and it is important to them to aid in any effort towards the co-operation and efficiency of our charities.

Charity comes to be administered within a score or so of institutions in cities like Toronto, and so far as indoor relief or assistance is concerned there is not so great a necessity for any organized co-operation. The waste and abuse and imposture is chiefly in regard to outdoor relief, and it is all the more in those cities where no well organized association of charities exist. It is of this organization of alms-giving that I propose to treat principally in this paper.

Within the last seven years 36 charity organizations have sprung up in the United States, and it is on the experience of the workings of these institutions that I propose to direct your attention. I have preferred relying upon the reports of charities in those cities having so many features in common with our own, and so have not gone into the workings of any other foreign charities. The *Monthly Register*, of Philadelphia, collects information from all quarters, and is the official journal for a large number of charity organizations. It is obvious that wherever a Poor Law system prevails there would be fewer materials for our guidance in organizations than where no legislation is required for their efficient working.

The principles upon which American charity organizations are founded are very simple and very well understood.

A charity organization does not mean one mere charitable society. "It means," in the language of Mr. Kellogg, the organizing Secre-

tary of the Associated Charities of New York City, "an alliance offensive for economy, thoroughness and efficiency of all such organizations of public official relief, and of congregational and individual beneficence, into one harmonious and co-operative body, maintaining intercourse and comparison through one central agency, and pledged to united and concurrent efforts for the suppression of the pauper and the rescue of the deserving poor."

It means a common field in which men of all beliefs and men of no belief can work side by side in the cause of humanity. It means an examination into the cases of individual destitution by a personal canvas, and it means a thorough investigation of every applicant, so as to detect and expose imposture, and is, therefore, a comparison and exchange of information in confidence.

This central agency or bureau does not interfere in any way with the workings of the existing charities. It gives no relief except in rare, urgent cases. It excludes no worthy applicant, and it frowns down any attempt at proselytism. It aims to prevent imposture, to reduce vagrancy and pauperism, to relieve the destitute, and to give relief in return for employment. It has its agencies, its branch offices, its paid and volunteer officers, and as efficient a system of registration as possible.

This last—a registration of the names of all in the city in receipt of private or official relief—is not only one of the first things insisted upon, but it will be noticed in comparing the reports for different years that it is considered of very increasing importance. The report from Baltimore (and I quote the latest issued) says that the charity directory has already proved of valuable assistance. In Brooklyn, Boston, Detroit, and many other cities, a map is prepared, the names of applicants collected as far as possible, and a list of those obtaining relief from the circle of charities in the city.

The manner in which this was done in Buffalo is a fair example of what can be done with little expense. "Circulars were sent to all church societies, relief societies, benevolent societies and fraternities, and to all asylums and hospitals, asking for particulars as to their mode of operation, the kind of relief given, &c. Then the books of the Poor-master's office were copied, and shortly after, through the kindness of the Superintendent of Police, blanks were delivered at every house in the city by the police, asking for full particulars of any relief that any citizen was giving at that time to

any poor person or pensioner. These forms were collected by the police twenty-four hours after delivery, and out of some 30,000 issued, some 3,000 were returned filled in." "And this," says the very able writer on the subject of Charity Organization, the Rev. Mr. Gurteen, "our first work of registering the names of all in the city in receipt of relief, whether official or private, was begun." Books were then opened for indoor and outdoor relief, and classified as public or private, and the information methodically arranged, with the names in alphabetical order. It was found that the same person, in some cases, was in receipt of relief from three or four different societies, from a dozen different individuals, and from one or more churches, besides being on the poor books. "It was a lesson," he adds, "Buffalo will never forget."

The Secretary of the Brooklyn Bureau of Charities says: "The value of the registry system is now proved by actual test in the principal cities of the country. The system in some form is indispensable to the intelligent administration of charity." * * * "A complete registry is the only adequate check upon those who subsist upon alms fraudulently obtained."

"In New York," Mr. Kellogg says, "we should feel ourselves powerless without it, and the bulk of the large relief societies would feel that its abandonment was a long step backward." There are 195,000 persons in the New York Registers.

One reason why this is insisted upon—and a number of other authorities could be cited—is that it corrects abuses in the outdoor relief. The tendency of outdoor relief, it is said, is demoralizing. Detroit officially reports in favour of its abolition. Brooklyn and Philadelphia have made it illegal. New York gives no outdoor relief, except to the adult blind. Buffalo has taken the same view, and great savings are reported in cities where the organizations are complete, or where outdoor relief is entirely abolished, as in Brooklyn and Philadelphia. To reduce imposture is to reduce vagrancy, and in this knowledge is really power. To know that one person is deserving and another is not, is not only to be in the way of effectual alms-giving, but it is a saving of expense and an encouragement to the relieved.

On all points of view every aim of methodical charity is assisted, strengthened and sustained for good by the completeness of its registration; registration of those who ought to be relieved, whether they

ask it or not, and registration of those who ought not, no matter how or where they apply for relief.

The other features of the American, or as it might be called, "The Buffalo Plan" of Organizing Charities, do not need especial mention. No good would be done by attempting to interfere with the existing charities, and every one would deprecate any attempt at proselytism. Charity, in this human aspect of it, as well as on the Divine side, should exclude no person, or body of persons, on account of religious creed, politics or nationality. Such an organization requires but little funds, as the rule is to give no alms. If it can direct where alms should be given and where withheld, a great good will have been accomplished. Its funds are intended to be used solely in payment of such paid officials as may be necessary. In Boston, with a population of about half a million, the expenses of the associated charities are in the neighbourhood of \$13,000, but they have 25,000 people on their books, and received reports from 47 charitable societies and 571 private individuals, and employ about 600 paid agents. Last year the central office received over 30,000 reports, and sent out about half that number. In Philadelphia, with a larger population, about 1,000 or over are employed, and the expenses are very much less, only about \$4,000. In Buffalo the expenses of the first year were \$6,700, and it is claimed that there was a saving to the ratepayers in that year of the sum of \$48,000.

The task of seeing that all deserving cases of destitution are properly relieved is, of course, one of the greatest aims of these associated charities. This is effected by a network of agencies throughout the city, at the headquarters of which the chief officer has a list of charities and a report of the person to be relieved. The visitors make a recommendation to the proper charity in order to obtain relief. This is not a thing to be done in a day or a year, and I notice that while the early reports recommend that all officers of the organizations be paid—that there be no sentiment but all business in the matter—some of them now admit that to have been an error; that volunteer charity is, when it can be got, the right sort of charity. This would not, however, apply to the central office, which is open all day, and where a complete register of every case of relief is to be had. In communication with this central office, and revolving around it, as it were, are the district committees, and with these

the use of volunteers is not only desirable but imperative. The work could not be carried on otherwise. The usual support given to the poor, the encouragement to elevate their home life, their health, and their habits are matters for the benevolent citizen who can snatch a half hour in the week for that purpose, and comes all the better from him than from the official representative of charity.

Indeed the associated charities must do good in this direction, or do very little at all, as they are not organized to relieve the poor by giving alms, but to enquire into the cases of deserving poor and thus aid the existing charities, and secondly, to help the poor to help themselves. So long as real misery exists or is skilfully counterfeited, so long will the charitable hand out their money on the street or in their offices, no matter how many charities there may be around them. The association of charities is opposed to this thoughtless or indiscriminate giving. An English clergyman, speaking of his experience in the terrible winter of 1867-'8 in the east end of London, says that out of every shilling ticket he had given he had done four pennyworth of good to eight pennyworth of harm—the 4*d.* representing the bread which had gone into the mouths of a wretched population, the 8*d.* the premium which was given to their wasteful, indolent habits. Immediately after the experience of these times a society was started in London called the "Charity Organization Society," and it gives no relief (except in the extreme cases of despair or imminent death) without previous and searching examination. At its head is the Bishop of London; and men like Cardinal Manning, Mr. Gladstone, Mr. Ruskin, the Earl of Shaftesbury and the Duke of Norfolk are amongst its officers.

One of the aims of a charity organization calls for special mention. The basis of relief is employment in all cases where work can be got, and where the applicant is able to work. This is easier to discuss in theory than to reduce to practice. One thing has, however, been noticed. Whenever work was obtainable the applications for relief fell off. In many cities the procuring of work is put on a commercial basis as they say; in many the civic authorities provide employment. In Baltimore it is made a substantive charity called the Provident Wood Yard. When a man professed a willingness to work and work could not be provided, it was cruel to dismiss him as undeserving. Any man making a proper application is provided with living wages until something better can be found for him.

Tickets for this purpose are with the charitable societies and the police. When the managers of a Boston charity attached thereto a wood yard, and announced that relief would be given to no able-bodied man unless willing to do a certain amount of work, the daily number of applicants fell off at once from 160 to 49, and Mr. Gurteen adds that in every city in which the test has been applied it has been eminently successful. In Philadelphia, when an able-bodied mendicant after an offer of such a ticket refuses to send to the office for relief, the police are called upon to arrest him.

As evidences of the assistance given to the public and to the existing charities, it is reported that in Buffalo, for example, street begging is effectually done away with. In another American city the assistance given towards repressing imposture is officially stated at a decrease of 58 per cent. in the number of vagrants and 73 per cent. in the number of undeserving poor.

Even on the low ground—but one not to be forgotten—of a pecuniary saving, very complimentary figures could be given. In London in ten years the cost of maintaining the poor has been reduced 30 per cent., and in some of the American cities to more than double that proportion.

These associated charities advise the public to give no money to any applicant, but to send the applicant to their central office, where his case will be considered and attended to. If he can work and if he refuse to work, he gets nothing; and it requires no comment to shew that private charity is almost always unable to detect this unwillingness. The money given to such a person is worse than thrown away. It is an encouragement to pauperism. It is not an agreeable task for the charitably disposed to encounter these applicants and to be never absolutely certain that their offering is not squandered on the most worthless of characters. The organized charities say, We can manage these things better, and what is a trespass on your time is our employment and duty.

These charitable organizations say, in the second place: visit the poor, give your information, your assistance, to find out and detect fraud, and to ascertain who are really deserving of relief, but give your money to the existing charities. The lame and the cripple, not to speak of the man with the seven helpless children, and no fire in the house for days, are frequently found to have amassed great sums of money by begging. And this art is so profitable that it seems to

be worth acquiring. An advertisement is said to have appeared in a London paper, where the art of begging is taught exhaustively in six lessons by a person who has founded a college for that purpose. He had an assortment of professional appliances, artificial wounds, trained dogs for the blind, crutches, and could direct his students to the most lucrative streets and neighbourhoods.

Whilst the existing charitable institutions and societies are not at all interfered with by these organizations, they are assisted and protected by them. It has been said that a knowing tramp in this city of Toronto, with its churches and its two dozen of charitable institutions, could put in the winter very well, and if detected too early, could easily earn the sixty days that would entitle him to free quarters in the gaol. The church societies are largely imposed upon also, and in the many cases of slender stipends of the clergymen the imposition is outrageous. The charity of all is much greater than the good done to the recipients of it, and whilst an association, such as we have been describing, may not remedy everything, it might do a vast deal of good.

Mr. Dale stated a case that came under his observation at Newport.

Mr. Hughes approved the idea of registration of paupers.

Mr. Murray thought we had in the Combined Charities the nucleus of what is wanted, and suggested that the children of confirmed paupers should be taken charge of by the State, but that the moral reformation of the parents should be left with the church.

Mr. Vandersmissen referred to the difficulty of the State assuming the care of children of criminals undergoing punishment.

Mr. Phipps said that pauperism might be reduced one-half by stopping immigration of unsuitable persons.

Mr. Livingstone and Mr. Elvins made some remarks.

TWELFTH ORDINARY MEETING.

The Twelfth Ordinary Meeting of the Session 1884-'85, was held on Saturday, January 31st, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

W. Boulton, Esq., C. E., was elected a member of the Institute.

The following list of donations and exchanges was read :

1. Report on the Necessity of Preserving and Replanting Forests, by R. W. Phipps, Esq.
2. Monthly Health Bulletins of Ontario, for October and November, 1884.
3. Science, Vol. V., No. 103, January 23rd, 1885.
4. Report of the Superintendent of the United States Coast and Geodetic Survey, for the year ending with June, 1883.
5. Bulletin of the Essex Institute, Vol. 16, Nos. 7-12, July to December, 1884.
6. Papers on Time-Reckoning, and the Selection of a Prime Meridian, by Sandford Fleming, C.M.G.

Mr. R. W. Phipps read a paper on

FORESTRY, AND THE NECESSITY FOR ITS PRACTICE IN ONTARIO.

I must beg the attention of my hearers for a short space to a subject which is not uninteresting, and is very important—the rapid and injurious deforesting of Ontario and the means whereby it can best be checked. When, not so long since, the white men came first hither, the forest wealth of all this region was immense. Could it have stood till now there would have been no difficulty in rapidly selling timber enough to build half-a-dozen Pacific Railways had we so chosen to invest our funds. But the settlers came; they needed sustenance; they could not eat the trees; they could not sell them, and they burned them. But unfortunately, much was uselessly burned. Much land so cleared had far better have remained un cleared until to-day. I have seen near Toronto great heaps of clear pine, worth now \$40 a thousand, burned to uncover poor land which gave but a crop or two, and ever since but very poor pasture. I have seen out west where great fields had been in walnut, two or

three trees, left by accident, had sold for a thousand dollars, showing that the field would have sold for a hundred thousand dollars—a field which, in its whole cleared day till now has never given a thousand profit. Much land through the Province might well have been spared the axe and yet enough been given to the field. But we cleared without method or order, each thinking the more he cleared the richer he grew, till a deadly hatred of trees seems to have pervaded the community, and their destruction was considered equally patriotic and beneficial. It is found, however that we have been under a great mistake, and that a country will grow more grain and cattle and produce them easier when one-fourth is left in woods interspersing the rest than when all is cleared. The reason of this is evident to all who consider the structure of a tree, which I will ask you to notice. Every tree draws its nourishment from the soil near its roots. It is carried upward by means of a large quantity of water, which passes with it to the leaves—the lungs of the tree. Here it is exposed to the air, changes occur, the food goes to its place in trunk, branch, or leaf, the water passes off into the air. It is said one oak may thus send off 440 gallons per day. At all events the amount transpired by a tree is large—that of a forest immense. This passes upward to the atmosphere—it is said that if it could be tinted the wood below would form no proportion in size to the vast coloured columns above—and being cool, necessarily compels precipitation on reaching a warmer stratum of moist air, and rain ensues as soon as the precipitation is sufficient. The forest is the great local cause of the showers which fertilize the spring and summer fields. The next great benefit to agriculture is the reservoir they form for water. Their bed is deep, loose, porous, a mass of decayed leaves, intersecting roots, and forest soil, which holds in reserve great quantities of water (which otherwise would flow rapidly off over the fields), and feeds therewith the innumerable underground channels which keep moisture in the soil. Once we got water by digging seven or eight feet in many places; now we must go forty or fifty. As land is too much cleared the springs recede from the surface, and the process goes on, where allowed, till it becomes a desert where no blade of grass can grow. In history countries are known to have been rich and fruitful, to have been deprived of their due amount of trees; to have become sterile and be abandoned by their population; to have been sufficiently replanted, to have recovered their lost watercourses and their vanished

rainfall, and to have become fertile again. (Mr. Phipps gave many instances from the history of different lands—Spain, France, Germany, Palestine, India, and others bearing on this point.) The operations of nature, he said, are chiefly hidden from our view. We see the tree grow and the field yield its increase, but the actual accretion, particle by particle, so that the buds sprang forth, the leaves appeared, the blossom and the fruit followed in due season, is not within our sight. But we know that the sun gave its warming beams; that the moisture continually rose from the earth at its call, and fell again in rain, and rose and fell again. And we know that when alternate heat has dried the land, and alternate shower has given its waters, till trunk and branches drip, and the roadside ditch is a flowing river, that then leaf and bud and blossom glow and swell with a newer beauty, that the great leaves of the cornfield broaden with a more vivid green, that the waving wheat receives growing impetus and overtops the rustic fence, and every embowering grove sends out a fresher fragrance upon the summer air. It is the enriching influence of the circulation of heat and moisture—it is with this we interfere when we deforest the land. In Ontario, in many parts, we have cleared all but ten per cent, and even this small amount is not remaining. How to preserve and increase it is the chief question for Ontario to-day, for on that alone depends whether her farms shall remain fertile or become barren. In the rest of the address, which was entirely impromptu, and of which this report is necessarily but a synopsis, Mr. Phipps narrated many interesting facts concerning the influence of deforesting on agriculture in Ontario, and stated that, in the older settled parts, there were but three ways of proceeding. By windbreak, by plantation, and by preserving whatever portions of forest yet stood, by excluding cattle, which last was the main point. He gave the methods of proceeding in each case, and mentioned the trees suitable for each. He also spoke of the large pine forests in the interior, the necessity of their preservation from fire, described the burnt lands he had lately seen near the Ottawa, where for a length of seventy miles, and a breadth of twenty, in one place alone, was nothing but dead trees, useless now, a pine forest worth many millions a few years back, and mentioned that Quebec was reserving great areas for forest alone, discouraging settlement wherever the pine forest should be preserved. He concluded by saying that it was much more than a Provincial, it was more than a national,

more than a moral question; it was an object which should be impressed upon us by the highest feelings of our religion. We found here the wood; the water; the fertile soil. We know that the deforesting of a country does more than remove the one, it greatly impairs the others; so that the land may not be able to support more than the tenth part it now maintains. We should remember that no proprietor can have a title to destroy the fertility of the soil; lest "the field cry out against him; and the furrows thereof likewise complain." The vast concourse of humanity continually emerges from the unknown past, it travels toilsomely by, it is lost in the clouds of the future. Be sure that there we shall meet with strict questioners; nor will those pass unchallenged who have, to serve their own purposes, rendered painful; sterile, and barren; the path of generations yet to follow.

Mr. Browning asked if the Government was taking any action in the direction suggested.

Mr. Phipps replied that several reports on the subject were made at the instance of the Government.

Mr. Macdougall spoke of Forestry Associations in the North-west, in Australia, and in India, whose work had produced beneficial results.

Mr. Murray considered the subject as one of great importance to this country, and suggested that cattle should not be allowed to pasture on forest land; as when they do so pasture they prevent second growth.

Mr. Bain and Mr. Livingstone made some remarks, and the President illustrated on the blackboard the difference between trees grown in the forest, and in the open field.

THIRTEENTH ORDINARY MEETING.

The Thirteenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, February 7th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

Neil McEachren, Esq., B. A., was elected a member of the Institute.

The following list of donations and exchanges was read :

1. The Canadian Practitioner, Vol. X., No. 2, for February, 1885.
2. Science, Vol. V., No. 104, for January 30th, 1885.
3. American Journal of Science for February, 1885.
4. Journal of the New York Microscopical Society, Vol. I., No. 1, for January, 1885.
5. Harvard University Bulletin, Vol. IV., No. 1, for January, 1885.
6. Transactions of the American Society of Civil Engineers for November, 1884.
7. Transactions of the Connecticut Academy of Arts and Sciences, Vol. VI., Part I.
8. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Sitzungen vom 17. Mar', vom 22. Jan., vom 19. Jul., 1884.
9. Correspondenz-Blatt der Deutschen Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, XV., Jahrgang, No. 11 u 12, November und Dezember, 1884.

Mr. Ernest E. T. Seton read a paper on "The Ruminants of the North-West," in which a brief account was given of the following twelve Ruminants :—

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|-------------------------------------|-------------------------------|
| 1. Common Virginian Deer..... | <i>Cervus virginianus.</i> |
| 2. Mule Deer or Jumping Deer..... | " <i>macrotis.</i> |
| 3. Woodland Caribou or Reindeer... | " <i>tarandus.</i> |
| 4. Barren Ground Caribou..... | " <i>arcticus.</i> |
| 5. Elk or Wapiti..... | " <i>canadensis.</i> |
| 6. Moose..... | " <i>alces.</i> |
| 7. Antelope or Cabri..... | <i>Antilocapra americana.</i> |
| 8. Rocky Mountain Goat..... | <i>Magamu montana.</i> |
| 9. Rocky Mountain Sheep or Bighorn. | <i>Ovis montana.</i> |
| 10. Musk Ox..... | <i>Ovibos moschatus.</i> |
| 11. Prairie Buffalo..... | <i>Bison americanus.</i> |
| 12. Wood Buffalo..... | " " <i>var ?</i> |

Original observations on each of these were brought forward, together with many facts relative to their economic value and preservation of the species. The last named had never before been described by scientists, therefore Mr. Seton's account of it is given in full.

THE WOOD BUFFALO.

(Bison americanus, var?)

The present is very closely related to the Prairie Buffalo. The majority of writers either hold them to be identical, or ignore this variety altogether; but this is owing chiefly to the lack of information regarding the animal, for, curiously enough, this the largest land mammal in America, is among those of which the very least is known.

The information which is here presented, is gathered from Captain Butler's narrative, and from the lips of two northern hunters, Elzear Mignault, who spent twelve years (1863-'75) on the Peace River, in the service of the Hudson's Bay Co., and Mr. K. N. L. Macdonald, a Winnipeg gentleman, who, for ten years, hunted on the upper Mackenzie. The accounts of the two latter agree in all important points, except that Mr. Macdonald considers the Wood Buffalo a mere variety of the prairie animal, while Mignault, whose experience is much greater, maintains, with the Indians, that it is distinct; urging also, in support of his opinion, that the last Prairie Buffalo ever seen in the valley, was killed in 1866. It was a solitary, mangy bull, a complete outcast, and this needed not to have been his condition had the Wood Buffaloes been his immediate kindred.

All my informants agree that the Wood Buffalo differs, chiefly, from its prairie relative in being much larger, and considerably darker in color. Mignault adds that its legs are proportionately shorter, its horns less robust and more curved inwards, its hair is shorter, finer, entirely without curl, and all over of a very dark brown—almost a black in winter,—but in summer assuming a hue similar to that of the prairie animal.

Capt. Butler, who traversed the Peace River valley in 1870, wrote as follows: "But, although, the Moose are still as numerous on Peace River as they were in days far removed from the present there is another animal which has almost wholly disappeared."

The giant form of the Wood Buffalo no longer darkens the steep, lofty shores. When first Mackenzie beheld the long reaches of the river, the "gentle lawns," which alternated with "abrupt precipices," were "enlivened" by vast herds of buffaloes. This was in 1793. Thirty-three years later, Sir George Simpson also ascended the river with his matchless Iroquois crew, yet no Buffalo darkened the lofty shores.

What destroyed them in that short interval? The answer is not difficult to seek—deep snow! The buffalo grazes on the grass, the moose browses on the tall willows. During one winter of exceptionally deep snow, eighty buffaloes were killed in a single day in the vicinity of Dunvegan. The Indians ran them into the snow-drifts, and then despatched them with knives.

It is still a matter of dispute whether the Wood Buffalo is the same species as his namesake of the southern plains; but, it is generally believed by the Indians that he is of a kindred race. He is, nevertheless, larger, darker and wilder; and, although the northern land in which he is still found abounds in open prairies and small plains, he, nevertheless, seeks in preference the thickest woods. Whether he be of the plain race or not, one thing is certain,—his habits vary much from his southern cousin. The range of the Wood Buffalo is much farther north than is generally believed. There are scattered herds, even now, on the banks of the Liard River, as far as sixty-one degrees of north latitude.

When Mignault left the Peace River in 1875, the Wood Buffalo were plentiful in the country between Dunvegan and Great Slave Lake, and the Liard and Arthabasca Rivers. In 1884, he heard from a comrade, that they were then still common.

The Indians, he said, call it *Ah-thuk-ard Moos-toosh*, and consider it quite distinct from the Prairie Buffalo, which they call *Mas-Kootay Moos-toosh*.

Its general habits differ a good deal from those of its prairie relative, rather resembling those of the Moose, although it is much less wary and difficult to approach than that animal.

It is rarely found in herds, except in the fall. The greatest number my informant ever saw together was three. These were going down to the river, as he rounded a point in a barge. As soon as he came in view, they scrambled up the bank and disappeared in the woods. But in the month of October, the mating season, they are inclined to gather into straggling bands of both sexes, and go roaming about the woods, which are made to resound continually with the thud and trampling of the males engaged in battle.

During the winter they confine themselves to the heaviest and densest timber, subsisting on willow scrub, moss, and such dry grass as is attainable. In the summer they are so much persecuted by the bull-dog flies, that they spend the greater part of warm days

immersed to the eyes in some lake or mud hole, and it is not an uncommon sight for the voyageur, who silently rounds some point on the Liard, Salt or Peace River, to observe, protruding from the water, the great black head of the buffalo, who, gazing stupidly for an instant, then suddenly bestirring himself, plunges to the shore and disappears among the trees. They feed in the night, the only time they are free from the torment of the gad flies. They seek the thick swamps from preference, but distinguish and avoid the treacherous bogs or *muskegs*, which are found in various parts of the country.

My informant thinks that they frequent the dense woods in summer, chiefly to escape the persecutions of the gad-flies; for, when the day chances to be so cold and windy that not a fly is to be seen, they take advantage of the opportunity to climb about even the high, rocky hills.

The young are produced sometime in June, usually one, but occasionally two at a birth. Concerning their color, development and growth, I have not been able to procure reliable information.

There is one other general observation that I would make in connection with the buffalo. In a previous paper, I brought forward reasons for believing that, within a very recent period, this prairie country was one continuous forest, and that fire had been the clearing agent. Where, then, it may be asked, were the Prairie Buffaloes in those forest days? I am inclined to think there were none, but that the sole bovine inhabitant of the country was the Wood Buffalo, and that the prairie animal is a recent specialization, which conforms in its change of form and habits to several precedents, wherein a wood animal has become smaller, lighter colored, and gregarious, on betaking itself to a life in the open country. As examples, I may cite the almost solitary giant Ure Ox of Cæsar's time, said to be the ancestor of our common cattle; the Prairie Wolf, doubtless very nearly akin to his larger brother of the timber; and the Barren Ground Caribou, which evidently was but recently differentiated from its larger, darker, and less gregarious woodland brother!

So far, I have not had an opportunity of examining the hide of the Wood Buffalo, though I learn that they are not esteemed great rarities, even among Fort Garry furs, yet, I hope that any reader who may have the opportunity of measuring or describing this

animal, or in any way adding to our knowledge of it, will not fail to avail himself of it, and thus render to Science most useful and valuable assistance.

Mr. Rouse suggested as a reason why the elks migrated to the north in winter the weakness of their horns, but this was doubted, because another species migrate the reverse way.

Mr. Notman asked what became of their cast-off horns, to which it was answered that they were eaten by small rodents.

Mr. Shaw asked the name of the Oat referred to. Ans.—*Stipa spartica*.

Mr. Murray asked as to the fertility of hybrid deer, to which it was answered that they were all fertile.

The President remarked that the only domesticated American animal was the Llama.

FOURTEENTH ORDINARY MEETING.

The Fourteenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, February 14th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges was read :

1. Rules and Regulations of the Royal Society of Canada.
2. The Canadian Entomologist, Vol. XVI., No. 12, December 1884.
3. Science, Vol. V., No. 105, February 6th, 1885.
4. Appleton's Literary Bulletin, Vol. IV., No. 1.
5. Journal of the Franklin Institute for February, 1885.
6. Monthly Notices of the Royal Astronomical Society, Vol. XLV., No. 2, for December, 1884.
7. Transactions of the Royal Scottish Society of Arts, Vol. XI., Part 2.
8. Atti della Società Toscana di Scienze Naturali, Processi Verbali, Vol. IV.
9. Boletín de la Academia Nacional de Ciencias in Cordoba (República Argentina), Tomo VI., Entrega 4a.

Mr. W. J. Loudon, B.A., read a paper on "The Decimal System applied to Time," of which the following is an abstract :

The system of Time which I propose is the following : The ordinary day of twenty-four hours would be divided into ten periods called, if necessary, hours ; each hour in the new system thus corresponding to two hours and twenty-four minutes of ordinary time. This new hour would be divided into one hundred divisions (which we may term minutes) : each of the latter minutes being equivalent, therefore, to 1.44 minutes of present time, and being a sufficiently good working unit. For small measurements, this minute could be subdivided into one hundred seconds, each of the new seconds corresponding to .864 of the old.

The advantages which I claim for the adoption of such a system are :—

1. All advantages arising from the use of a system based on our natural scale of ten. Instead of using separate symbols to denote hours, minutes, seconds, time would be denoted by a number and a decimal : thus, instead of saying and writing 2 hrs., 25 min., 30 sec., we would simply say and write 1.45. The labour saved in addition, subtraction, etc., would be incalculable. As a corresponding example of labour saved, I need only refer to the English system of pounds, shillings, pence, and farthings, when contrasted with our decimal system of dollars and cents.

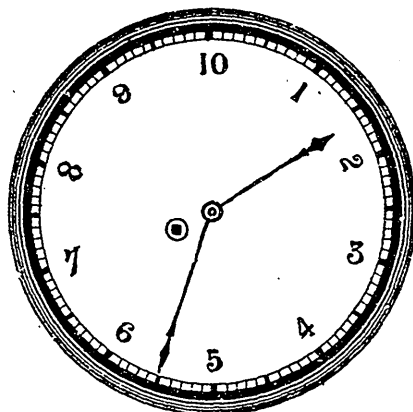
2. The abolition of the a.m. and p.m. nuisance. This has, of course, been overcome by the twenty-four hour scheme, but the latter is too unwieldy ever to come into common use.

3. The change in units, the hour becoming longer and the minute longer, than the present hour and minute.

4. The fact that the numbers on the face of the clock indicate the time at once. The greatest objection to our present system (if we omit the a.m. and p.m. distinction) is, that the time at any instant cannot be inferred by any simple process of the mind from the dial of the clock ; when the minute hand is at one, we say it is five minutes past ; when the minute hand is at eight, we say it is twenty minutes to ; when at eleven it is five minutes to, and so on. If we analyze the reasons for which children find so much difficulty in learning to tell time, we shall find the cause of all their trouble in

this strange arrangement of time measurement. Indeed, it is only after years of patient labour and mental struggle, that the majority of children succeed in fixing in their minds the meaning of the minute hand when in different places. Let anyone take the clock constructed in the manner I have indicated, and I will venture to say that any child can learn to tell the time from it in a few short lessons. I might go still further, and make the general statement that an enormous amount of mental labour is expended among ordinary people in looking at a clock or watch, and going through the struggle that is termed "telling the time."

The clock which I have constructed from an ordinary eight day clock, and which fulfils accurately the above conditions, as regards the hours and minutes, is represented in the Figure.



TIME 1-55.

Mr. Keys, referring to the clock on the decimal system by which the paper was illustrated, showed the ease with which the change could be made, viz., by the use of two additional wheels, and congratulated the Institute on the reading of this paper so soon after Sandford Fleming's, by which important changes were brought about.

Mr. Livingstone doubted whether the change could be made, because the human mind is not mathematical, but rather musical, running in 2's 3's and 4's.

The President approved of the change because we are committed to the decimal system of numeration, but thought

it a misfortune that the duodecimal system had not been adopted in the first instance.

FIFTEENTH ORDINARY MEETING.

The Fifteenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, February 21st, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

The following list of donations and exchanges received since last meeting was read :

1. Monthly Weather Review, Dominion of Canada, for January, 1885.
2. Science, Vol. V., No. 106, February 13th, 1885.
3. Annual Report of the Board of Managers of the Buffalo Historical Society, January 13th, 1885.
4. Second Annual Report of the Board of Trustees of the Public Museum of the City of Milwaukee, October 1st, 1884.
5. Anthony's Photographic Bulletin, Vol XVI., No 1.
6. Proceedings of the Royal Geographical Society, Vol. VII., No. 2, February, 1885.
7. Notice Historique de l'Université de Bruxelles, 1834—1884, par L. Vanderkinden.
8. Bericht über die Senckenbergische Naturforschende Gesellschaft, vom Juni, 1863, bis Juni, 1884.
9. Funfter Jahresbericht der Geographischen Gesellschaft zu Hannover, 1883-84.

Mr. Vandersmissen gave notice that at the next meeting of the Institute, he would move that a committee be appointed to consider in what way the work of the Institute could be carried on in sections.

Mr. Lennox read a paper on "The Fossil Sharks of the Devonian."

The subject of this paper was the fossil fin-spine of a shark, taken from the corniferous limestone, at St. Mary's, Ont. It belongs to the genus *Muchacacanthus*, Newberry. This genus is distinguished from all other fossil fish-spines by not being bilaterally symmetrical. They have been found only in the corniferous of Ontario, New

York, and Ohio. The specimen in question, *M. sulcatus*, is ten and a-half inches in length, about an inch wide, and two-thirds of an inch deep. Its original length, however, may have been fourteen or fifteen inches. It is grooved longitudinally upon one side, smooth and keeled on the other.

Symmetrical spines like *Pleuracanthus* were, doubtless, implanted in the flesh, in front of the dorsal fins; but the asymmetrical forms were, in all probability, imbedded in the integuments, before the pectoral fins.

Judging from pieces of shagreen found with the spines, and the total absence of traces of a long skeleton, we may fairly conclude that these were the defensive weapons of very large sharks, which must have been formidable indeed.

Mr. Dale mentioned a spine somewhat similar, which he had found in marl, in New Jersey, and drew attention to the mode of attachment of the spines, by which they were held erect.

Mr. Boyle having asked as to the traces of shagreen in the rocks at St. Mary's, Mr. Lennox replied that they were found in patches, five or six inches square.

Mr. Livingstone suggested a theory that the carboniferous had something to do with the destruction of these fish, and that coal was the result of solidification of coal oil.

Mr. Macdougall, Mr. Notman, and Mr. Murray, made some remarks, and the President noted the great interest of a discovery of remains of sharks at so remote a period.

SIXTEENTH ORDINARY MEETING.

The Sixteenth Ordinary Meeting of the Session 1884-'85, was held on Saturday, February 28th, 1885, the President in the Chair.

The minutes of last meeting were read and confirmed.

It was moved by Mr. Vandersmissen, seconded by Dr. Kennedy, and resolved,—“That the following gentlemen be a

committee to consider the advisability of dividing the Institute into sections, in accordance with the suggestions contained in the President's Inaugural Address, and to report upon a scheme for that purpose if advisable: the President, the Secretary, Mr. Boyle, Mr. Geo. E. Shaw, Mr. J. M. Buchan, Mr. Alan Macdougall, Prof. Loudon, Mr. Murray, and the mover and seconder."

The following list of donations and exchanges was read:

1. The Canadian Entomologist, XVII., Nos. 1 and 2, January and February, 1885.
2. Science, Vol. V., No. 107, February 20th, 1885.
3. Journal of the New York Microscopical Society, Vol. I., No. 2, February, 1885.
4. Journal of the Anthropological Institute of Great Britain and Ireland, Vol. XIV., No. 3, February, 1885.
5. Boletín de la Academia de Ciencias in Cordoba (Republica Argentina), Tomo VII., Entrega 1a, 2a.
6. Annaes da Escola de Minas de Ouro Preto, No. 3., Rio de Janeiro, 1884.
7. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, 4e Série, 36e Année, 12e Cahier, December, 1883, 4e Série, 37e Année 8e, et 9e Cahier, Août et Septembre, 1884.
8. Les Annales des Mines:—
 Septième Série, Mémoires, Tome XVI., 6e Livraison de 1879, Tomes XVII., XVIII., XIX., XX., 1880, 1881. Huitième Série, Mémoires, Tomes I., II., III., IV., V., Livraison 1re 2e, 3e, Tome VI., Livraison 4e, 5e, 1882, 1883, 1884. Lois Décrets, Arrêts, 1880, 1881, 1882, 1883. 7e Série, Tomes IX., X. 8e Série, Tomes I., II.
9. Proceedings of the Conference relating to a Prime Meridian, from the Dominion Government.

Mr. John Phillips read a paper on "The Centrifugal Forces of the Planets."

The object of the paper was to establish the proposition that the moon was projected vertically from the earth at an initial velocity of about seven miles a second, the earth and moon having originally formed a single mass. Mr. Phillips showed the process by which he determined the velocity with which a heavy body falling from a state of rest towards the earth from the distance of the moon would strike the earth's surface, this being also the initial velocity with which a body would have to be projected in order to ascend to that distance. Having exhibited the formulæ and substituted for the general terms the particular quantities as determined by observation,

he found this velocity to be 36,707 feet per second, or 253 feet less than seven miles. He then showed the effect upon a body so projected of the rotary motion of the earth, and of the perturbation caused by the sun's attraction, and how these forces combined would give such a body exactly the orbit in which the moon actually moves. Having also indicated how the permanency of the system is ensured, he deduced the conclusion as irresistible that this is how the moon was projected into her present orbit.

Mr. Livingstone took exception to some of the positions of the paper, and drew special attention to his doctrine that there is no such thing as centrifugal force at all, but that orbital motion is only vibration.



FIRST SERIES—Begun August, 1852; concluded December, 1855; 41 numbers, 3 vols. 4to.

SECOND SERIES—Begun January, 1856; concluded January, 1878; 92 numbers, 15 vols. 8vo.

THIRD SERIES—Begun 1879.

NOTES.

1.—The First Series has for title, "The Canadian Journal: a Repertory of Industry, Science and Art; and a Record of the Proceedings of the Canadian Institute." The Second series has for title, "The Canadian Journal of Science, Literature, and History." The title of the Third Series is, "Proceedings of the Canadian Institute." Parts 1 & 2, Third Series, are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

2.—By inadvertence, No. 85 (November, 1873) of the "Canadian Journal," 2nd Series (Vol. XIV.) immediately follows No. 79. There is, however, no *lacuna* between these two numbers, as is shown by the fact that the paging is consecutive.

3.—Societies wishing to exchange back numbers of their Proceedings can be supplied with complete sets of the Publications of the Canadian Institute, except Vol. XV., No. 5, Second Series, and Vol. I., Part 1, Third Series.

4.—Members having either of the above, Vol. XV., No. 5, Second Series, April, 1877, or Vol. I., Part 1, Third Series, 1879, and being willing to part with them, will please communicate with the Assistant Secretary.

