Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured covers/ Couverture de couleur
- ☐ Covers damaged/ Couverture endommagée
- ☐ Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/ Le titre de couverture manque
- ☐ Coloured maps/ Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- ☐ *Bound with other material*/ Relié avec d'autres documents
- ☐ Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- ☐ Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

- ☐ Coloured pages/ Pages de couleur
- ☐ Pages damaged/ Pages endommagées
- ☐ Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- ☐ Pages detached/ Pages détachées
- ☐ Showthrough/ Transparence
- ☑ Quality of print varies/ Qualité inégale de l'impression
- ☐ *Continuous pagination*/ Pagination continue
- ☐ Includes index(es)/ Comprend un (des) index

  Title on header taken from:/ Le titre de l'en-tête provient:

- ☐ Title page of issue/ Page de titre de la livraison
- ☐ Caption of issue/ Titre de départ de la livraison
- ☐ Masthead/ Générique (périodiques) de la livraison

☑ Additional comments:/ Commentaires supplémentaires: There are some creases in the middle of pages.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
						✓					

THE

CANADIAN JOURNAL

OF

INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES. No. LVII.

MAY, 1865.

TORONTO:

PRINTED FOR THE CANADIAN INSTITUTE,

BY LOVELL AND GIBSON, YONGE STREET.

CANADIAN INSTITUTE.

EDITING COMMITTEE.

GENERAL EDITOR - - REV. WM. HINCKS, F.L.S.

I. *Geology and Mineralogy:* E. J. CHAPMAN, Ph.D., Prof. of Geology and Mineralogy, Univ. Coll. Toronto.

II. *Physiology and Natural History:* REV. WM. HINCKS, F.L.S., Prof. of Natural History, Univ. Coll., Toronto.

III. *Ethnology and Archæology:* DANIEL WILSON, LL. D., Prof. of History and English Literature, Univ. Coll., Toronto.

IV. *Meteorology:* G. T. KINGSTON, M.A., Director of the Magnetic Observatory, Toronto.

V. *Chemistry:* HENRY CROFT, D. C. L., Prof. of Chemistry and Experimental Philosophy, Univ. Coll., Toronto.

VI. *Mathematics and Natural Philosophy:* J. B. CHERRIMAN, M. A., Prof. of Natural Philosophy, Univ. Coll., Toronto; and the Rev. G. C. IRVING, M.A., Prof. of Mathematics, Trin. Coll., Toronto.

VII. *Engineering and Architecture:* SANDFORD FLEMING, C. E.

VIII. *Philology:* REV. E. HATCH, B.A., Prof. of Classics, Morin Coll., Quebec.

The Canadian Journal is printed exclusively for gratuitous distribution among the Members of the Canadian Institute, and such Institutions and Societies as the Council may determine; but Members may purchase extra copies at 2s. 6d. per number, and Provincial Literary and Scientific Societies may obtain the Journal at the same rate, by an annual payment in advance.

*** *Communications for the Journal to be addressed to the General Editor,* Prof. HINCKS, *Univ. Coll., Toronto. Communications on general business of the Institute, to be addressed to* U. OGDEN, *Esq., M.D., Corresponding Secretary, or to Mr. Jas. Johnson, Assistant Secretary, Canadian Institute, Toronto.*

☞ MR. EDWARD ALLEN, 12, Tavistock Road, Covent Garden, London, W, has been appointed the English Agent for the Institute. All European communications are requested to be forwarded through him.

THE CANADIAN JOURNAL.

NEW SERIES.

No. LVII.—MAY, 1865.

REMARKS ON PROFESSOR BOOLE'S MATHEMATICAL THEORY OF THE LAWS OF THOUGHT.

BY GEORGE PAXTON YOUNG, M. A.,
INSPECTOR OF GRAMMAR SCHOOLS FOR UPPER CANADA.

In a recent issue we announced the death of Professor George Boole, of Queen's College, Cork, a man of varied and profound acquirements, and of singular originality of mind. The work on which his fame will mainly rest is undoubtedly his "Investigation of the Laws of Thought, on which are founded the Mathematical Theories of Logic and Probabilities." We have long purposed to call attention to this remarkable production, though various circumstances have hitherto prevented us from doing so. The present seems a suitable occasion for testifying our admiration of the genius of the deceased philosopher, and, at the same time, endeavouring to give a brief account, inadequate as it must necessarily be, of what may be termed his Mathematico-logical speculations.

The primary, though not the exclusive, design of the "Investigation," is to express in the symbolical language of a Calculus, the fundamental Laws of Thought, and upon this foundation to establish the science of Logic and construct its method.

The elementary symbols of Professor Boole's Calculus are of three kinds: 1st. Literal symbols, as x, y, &c., representing the objects of our conceptions; 2nd. Signs of operation, as $+$, $-$, $\times$; and 3rd,

the sign of identity, $=$. The sign $+$ is used to express the mental operation by which parts (of extensive quantity) are collected into a whole. For instance, if x represent *animals*, and y *vegetables*, $x + y$ will represent the class made up of *animals and vegetables together*. On the other hand, the sign $-$ is used to express the mental operation of separating a whole (of extensive quantity) into its parts. Thus x representing *human beings*, and y representing *negroes*, $x - y$ will represent *all human beings except negroes*. With regard to the sign $\times$, $x \times y$ or $x\,y$ (as it may be written) is used to denote those objects which belong at once to the class x and to the class y; just as, in common language, the expression *dark waters* denotes those objects which are at once *dark* and *waters*. Hence we obtain a method of representing a concept taken particularly. For, if x denote *men*, then, since *some men* may be viewed as those who besides belonging to the class x belong also to some other class v, *some men* will be denoted by $v\,x$. In general,

$$v\,x = \text{some } x. \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

It can easily be shown, that, as in Algebra, so in the logical system which we are describing, the literal symbols, x, y, &c., are commutative; that is,

$$x\,y = y\,x; \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

and that they are also distributive; that is,

$$z\,(x \pm y) = z\,x \pm z\,y \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Another relation between Algebra and the Logical System under consideration is, that, in the latter as well as in the former, a literal symbol may be transposed from one side of an equation to the other by changing the sign of operation, $+$ or $-$. But there is an important relation which subsists in the science of Thought, and not generally in Algebra, namely,

$$x^2 = x \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

That this is true in the Logical system, is plain; for x^2, which is another form of $x\,x$, denotes (by definition) those things which belong at once to the class x and to the class x; that is, it denotes simply those things which belong to the class x; and it is therefore identical with x. But though the equation (4) does not generally subsist in Algebra, it subsists when x is unity or zero. If, therefore, we take the science of Algebra with the limitation that its unknown

quantities can receive no values distinct from unity and zero, the analogy between the two sciences will still be preserved.

It is necessary to observe that unity and zero (1 and 0) are virtually included by Professor Boole among his literal symbols. Of course we can give 1 and 0 any meaning we please, provided the meaning once imposed on them be rigidly adhered to. By 0, then, Professor Boole understands Nothing—a class (if the expression may be permitted) in which no object whatever is found. On the other hand, by 1 he understands the universe of conceivable objects. Thus 1 and 0 are at two opposite poles; the former including every thing in its extension; the latter, nothing. The meaning which has been affixed to 1 and 0 preserves, in the Logical system as in Algebra, the equations,

$$\left.\begin{aligned} 1 \times x &= x, \\ \text{and, } 0 \times x &= 0; \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

for, the meaning of the former is, that objects which are common to the universe and to the class x are identical with those which constitute the class x; and the latter means, that there are no objects which are common to a class in which nothing is found and to a class x: both of which propositions are self-evident. From the meaning affixed to 1, we see what the meaning of $1 - x$ must be. In fact, x and $1 - x$ are logical contradictories, the latter denoting all conceivable objects except those which belong to the former; so that

$$1 - x = \text{not } x \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

This value of the symbol 1 being admitted, we can, by the principles of transposition and distribution [see (3)] reduce equation (4) to the form,

$$x\,(1 - x) = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

The law here expressed, which is termed the Law of Duality, plays a most important part in the development of logical functions, and in the elimination of symbols. In fact, it may be described as the germ out of which Professor Boole's whole system is made to unfold itself.

Having shown how concepts, whether taken universally or particularly, are represented, and also how the contradictory of a concept is represented, we have next to notice the manner of expressing judgments. All judgments are regarded by our author as affirmative; the negation, in those which are commonly called negative,

being attached by him to the predicate. But an affirmative judgment is nothing else than an assertion, through immediate comparison, of the identity of concepts. Suppose, therefore, that we are required to express the judgment, "Some stones are precious." Let x denote *stones;* and y, *precious.* The proposition means, that some stones are identical with some precious things. Consequently, its symbolical expression [see (1)] is,

$$vx = vy.$$

If the judgment to be represented had been, "Some stones are not precious," its expression would [see (6)] have been

$$vx = v\,(1 - y).$$

These examples in the meantime may suffice. More complicated forms will present themselves afterwards.

With the few simple preliminary explanations which have been given, and which were necessary to render intelligible some of the criticisms presently to be offered, we are now prepared to state the view which our author takes of the science of Logic. Logic he regards as the science of Inference; and the problem which it seeks to solve is this: Given certain relations among any number of concepts (x, y, z, &c.), it is required to find what inferences can be drawn regarding any one of these or regarding a given function of any one of them. A properly constructed science of Logic would require to solve this problem adequately, and by a definite and invariable method. Now, Professor Boole claims that the view which he presents of the problem which Logic has to solve, is both deeper and broader than that commonly taken; and he claims at the same time that he has devised an adequate method, different from all existing methods, for solving this problem, and that his method is one of definite and invariable application.

The objections brought against the logic of the schools, that it is neither sufficiently deep nor sufficiently broad, will probably take our readers by surprise. It is not difficult to understand how a question might be raised as to the practical utility of the scholastic logic; but most persons who have examined the subject will be ready to admit, both that the scholastic logic is well founded, and that, when properly developed from its first principles, it forms a complete and perfect system. In the opinion of our author, however, it is so defective in its foundation, and so incomplete in its superstructure, as not to be entitled to the name of a science. "To what final con-

clusions," he says, "are we then led respecting the nature and extent of the scholastic logic? I think to the following: that it is not a science, but a collection of scientific truths, too incomplete to form a system of themselves, and not sufficiently fundamental to serve as the foundation upon which a perfect system may rest."

In order that it may be understood in what sense it is held that *the foundation of the scholastic logic is defective*, we make two other quotations. "That which may be regarded as essential in the spirit and procedure of the Aristotelian, and of all cognate systems of logic, is the attempted classification of the allowable forms of inference, and the distinct reference of those forms, collectively or individually, to some general principle of an axiomatic nature, such as the Dictum of Aristotle." Again: "Aristotle's Dictum de omni et nullo is a self-evident principle, but it is not found among those ultimate laws of the reasoning faculty to which all other laws, however plain and self-evident, admit of being traced, and from which they may in strictest order of scientific evolution be deduced. For though of every science the fundamental truths are usually the most simple of apprehension, yet is not that simplicity the criterion by which their title to be regarded as fundamental must be judged. This must be sought for in the nature and extent of the structure which they are capable of supporting. Taking this view, Leibnitz appears to me to have judged correctly when he assigned to the principle of contradiction a fundamental place in logic; for we have seen the consequences of that law of thought of which it is the axiomatic expression." The sum of what is contained in these passages, in so far as they bear on the point before us, is, 1st, That the foundation of the Aristotelian, and of all cognate systems of logic, is some such canon as the Dictum; 2nd, That that canon, and other maxims of a like description, though self-evident, are not deep enough to serve as a basis for a science of logic in which all the forms of thought are to be exhibited; and, 3rd, That the only principle sufficiently fundamental to form the basis of a complete science of logic is the principle of contradiction. Now what is the real state of the case? Nothing is more certain than that the Dictum was not considered by Aristotle as either the exclusive or the ultimate foundation of his logical system. Not the exclusive foundation; for, as a matter of fact, many of the forms of thought embraced in the Aristotelian logic receive no direct warrant from the Dictum,

but can be derived from it only by the aid of the principle of contradiction. Not the ultimate foundation; for what is the Dictum, but a particular case of a more comprehensive, and (in this sense) more fundamental, law? Aristotle saw this, and has expressed it as clearly as any man that ever lived. "It is manifest," he says, "that no one can conceive to himself that the same thing can at once be and not be, for thus he would hold repugnant opinions, and subvert the reality of truth. Wherefore, all who attempt to demonstrate, reduce everything to this as the ultimate doctrine; for this is by nature the principle of all other axioms."

Professor Boole's acceptance of the Leibnitzian maxim (though it was much older than Leibnitz) that the true foundation of the science of logic is the principle of contradiction, has the appearance of being at variance with some extraordinary statements which he elsewhere makes, to the effect that the principle of contradiction is a consequence of the law of duality. We may remind our readers that the law of duality [see (4) and (7)] is substantially the principle out of which all the details of Professor Boole's own doctrine are evolved. Now, under the influence of what was, perhaps, not an unnatural desire to vindicate for his system a peculiar depth of foundation, Professor Boole has been betrayed into observations by which his fame as a philosophic thinker must be seriously affected. For instance: "that axiom of metaphysicians which is termed the principle of contradiction, and which affirms that it is impossible for any being to possess a quality and at the same time not to possess it, is a consequence of the fundamental law of thought, whose expression is $x^2 = x$." And again: "the above interpretation has been introduced, not on account of its immediate value in the present system, but as an illustration of a significant fact in the philosophy of the intellectual powers, viz., that what has commonly been regarded as the fundamental axiom of metaphysics is but the consequence of a law of thought, mathematical in its form." In thus speaking of the principle of contradiction as a consequence of the law of duality, Professor Boole seems to take away the fundamental character of the principle of contradiction; for, if that principle be, in the proper sense of the term, a consequence of something else, it cannot be itself truly fundamental. Yet, as we have seen, Professor Boole admits that it is the real and deepest foundation of the science of logic. What, then, does he mean? On the one hand, he cer-

tainly does not intend to deny that the principle of contradiction is self-evident. On the other hand, it is plain that he does hold that the principle of contradiction can be deduced from the law of duality. But (we ask) how? Can the principle of contradiction be deduced from the law of duality, without our assuming the principle of contradiction itself as the basis of the deduction? This would be absurd; for a conclusion can be established in no other way than by pointing out that the supposition of its being false involves a contradiction. In the particular case before us, the equation $x\,(1 - x) = 0$, which is that expression of the law of duality in which the principle of contradiction is regarded as being brought to light, is only reached by a process of reasoning, every step of which takes the principle of contradiction for granted. The only interpretation, therefore, which Professor Boole's words can bear, unless we give them a meaning palpably absurd, is, that a formula, which we are enabled to state by assuming the law of contradiction, contains a symbolic representation of that law. This hardly seems to us a very significant fact in the philosophy of the intellectual powers. If indeed the formula in question could be shown to represent some law of thought of wider application than the law of contradiction, that would be a very significant fact. But such is not the case. The equation $x\,(1 - x) = 0$ is just the law of contradiction symbolically expressed: neither more nor less.

The Aristotelian logic is charged with being *incomplete*, as well as with being not sufficiently fundamental. By this our author does not mean that Aristotle and his followers have casually omitted some forms of thought which their system ought to have embraced: had they done so, the fault would have been chargeable—not upon the system, but upon its expounders; but he means, that, from the very nature of the system, there is an indefinite variety of problems belonging to the science of inference, which their system is incapable of solving, or for the solution of which at all events it furnishes no definite and certain method.

It will be observed that there are two questions here, which, as radically distinct from one another, require to be considered separately: the one being, whether the Aristotelian logic is capable of solving all the problems belonging to the science of inference; and the other, whether it furnishes a definite and certain method for the solution of these.

The former of these questions may, with perfect confidence, be answered in the affirmative. It admits of absolute demonstration, that there is no chain of valid inference which the ordinary logic is incompetent to express, or, in other words, which is not reducible to conversion or syllogism. Some logicians have been of opinion that conversion is nothing else than syllogism at bottom; but, for what we have at present in view, it is unnecessary to discuss this question. Suffice it to say, that, whether conversion and syllogism be substantially identical or not, all immediate inference is of the nature of conversion, and all mediate inference (or reasoning proper) of the nature of syllogism. Does Professor Boole deny this? Formally, and in plain terms. "Possibly," he writes, "it may here be said that the logic of Aristotle, in its rules of syllogism and conversion, sets forth the elementary processes of which all reasoning consists, and that beyond these there is neither scope nor occasion for a general method. I have no desire to point out the defects of the common logic, nor do I wish to refer to it any further than is necessary, in order to place in its true light the nature of the present treatise. With this end alone in view, I would remark: 1st. That syllogism, conversi ¬ &c., are not the ultimate processes of logic. It will be shown in this treatise that they are founded upon, and are resolvable into, ulterior and more simple processes which constitute the real elements of method in logic. Nor is it true that all inference is reducible to the particular forms of syllogism and conversion. 2nd. If all inference were reducible to these processes alone (and it has been maintained that it is reducible to syllogism alone), there would still exist, &c." In illustration of the statement, that some inference is not reducible to the forms of syllogism and conversion, Professor Boole examines the case of conversion, and arrives at the result that "conversion is a particular application of a much more general process in logic, of which," he adds, "many examples have been given in this work." In like manner he examines the case of syllogism; and his conclusion is as follows: "Here, then, we have the means of definitely resolving the question, whether syllogism is indeed the fundamental type of reasoning,—whether the study of its laws is co-extensive with the study of deductive logic. For if it be so, some indication of the fact must be given in the system of equations upon the analysis of which we have been engaged. No sign, however, appears that the discussion of all systems of equations expressing propositions is involved in

that of the particular system examined in this chapter. And yet writers on logic have been all but unanimous in their assertion, not merely of the supremacy, but of the universal sufficiency of syllogistic inference in deductive reasoning." These statements, that conversion and syllogism are branches of a much more general process, have of course no meaning except on the supposition that the "much more general process" is not reducible to conversion and syllogism. If reducible to these, it would not be a more general process. Now we take our stand firmly on the position, that a chain of valid reasoning, which cannot be broken into parts, every one of which shall be an instance either of conversion or of syllogism, is not possible. We are prepared to show this in the case of every one of the examples of his "more general process" which Professor Boole gives in his work. Nay, we go farther, and as was intimated above, hold it to be absolutely demonstrable, that, from the nature of the case, inference cannot be of any other description than conversion or syllogism.

To make this out, let it be remarked that the conclusion of an argument exhibits a relation between two terms, say X and Y. It is an important assumption in Professor Boole's doctrine, that a proposition may exhibit a relation between many terms. This is not exactly true. A proposition may involve a relation between a variety of terms implicitly; but explicitly exhibits a relation only between two. Take, for instance, the proposition—"Men who do not possess courage and practise self-denial are not heroes." Here, on Professor Boole's method, a variety of concepts are supposed to be before the mind, as, *men, those who practise self-denial, those who possess courage*, and *heroes*. But in reality, when we form the judgment expressed in the proposition given, the separate concepts, *men, those who practise self-denial, those who possess courage*, are not before the mind; but simply the two concepts, *men who do not possess courage and practise self-denial*, and *heroes*. What is a judgment but an act of comparison? And the comparison is essentially a comparison of two concepts, each of which may no doubt involve in its expression a plurality of concepts, but these necessarily bound together by the comparing mind into a unity. Now, if the conclusion of an argument exhibits a relation between two terms X and Y, this conclusion must be drawn (what other way is possible?) either through an immediate comparison of X and Y with one another, or by a mediate comparison of them through something else. If it be drawn by an

immediate comparison of X and Y, then no concepts enter into the argument except X and Y, and the argument is reduced to conversion. But if the conclusion be drawn mediately, it must be by the comparison of X and Y with some third thing: not with a plurality of other things, but with some single thing. Here we have the mind drawing its inference in a syllogism. What the various admissible forms of conversion and syllogism may be, or whether these forms have been correctly specified by particular eminent logicians, are minor questions. The essential thing in a philosophical respect is, that the mind, in the inferences which it draws, does and can work in no other moulds than those described. All this seems to us so plain that we confess ourselves utterly puzzled to comprehend how men of profound and original genius have been beguiled into an assertion of the contrary.

Professor Boole himself, in summing up his assault on the Aristotelian Logic, comes very near admitting what we contend for. "As Syllogism," he says, "is a species of elimination, the question before us manifestly resolves itself into the two following ones: 1st. Whether all elimination is reducible to Syllogism; 2nd. Whether deductive reasoning can, with propriety, be regarded as consisting only of elimination. I believe, upon careful examination, the true answer to the former question to be, that it is always theoretically possible so to resolve and combine propositions that elimination may subsequently be effected by the syllogistic canons, but that the process of reduction would in many instances be constrained and unnatural, and would involve operations which are not syllogistic. To the second question I reply, that reasoning cannot, except by an arbitrary restriction of its meaning, be confined to the process of elimination." With regard to this second question, we merely note in passing, that we have proved in the preceding paragraph that inference, where not immediate or of the nature of conversion, can be nothing else than elimination. It is, however, with the first question, whether elimination is reducible to syllogism, that we have now more particularly to do; and we accept with satisfaction the admission, guarded and (to some extent) neutralised as it is, that every line of argument may be thrown into a form in which the eliminations that take place are effected by the syllogistic canons. It is quite irrelevant to notice, as Professor Boole does, that the process of reduction would, in many instances, be constrained and unnatural; for we are

not here in the province of Rhetoric. Much more to the purpose is the charge, that the process of reduction would involve operations which are not syllogistic. The operations referred to are those embraced in the "much more general process" in which, as we have seen, our Author holds conversion and syllogism to be contained. Of course, the ground which we take in reply is, on the one hand, to challenge the production of an instance of valid inference, which cannot be reduced to either conversion or syllogism; and on the other hand, to fall back upon the demonstration which we have given of the absolute impossibility of valid inference being anything else than conversion or syllogism.

In stating the charge of incompleteness brought by our Author against the Aristotelian system, we explained his meaning to be, that, from the very nature of the system, there is an indefinite variety of problems belonging to the science of inference, which the system is incapable of solving, or for the solution of which, at all events, it furnishes no definite and certain method. We have, we trust, fully refuted the opinion that there are problems in the science of inference which the Aristotelian logic is incapable of solving. But Professor Boole urges, that, even if all inference were reducible to conversion and syllogism, "there would still exist the same necessity for a general method. For it would still be requisite to determine in what order the processes should succeed each other, as well as their particular nature, in order that the desired relation should be obtained. By the desired relation I mean that full relation which, in virtue of the premises, connects any elements selected out of the premises at will, and which, moreover, expresses that relation in any desired form and order. If we may judge from the mathematical sciences, which are the most perfect examples of method known, this directive function of method constitutes its chief office and distinction. The fundamental processes of arithmetic, for instance, are in themselves but the elements of a possible science. To assign their nature is the first business of its method, but to arrange their succession is its subsequent and higher function. In the more complex examples of logical deduction, and especially in those which form a basis for the solution of difficult questions in the theory of probabilities, the aid of a directive method, such as a Calculus alone can supply, is indispensable."

Now, we at once admit that the Aristotelian logic neither has, nor

professes to have, any such method as that here described. But can it justly, on that account, be charged with incompleteness? A science must not, because it does not teach everything, be therefore reckoned incomplete: enough, if it teaches the whole of its own proper circle of truths. The special question which the scholastic logic proposes to itself is: what are the ultimate abstract forms according to which all the exercises of the discursive faculty proceed? The science is complete, because it furnishes a perfect answer to this question.

But, it may be said, is it not desirable to have a method enabling us certainly to determine, in every case, the relation which any of the concepts explicitly or implicitly entering into a group of premises bear to the others? Most desirable. And herein consists the real value of Professor Boole's labours. He has devised a brilliantly original Calculus by which he can, through processes as definite as those which the Algebraist applies to a system of equations, solve the most complicated problems in the science of inference—problems which, without the aid of some such Calculus, persons most thoroughly versed in the ordinary logic might have no idea how to treat. In expressing our dissent, as we have been obliged very strongly to do, from much that is contained in Professor Boole's treatise, we have no desire to rob that eminent writer of the credit justly belonging to him. Our wish has been simply to separate the chaff from the wheat, and to point out accurately what constitutes, as far as the "Investigation" is concerned, Professor Boole's claim to renown.

Our readers will, however, be now anxious to obtain some fuller information regarding the method about which so much has been said, and which is the same with "the more general process" under which the processes of the scholastic logic are held by Professor Boole to be comprehended. This part of our article must necessarily be altogether technical; and we shall require to ask our readers to take a few things on trust; but we hope to be able to present the subject in such a manner as to give at least some idea of the system we are to endeavour to describe. Those who desire to become thoroughly acquainted with it will of course study the "Investigation" for themselves.

We begin by referring to the development of logical functions. An expression which in any manner involves the concept x, is called a function of the concept, and is written $f(x)$. Now there is one

standard form to which functions of every kind may be reduced. This form is not an arbitrary one, but is determined by the circumstance that every conceivable object must rank under one or other of the two contradictory classes x and $1 - x$. Hence every conceivable object is included in the expression,

$$ux + v(1 - x); \qquad (8)$$

proper values being given to u and v. For, if a given concept belong to the class x, then, by making $v = 0$, the expression (8) becomes ux, which, by (1), means *some* x; and if the given concept belong to the class $1 - x$, then, by making $u = 0$, the expression (8) becomes $v(1 - x)$, which, by (1) and (6), means *some not* x. Therefore, $f(x)$ being any concept depending on x, we may put

$$f(x) = ux + v(1 - x) \qquad (9)$$

It has been shown that one of the coefficients, u, v, must always be zero; but the forms of these coefficients may be determined more definitely. For, by making $x = 0$ in (9), the result is $v = f(0)$; and by making $x = 1$, there results $u = f(1)$; by substituting which values of u and v in (9), we get

$$f(x) = f(1)\,x + f(0)(1 - x) \qquad (10)$$

This is the expansion or development of the function x. The expressions x, $1 - x$, are called the constituents of the expansion; and $f(1)$ and $f(0)$ are termed the coefficients. The same phraseology is employed when a function of two or more symbols is developed.

Any one in the least degree acquainted with mathematical processes will understand how the development of functions of two or more symbols can be derived from equation (10). In fact, by (10), we have

$$f(x, y) = f(1, y)\,x + f(0, y)(1 - x).$$

But again, by (10),

$$f(1, y) = f(1, 1)\,y + f(1, 0)(1 - y),$$

and

$$f(0, y) = f(0, 1)\,y + f(0, 0)(1 - y).$$

$$\therefore f(x, y) = f(1, 1)\,xy + f(1, 0)\,x(1 - y)$$
$$+ f(0, 1)\,y(1 - x) + f(0, 0)(1 - x)(1 - y) \qquad (11)$$

The development of a function ` three symbols may be written down, as we shall have occasion in the sequel to refer to it:

$$\begin{aligned} f(x, y, z) = {} & f(1, 1, 1)\, xyz + f(1, 1, 0)\, xy\,(1 - z) \\ & + f(1, 0, 1)\, xz\,(1 - y) + f(1, 0, 0)\, x\,(1 - y)\,(1 - z) \\ & + f(0, 1, 1)\, yz\,(1 - x) + f(0, 1, 0)\, y\,(1 - x)\,(1 - z) \\ & + f(0, 0, 1)\, z\,(1 - x)\,(1 - y) \\ & + f(0, 0, 0)\,(1 - x)\,(1 - y)\,(1 - z) \quad \ldots\ldots\ldots (12) \end{aligned}$$

As the object of the expansion of logical symbols may not be evident at first sight, and as the process may consequently be regarded by some as barbarous, we may observe that not only is there a definite aim in the development, but the thing aimed at, has, in our opinion, been most felicitously accomplished. Of this our readers will probably be satisfied when they are introduced to some specimens of the use which is made of the formulæ obtained; in the meantime it may throw some light on the character of these formulæ if we notice that the constituents of an expansion represent the several exclusive divisions of what our author terms the universe of discourse, formed by the predication and denial in every possible way of the qualities denoted by the literal symbols. In the simplest case, that in which the function is one of a single concept, it will be seen by a glance at (10) that there are only two such possible ways, x and $1 - x$. In the case of a function of two symbols, there are [see (11)] four such ways, xy, $x\,(1 - y)$, $y\,(1 - x)$, $(1 - x)\,(1 - y)$. In a function of three symbols there are eight such ways; and so on. A development in which the constituents are of this kind prepares the way for ascertaining all the possible conclusions, in the way either of affirmation or denial, that can be deduced, regarding any concept, from any given relations between it and the other concepts.

If S be the sum of the constituents of an expansion, and P the product of any two of them, then

$$S = 1, \quad \ldots\ldots\ldots (13)$$

$$\text{and } P = 0. \quad \ldots\ldots\ldots (14)$$

The truth of these beautiful and important propositions will easily be gathered by an intelligent reader from an inspection of the formulae, (10), (11), (12). Another important proposition is involved in (14), namely, that, if $f(x) = 0$, either the constituent or the coefficient in every term of the expansion of $f(x)$ must be zero. For, let

$$f(x) = Q + A\,X + A_1\,X_1 + \ldots\ldots + A_n\,X_n;$$

where A, A_1, &c., are the coefficients which are not zero, their corresponding constituents being X, X_1, &c.; while Q represents the sum

of those terms in which the coefficients are zero. Then we say that

$$X = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (15)$$

For, since $Q = 0$, and $f(x)$ is supposed to vanish,

$$A X + A_1 X_1 + \&c. = 0$$
$$\therefore A X^2 + A_1 X X_1 + \&c. = 0$$

But, by (14), $X X_1 = X X_2 = \ldots\ldots\ldots = X X_n = 0$. Therefore

$$A X^2 = 0.$$

But A is not zero. Therefore X must be zero.

These principles having been laid down, our best course will probably now be to take a few examples, and to offer in connection with them such explanations as may seem necessary of the mode of procedure which they are intended to illustrate.

Our first example shall be one in which but a single proposition is given: "clean beasts are those which both divide the hoof and chew the cud." Let

x = clean beasts,
y = beasts dividing the hoof,
z = beasts chewing the cud.

Then, the given proposition, symbolically expressed, is,

$$x = y z,$$

or, by transposition,

$$x - y z = 0 \ldots\ldots\ldots\ldots\ldots\ldots (16).$$

This premiss contains a relation between three concepts; and, according to Professor Boole, a properly constructed science of inference should enable us, by some defined process, to show what consequence, as respects any one of these, follows from the premiss. Now, the definite and invariable process which Professor Boole applies, with the design which has been indicated, to an equation such as (16), is to develop the first member of the equation. Writing, then,

$$f(x, y, z) = x - y z,$$

we have, $f(1, 1, 1) = 0$,

$$f(0, 0, 0) = 0,$$

and so on. Hence [see (12)] the developement required is

$$\begin{aligned} x - y z = {} & x y (1 - z) + x z (1 - y) \\ & + x (1 - y) (1 - z) - y z (1 - x) \\ & + 0\, x y z + 0\, y (1 - x) (1 - z) \\ & + 0\, z (1 - x) (1 - y) \\ & + 0 (1 - x) (1 - y) (1 - z). \end{aligned}$$

Therefore, by (16),

$$x\,y\,(1-z) + x\,z\,(1-y) + x\,(1-y)\,(1-z) - y\,z\,(1-x) = 0:$$

and therefore, by (15),

$$\left.\begin{aligned} x\,y\,(1-z) &= 0, \\ x\,z\,(1-y) &= 0, \\ x\,(1-y)\,(1-z) &= 0, \\ y\,z\,(1-x) &= 0. \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (17)$$

Still farther, since, by (13), the sum of the constitutents of an expansion is unity; and since four of the constituents in the expansion of $x - y\,z$ have been shewn to be zero; it follows that the sum of the remaining constituents in the expansion of $x - y\,z$ is unity. That is,

$$x\,y\,z + y\,(1-x)\,(1-z) + z\,(1-x)\,(1-y) + (1-x)\,(1-y)\,(1-z) = 1. \quad \ldots\ldots \quad (18)$$

It is obvious that this method can be applied in every case. To what then does it lead? First of all, in the group of equations (17), we have brought before us all the different classes (if the expression may be permitted) to which the given proposition warrants us in saying that nothing can belong; and next, in equation (18) we have brought before us those different classes to one or other of which the given proposition warrants us in asserting that everything must belong. For instance, the first of equations (17) denies the existence of beasts which are clean (x) and divide the hoof (y) but do not chew the cud ($1 - z$); the second denies the existence of beasts which are clean (x) and chew the cud (z) but do not divide the hoof ($1 - y$); and so on. Equation (18), again, informs us that the universe, which is represented by 1, is made up of four classes, in one or other of which therefore every thing must rank; the first denoted by $x\,y\,z$, the second by $y\,(1-x)\,(1-z)$; and so on. As an example of the interpretation of the expressions by which these classes are denoted, we may take the last, $(1-x)\,(1-y)\,(1-z)$. This represents things which are neither clean beasts, nor beasts chewing the cud, nor beasts dividing the hoof.

By the method employed, we have been able to indicate certain classes which do not exist, and also to indicate certain classes in one or other of which every thing existing is found. But this, it may be said, is not a solution of the most general problem of inference. The most general problem is: to express (speaking mathematically) any one of the symbols entering into the given premiss, or any func-

tion thereof, as an explicit function of the others. To the problem as put even thus in its widest generality, Professor Boole's processes extend. It would make our article too lengthened were we to go into minute details; but we must endeavour to give some idea of the course here followed, as it both is extremely interesting as a matter of pure speculation, and forms an important part of the system under consideration.

Take the equation in (16), $x - yz = 0$; and, as a simple instance will serve the purpose of illustration as well as a complicated one, let the inquiry be: how can z be expressed in terms of x and y? In ordinary Algebra we should have

$$z = \frac{x}{y} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (19)$$

But though both sides of an equation may, in Logic as in Algebra, be multiplied (so to speak) by the same quantity, they cannot, in Logic, be legitimately divided by the same quantity. For instance, let the objects common to the class X and to the class U be identical with those common to the class Y and to the class U; in other words, let

$$UX = UY;$$

it does not follow that X is identical with Y, or symbolically, that

$$X = Y.$$

Hence equation (19) could not, in Logic, be legitimately deduced from (16), even if y were an explicit factor of x. But still further, when x has not y as one of its factors, the expression $\frac{x}{y}$ is not, in the logical system, interpretable. Nevertheless, Professor Boole shows that conclusions both interpretable and correct will *ultimately* be arrived at, if the value of z be deduced Algebraically, as in (19), and the expression $\frac{x}{y}$ be then, as a logical function, subjected to development. Now, if $\frac{x}{y}$ be developed by (11), and the expansion equated to z, we get

$$z = xy + \tfrac{1}{0}x(1-y) + 0(1-x)y + \tfrac{0}{0}(1-x)(1-y) \ldots\ldots (20)$$

Here we have two symbols, $\frac{0}{0}$ and $\frac{1}{0}$, the meaning of which has not yet been determined. Our author shows that the former, which in Algebra denotes an indefinite numerical quantity, denotes in the logical system an indefinite class. In Algebra $\frac{1}{0}$ denotes infinity; and, as is well known, when it occurs as the co-efficient in a term in

an equation all of whose other terms are finite, this indicates that the quantity of which it is the co-efficient is zero. So, in the logical system, if, in any term of an equation obtained in the manner in which equation (20) has been obtained, the co-efficient be $\frac{1}{0}$, the corresponding constituent must be 0. These are certainly very remarkable analogies. But let us see what follows. We have first, from (20),

$$x\,(1-y) = 0.$$

Hence as the equation (20) describes the separate classes of which z consists, and as there is no such class as $x\,(1-y)$ in existence, the second term on the right hand side of equation (20) may be rejected. The third term also may be omitted, its co-efficient being zero. This reduces the equation to the form,

$$z = x\,y + \tfrac{0}{0}\,(1-x)\,(1-y):$$

which means, that beasts which chew the cud consist of the class $x\,y$, together with an indefinite remainder of beasts common to the classes $1-x$ and $1-y$.

Before leaving the subject of inference from a single premiss, we must say a few words regarding elimination; for though, in Algebra, elimination is possible only when two or more equations are given, Professor Boole, shows that, in Logic, a class symbol may be eliminated from a single equation. In fact, elimination from two or more premises is ultimately reduced by our author to elimination from a single premiss. And yet, as if to preserve the analogy between Algebra and Logic, even where the two sciences seem to differ most widely from one another, the possibility of eliminating x from a single premiss in the latter science, arises from the circumstance, that, in that science the equation previously referred to as expressing the Law of Duality always subsists; and it is by the combination of that equation with the given proposition that the elimination of x from the given proposition is effected. For let the given proposition be

$$f(x) = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (21)$$

Then, by (10),

$$f(1)\,x + f(0)\,(1-x) = 0.$$

$$\therefore x\,\{f(0) - f(1)\} = f(0),$$

$$\text{and, } (1-x)\,\{f(0) - f(1)\} = -f(1).$$

$$\therefore x\,(1-x)\,\{f(0) - f(1)\}^2 = -f(0)f(1).$$

But, by the Law of Duality, $x\,(1-x) = 0$. Therefore

$$f(0)f(1) = 0 : \ldots\ldots\ldots\ldots\ldots\ldots (22)$$

which is the result of the elimination of x from equation (21). We cannot pause to give examples of the use of the formula (22); but we must quote an interpretation of it, viewed as the result of the elimination of x from (21), which strikes us as extremely elegant. The formula implies that either $f(0) = 0$, or $f(1) = 0$. Now the latter equation $f(1) = 0$ expresses what the given proposition $f(x) = 0$ would become if x made up the universe; and the former $f(0) = 0$ expresses what the given proposition would become if x had no existence. Hence, (22) being derived from (21), it follows that *what is equally true whether a given class of objects embraces the whole universe or disappears from existence, is independent of that class altogether.*

The principle of elimination is extended by our author to groups of equations, by the following process. Let

$$\left.\begin{array}{l} T = 0, \\ V = 0, \\ U = 0, \\ \ldots\ldots\ldots \end{array}\right\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (23)$$

be a series of equations, in which T, U, V, &c., are functions of the concept x. Then

$$T^2 + V^2 + U^2 + \&c. = 0. \ldots\ldots (24)$$

It is shown by Professor Boole that the combined interpretation of the system of equations (23) is involved in the single equation (24). Indeed, had all the terms in the developments of T, V, U, &c., been such as to satisfy the Law of Duality, it would have been sufficient to have written

$$T + V + U + \&c. = 0.$$

In order now to eliminate x from the group (23), it is sufficient to eliminate it, by the method described in the preceding paragraph, from the single equation (24); and, if the result be

$$W = 0,$$

this equation will involve all the conclusions that can legitimately be derived from the series of equations (23) with regard to the mutual relations of the concepts, exclusive of x, which enter into these equations.

We do not see how it is possible for any one not blinded by prejudice against every thing like an alliance of Logic with formulæ and

processes of a mathematical aspect to deny that these are very remarkable principles. By way of instance, we select from the work under review the following problem, in which two premises are given. Let it be granted, first, that the annelida are soft-bodied, and either naked or enclosed in a tube; and, next, that they consist of all invertebrate animals having red blood in a double system of circulating vessels. Put

A = annelida, s = soft-bodied animals,
n = naked, t = enclosed in a tube,
i = invertebrate, r = having red blood in &c.

Then the given premises are

$$A = vs\left\{n\,(1-t) + t\,(1-n)\right\}, \ldots\ldots(25)$$
$$A = ir \ldots\ldots(26)$$

Suppose the problem then to be: to find the relation in which soft bodied animals enclosed in tubes stand to the following elements, viz., the possession of red blood, of an external covering, and of a vertebral column. Professor Boole would doubtless have granted that this problem admits of being solved by what he calls the ordinary logic; but he would probably have contended that the ordinary logic does not possess any definite and invariable method of solution. A skilful thinker may be able to find out how syllogisms may be formed so as ultimately to give him the relation which soft bodied animals enclosed in tubes bear to the elements specified; but what of thinkers who are not very skilful? How are they to proceed? In Professor Boole's system, the process is as determinate, and as certain of leading to the desired result, as the rules for solving a group of simple equations in Algebra. Eliminate v, the symbol of indefinite quantity, from (25). Reduce (25), thus modified, and (26), to a single equation, by the method described in a previous paragraph. The equation is

$$A\left\{1 - sn\,(1-t) - st\,(1-n)\right\} + A\,(1-ir) + ir\,(1-A) + nt = 0.$$

Then, since the annelida are not to appear in the conclusion, we must eliminate A, by (22), from this equation. This will be found to give us

$$ir\left\{1 - sn\,(1-t) - st\,(1-n)\right\} + nt = 0.$$

And ultimately we get

$$st = ir\,(1-n) + \tfrac{0}{0}\,i\,(1-r)\,(1-n) + \tfrac{0}{0}\,(1-i)\,(1-n);$$

the interpretation of which is: *Soft bodied animals enclosed in tubes*

(*st*) *consist of all invertebrate animals having red blood* (*ir*) *and not naked* ($1 - n$), *and an indefinite remainder* ($\frac{?}{0}$) *of invertebrate animals* (*i*) *not having red blood* ($i - r$) *and not naked* ($1 - n$) *and of vertebrate animals* ($1 - i$) *which are not naked* ($1 - n$).

We have entered so fully into the explanation of Professor Boole's system in its bearing on what he terms Primary (virtually equivalent to Categorical) Propositions, that we cannot follow him into the field of Secondary (virtually equivalent to Conditional, that is, Disjunctive and Hypothetical) Propositions. Nor is it necessary that we should do so; for our object is not to give a synopsis of the "Investigation," but simply to make the nature of the work understood; and, for that purpose, what has been said is sufficient. The application of the Calculus to Secondary Propositions is exceedingly similar, in respect not only of the general method followed, but even of the particular formulæ obtained, to its application to Primary. All that is peculiar in the treatment of Secondary Propositions arises from the introduction of the idea of Time. For instance, the proposition, "If X is Y, A is B," is held to be not substantially different in meaning from this: "the time in which X is Y, is time in which A is B." Such being the fundamental view taken, symbols like x and y are used to represent the portions of time in which certain propositions (e.g., X is Y, A is B) are true. Then, the symbol 1 denoting the universe of Time, or Eternity, the expressions, $1 - x$, $1 - y$, will denote those portions of time respectively in which the propositions, X is Y, A is B, are not true; and so on.

The extension of his method, by Professor Boole, to the theory of Probabilities, is a splendid effort of genius on the part of the author, and furnishes a most convincing illustration of the capabilities of the method. The part of the "Investigation" which is devoted to this subject, is much too abstruse to admit of being here more particularly considered; but, to show what the method can accomplish —though the bow of Ulysses perhaps needs the arm of Ulysses to bend it—we may simply state one of the problems of which Professor Boole gives the solution. "If an event can only happen as a consequence of one or more of certain causes, A_1, A_2, ... , A_n, and if generally C_i represents the probability of the cause A_i, and p_i the probability that, if the cause A_i exist, the event E will occur, then the series of C_i and p_i being given, required the probability of the event E."

To those who have followed us thus far, it will be evident what final judgment we are to pass on the work under review. On the one hand, as a contribution to philosophy, in the strict sense of that term, it does not possess any value. Professor Boole distinctly, though modestly enough, avows the opinion, that, in his "Investigation," he has gone deeper than any previous inquirers into the principles of discursive thinking, and that he has thus thrown new light on the constitution of the human mind. We are sorry to be unable to accept this view. But, on the other hand, Professor Boole is entitled to the praise of having devised a Method, according to which, through definite processes, it can be ascertained what conclusions, regarding any of the concepts entering into a system of premises, admit of being drawn from these premises. This Method depends on a Calculus, original, ingenious, singularly beautiful both in itself and in its relations to the science of Algebra, and capable (in hands like those of its inventor) of striking and important applications. In a word, the merit of the Treatise lies in that part of it which has nothing to do with the Laws of Thought, but which is devoted to showing how inferences, from data however numerous and complicated, and whatever be the matter of the discourse, can be reached through definite mathematical processes.

THE MOHAWK LANGUAGE.

BY ORONHYATEKHA.

When I was requested to prepare a paper concerning the language of my people, to be read before your learned body, I readily assented; not because I was not fully sensible of the difficulty of the task, or that I was not painfully aware of my own inability to do a subject of so much importance anything like full justice: but in the hope that I might be able to contribute something which may prove of some assistance to those whose inquiries may be turned in the same direction.

It will not be expected, in a short paper like this, that more can be

done than merely to give a brief introduction to the subject in hand, trusting that future opportunities may be afforded to further prosecute the work. While it is my design to direct your attention mainly to the Language, it may not be amiss to give at the outset a general outline of the history of the Mohawks.

They are the head Tribe of the *Confederacy of the Six Nations*, and, like the other Indian tribes of this continent, their origin is involved in mystery.

The only source which has not been exhausted, from which we can derive any information, at present within reach, is the Indian traditions. They are, however, so mythical in their character, as touching the origin of the Indian, that but little, if any, reliance can be placed on them. I may say, however, that they all teach that the Red Man was created upon this continent; and were I to weigh the evidence given by these traditions, and that derived from the various theories of scientific writers upon the subject, I should be inclined, after making all allowances for the legendary character of Indian History, to decide in favour of the evidence of tradition. For I am disposed to attach but little weight to theories founded upon supposed similarity in manners and customs, or accidental resemblance in words of the language. I do think, however, that there is every reason to hope that we shall find, if not a solution of this difficulty, at least great assistance from the science of language.

I know that the traditions of the Mohawks assume a rational and reliable character with the formation of the Confederacy of the Five Nations by the Mohawk Chief De-ka-na-wi-dah. Yet, the Tuscaroras are completely lost sight of in all the earlier traditions of the Five Nations, and are represented to have first met the Mohawks when they joined the Confederacy at a comparatively recent date. An examination, however, of the two languages leaves no room to doubt that at some remote period these two nations were one.

Here, therefore, we have a case where we are enabled, by a knowledge of, and an examination into the languages, to pronounce judgement, with absolute certainty, upon a point which goes farther back than tradition. I should be placing a low estimate to say that the confederacy is 500 years old. Philology, therefore, immediately solves a question for us in relation to events from 600 to 1000 years old. Leaving, however, this question of our origin for discussion till we are in a position to bring the science of language to bear upon it, we will

proceed to give a hasty view of the confederacy of which we have already made mention.

I have said that it was first conceived by De-ka-na-wi-dah, at a time when the nations which subsequently formed the League were living in separate and independent communities, continually engaged in hostilities with each other. The Chief, thoroughly satisfied that a confederation of the neighboring tribes would result in mutual benefit and prosperity, made proposals to the Oneida for an alliance, to which the latter fortunately acceded without hesitation.

They next proceeded to the Onondaga, who at that time was the most powerful of the neighboring tribes. Having received the proposition of the Mohawk and Oneida, to form an alliance in which all should be equal, the Chief rejected it, as he was then more powerful and had more influence than they, and by entering the alliance he would be brought down to an equality with them. Determined, however, to carry out the confederation scheme, the Mohawk and Oneida tendered the Onondaga the office of "Fire Keeper" in the new council they would form. This giving him the sole authority of opening or closing the Councils of the Five Nations, and a veto power upon all transactions of the confederate chiefs, induced the Onondaga to yield. The Cayugas and Senacas were subsequently added and thus completed the scheme of confederation of the Five Nations: a lasting evidence of their wisdom, and that they were entitled to the name of statesmen much more than many "pale-faces" of the present day. From the consummation of this scheme, the "new nationality" steadily, though slowly, increased in prosperity and power, till about the time of the settlement of the English at Jamestown, when they had reached the zenith of their power and glory. Their hunting grounds extended from the Great Lakes, upon the north, to the Cumberland River and Cherokee country upon the south, and east of the Mississippi. They subdued nation after nation till their name was known and their arms dreaded by nearly all Indian tribes east of the Rocky Mountains.

With what has occurred to us since we came in contact with the pale-faces, most of you are familiar, and I need say but a few words.

At the time that New Amsterdam changed masters, was formed that alliance with the English which has been kept inviolate by the Mohawks unto this day. The Indians were engaged in all the wars that took place upon this continent for the possession of Canada, be-

tween the English and French, and to them England, most undoubtedly owes her possessions in America. Their fidelity and the strength of their friendship will better appear when it is taken into consideration that they had not only no personal interest to serve, but also tempting offers were frequently made to them by the foes of England, to remain at least neutral. But their invariable reply was: "When my brother is glad, we rejoice; when he weeps, we weep also."

At the close of the revolutionary war, the Mohawks—having throughout fought for their brother the King, though the American Government generously offered them the undisturbed possession of their territory,—left their "hunting grounds and the graves of their forefathers," and sought a new home in the wilds of Canada, in order still to preserve their alliance with their great brother, the King.

A portion settled upon the shores of the Bay of Quinté, where there are now about 700, while the remainder passed up to their present reservation at the Grand River, numbering at the present day about 2,500. So, again, in the War of 1812, these people gave good evidence, at "Beaver's Dam," "Lundy's Lane," and "Queenston Heights," that the spirit of their forefathers had not entirely died out. As illustrating the "ruling passion," strong even in the din and smoke of battle, the father of the writer, who took a leading part in all the engagements on the Niagara Frontier, being present at the burning and sacking of Buffalo, selected from a rich, varied, and costly assortment, as his share of the plunder, *a keg of rum*.

With this bare outline, we shall now proceed with our subject proper.

Although all the traditions represent the Six Nations as originally separate and distinct tribes, there can be no doubt of their common origin when we come to examine the dialects.

The migration of a family, away from the rest, and living in isolation, would, in time, give the dialectic differences now existing among the languages spoken by the Six Nations. If this be true, we must naturally suppose that the greatest similarity would be found to exist between the languages spoken by tribes located contiguous to each other, and on the contrary the greatest dissimilarity between the languages of tribes that are most remote from each other. On reference to the geographical position of the tribes, we find that, according to this, the Mohawk and Oneida ought to be most alike.

An examination will prove this fact; while the Tuscarora differs

more from the Mohawk than any of the others. For the Chiefs of the Mohawks, Oneidas, Onondagas, Cayugas and Senacas speak each in his own language in the Council House and are readily understood by all. But the speech of a Tuscarora Chief usually has to be interpreted into one or other of the five dialects before it can be understood by the Council.

Our first inquiries must be directed, as a matter of course, to the alphabet of the leading language, viz: the Mohawk, and attention will at once be arrested by a curious peculiarity, in the entire absence of the labials which, in English, are so prominent.

I ought, perhaps, here to explain that the name Mohawk was given to us by foreigners, and that the signification or derivation is entirely unknown to us. Some writers, I believe, have conjectured it to mean *man eaters*; but if it is implied by this that the Mohawks were Cannibals, I have no hesitation in pronouncing it to be a libel.

The name by which we are known among Indians is, perhaps, not quite so euphonious, but much more complimentary. It is *Ka-nyen-ke-há-ka* which means "Flint People" or "people derived from the flint," given no doubt by those who had experienced something of the flinty character and the scalping propensities of the Mohawk upon the war-path. The following comprises all the letters of the alphabet, viz:

Vowels.

a as *a* in far.
e " a " fate.
i " e " meet.
o " o " old.
u " u " tune.

Vowels followed by h have a short quick explosive sound, *e.g.*, *eh* as *e* in met; *ih* as *i* in pin.

E followed by n has the sound of *u* in under.

Consonants.

d h j k n q r s t w x y.

It will thus be seen that b c f g l m p v z are wanting, leaving 17 letters in the alphabet.

Writers who have gone before me have, as a general thing, retained c and q, but I conceive uselessly, as I think where those former writers would employ these letters, j and k could be used quite as correctly.

It will be my object, not so much to exhibit the language in some particular form, or according to certain preconceived grammatical notions, as to examine and analyze the language, and afterwards de-

duce rules founded upon such analysis. With most of the works upon the subject, that I have been able to examine, I have found this difficulty—that instead of truly exhibiting the language as it exists, it has been distorted and made to assume new forms to suit the purposes of the author.

In order to indicate the connection between the language of the Mohawks and the other dialects of the Six Nations, I have prepared a comparative table of the numerals, and of a few common words, from which it will be seen that the Mohawk and Oneida are most alike, while the Tuscarora is most dissimilar from the rest.

—	Mohawk.	Oneida.	Onondaga.	Cayuga.	Tuscarora.
1	En-ska	En-ska	Ska-dah	Skat	En-jih.
2	De-ke-nih	De-ke-nih	De-ke-nih	Dek nh	Ne-ktih.
3	Ah-senh	Ah-senh	Ah-senh	Ah-senh	Ah-senh.
4	Ka-ye-rih	Ka-ye-lih	Ka-ye-in	Ke-ih	En-dah.
5	Wisk	Wisk	Wiks	Wi-sh	Whisk.
6	Ya-yak	Ya-yak	Ah-yak	Hye-ih	O-yak
7	Ja-dah	Ja-dah	Ja dah	Ja-dak	Ja nah.
8	Sa-de konh	De-ke-ronh	De-kenh	De-krunh	Na-krunh.
9	Tyo-donh	Wa-deh	Wa-donh	Dyo-ton	Ni-renh.
10	O-ye-rih	O-ye-lih	Wa-senh	Wa-senh	Wa-senh.
11	En-ska-ya-wen-reh	Combined same as in Mohawk, only using ? wherever *r* occurs in the Mohawk.	Ska-dah-ka-he	Skat-ska-reh	En-jih-ska-reh.
12	De-ke-nih-ya-wen-reh		De-ke-nih-ka-he	Dek-nih ska-reh	Ne-ktih-ska-reh.
20	De-wa senh		De-wa-senh	De-wa-senh	Ne-wa-senh.
21	De-wa-senh-en-ska-ya-wen-reh		De-wa-senh-ska-dah-ka-he	De-wa-senh-skat-ska-reh	Ne-wa-senh-en-jih-ska-reh.
22	De-wa-senh-de-ke-nih-ya-wen-reh		Ah-senh-ni-wa-senh	Ah senh-ni-wa-senh	Ah-senh-di-wa-senh.
30	Ah-senh-ni-wa-senh		Ka-ye-ih-ni-wa-senh, &c	Ke-ih, &c., &c	En-dah-di-wa-senh, &c.
40	Ka-ye-rih-ni-wa-senh				
50	Wisk-ni-wa-senh				
60	Ya-yak-ni-wa-senh				
70	Ja-dah-ni-wa-senh				
80	Sa-de-konh-ni-wa-senh				
90	Tyo-donh-ni-wa-senh				
100	En-ska-de-wen-nya-weh		Ska-dah-de-wen-nya-eh-weh	Skat De-wen-nya-weh	Ka-ya-swih.
150	En-ska-de-wen-nya-weh One Hundred nok-wisk-ni-wa-senh and Fifty.		Similar to the Mohawk.		
200	De-ke-nih-de-wen-nya-weh		De-ke-nih-de-wen-nya-eh-weh		
Man	Ron-kwe	Lon-kwe	Ha-ji-nah	Ha-ji-nah	Ra-ni-ha.
Woman	Yon-kwe	Yon-kwe	E-henh	Kunt-swi-sah	Ka-neu-wenh.
Boy	Rax-ha	Lax-ha	Hak-sa-ah	Hak-sa-ah	Ra-ka-senh.
Girl	Kax-ha	Ex-ha	Ek sa-ah	Ex-ha-ah	Ya-ken-wa-ston.
Husband (my)	De-ya-ke-ni-de-ronh	De-ya-ke-ni-de-lonh	De-ya-ke-ni-de-onh	Ho oh	Ro-ho.
Wife (my)	" " "	" " "	" " "	De-ya-ke-ni-ya-seh	Ke-ho.
Father (my)	Ra-ke-ni-ha	La-ke-nih	Kho-ni-ha	Ha-nih	Ri-enh.
Mother (my)	Is-ten-ah	Ah-ke-nol-ha	Ah ke-no-ha	Kno-ha	Kwi-renh.

—	DELAWARE.*	—	DELAWARE—*Continued.*
1	En-kwi-ta.	50	Naw-lon nach-kenh.
2	Ni-sha.	60	En-kwi-tash-ta nach kenh, &c.
3	N-ghah.	100	En-kwi ta-peh-kenh.
4	Ni-wah.		(En-kwi-ta-peh-kenh wak One Hundred and
5	Nau-lon.		
6	En-kwi-tash.		ni-shash-ta-nach-kenh wak
7	Ni-shash.	175	Seventy and
8	Nghash.		nau-lon.
9	Nole.		Five.
10	Wi-mbut.	Man	Lin-non.
11	En-kwi-ta-nih.	Woman	Ah-kwi.
12	Ni sha-nih.	Boy	Ska-hen-tson.
13	Nghah-nih.	Girl	Oh-kwi-*sis* (little woman.)
14	Ns-wa-nih.	Husband	Ni-tah-wun-mask.
15	Naw-lon-na nich.	Wife	Ni-tah-wun-mask.
16	En-kwi-tash-ta-nich.	Father	Noch.
17	Ni-shash-ta-nich.	Mother	En-gak.
18	Nghash-ta-nich.	Son	We-quo-shein.
19	Nole-ta-nich.	Daughter	En-da-nish.
20	Ta-kwi-na-cheh.	Day	Ki-ish koh.
21	Ta-kwi-na-chch-wak-en-kwi-ta, &c.	Night	Pi-shak.
30	Ngheh-nach-kenh.		
40	Ni-wah-nach-kenh.		

From the above table we can readily see that the numerals are combined according to the decimal system of notation, and that in the language of the Six Nations they counted as far as ten, and then began to combine, as *ten and one, ten and two,* &c.; while in the Delaware language they counted only as far as five. For the form *En-kwi-tash* = 6 is evidently allied to *Enkwita* = 1, and so of *Nishash* = 7 and *Nisha* = 2, &c.

Although there does not appear to be much connection between the Mohawk *O-ye-rih* = 10, and *De-wah-senh* = 20; yet when we come to look at the forms for ten in the other languages with which it is allied, we readily recognize in *De-wah-senh* the words *De-ke-nih* + *Wa-senh:* — two-tens.

The addition of the ending *Ya-wen-reh* to *one, two,* &c., to express *eleven, twelve,* &c., is peculiar to the Mohawk and Oneida. The form for the other languages—as in Cayuga †*Wa-senh-skat-skareh,* simply means *ten* and *one piled on* in the sense of added. I am at a loss to trace the Mohawk and Oneida form *Ya-wen-reh*; it may be derived from *O-ye-rih* = 10, but more likely from *De-ya-wen-rénh* = *over,* in the sense of overflowing, more than enough. You will have

* The writer is indebted for the *Delaware* to an educated young Indian of that tribe (Mr. Albert Anthony). Every possible care has been taken to guard against errors; and, it is believed, that the examples given are as near correct as possible.

† *Wa-senh* is usually understood.

noticed the peculiarity in the Oneida, in the substitution of *l* where *r* is used in the remaining dialects; in fact this seems to be its principal difference from the Mohawk. The initial R, and Y or R seem to have some connection with the gender, as, for instance, *On-kwe* for mankind, in contradistinction from *Kar-yoh* = beast, is changed into man by simply prefixing R, and into woman by simply prefixing Y. So we have *Ex-ha* = child, *Rax-ha* = a boy, and *Kax-ha* = a girl.

Before subjecting a verb through its various forms it may help us to understand some of the changes which it undergoes, by first looking at the pronouns and nouns.

Singular.	*Dual.*
I — I-ih.	We — Un-ke-non-ha.
My — Ah-kwa-wenh.	Ours — Un-kya-wenh.
Me — I-ih	Us — ————

Plural.

We — Un-kyun-ha.
Ours — Un-kwa-wenh.
Us — ————

Singular.	*Dual.*	*Plural.*
Thou — I-seh.	You — Se-non-ha.	You — Jon-ha.
Thy — Sa-wenh.	Yours — Ja-wenh.	Yours — Se-wa-wenh.
He — Ra-on-ha.	They — Ro-non-ha.	Thy — Ro-non-ha.
His — Ra-o-wenh.	Theirs — Ra-o-na-wenh.	Theirs — Ra-o-na-wenh

Singular.	*Dual and Plural.*
She, or it — A-on-ha.	They — O-non-ha.
Hers, or its — A-o-wenh.	Theirs — A-o-na-wenh.

There is another form for *she* and *hers* applied to those for whom we entertain love, respect, or esteem, viz: she = ah-ka-on-ha, hers = ah-ko-wenh, in which we have introduced the *k* we have already mentioned, as having some connection with the feminine gender. There is but one form for the nominative and accusative cases. But the chief peculiarity is the existence of a dual element; as, however, we shall see this more clearly when we come to consider the verbs, it may perhaps be better to proceed to an examination of the verbs before saying anything of this peculiarity of the language.

We shall find great difficulty in our process of analyzing and tracing the words, from the great tendency to agglutination which exists in all of the dialects of the Six Nations. We shall frequently meet with compound words, in which the character of the original elements are

so entirely changed, or so little left of them, that it will require the utmost caution to keep clear of error. It may be better, where such cases occur, not to attempt an analysis, rather than incur the risk of misleading in the matter.

As an example of their tendency to run words together, as well as showing how the possessive of nouns are formed, we have—my apple = *ah-kwa-hih* which is evidently a compound of the pronoun my = ah-kwa-wenh and apple = ka-hih, but instead of using the full form. *ah-kwa-wenh* + *ka hih*, we have the last syllable of the pronoun, and the first of the noun elided, and we get *ah-kwa-hih*. So in the 2nd and 3rd persons we have

Singular.

Thy apple = *Sa-hih* from *Sa-wenh* + *Ka-hih.*
His apple = *Ra-o-hih* " *Ra-o-wenh* + *Ka hih.*
Her apple = *Ah-ko-hih* " *Ah-ko-wenh* + *Ka-hih.*
Her or its apple = *A-o-hih* " *A-o-wenh* + *Ka-hih.*

Dual.			*Plural.*		
Our apple,		Un-kya-hih.			Un-kwa-hih.
Your "		Ja-hih.			Se-wa-hih.
Male, Their "		Ra-o-na-hih.	Male,		Ra-o-na-hih
Neuter or female,	Their "	A-o-na-hih.	Female or neuter,		A-o-na-hih.

The rule which may be deduced from the above with reference to the formation of the possessive case of nouns, I think, will be found general. In many cases, however, we shall find that the final syllable of the pronominal part of a compound word, or rather of the possessive, is modified, doubtless for the sake of euphony and according to certain general rules.

Take any number of words, as bow = *Ah-en-nah,* arrow = *Ka-yen-kwi-reh,* Tommahawk = *Ah-do-kenh,* Knife = *Ah-sa-reh,* shoes = *Ah-dah,* and form their possessive cases, and we shall, I think, find that the same general rule applies to all, *e.g.* :

My Bow,	Ah-kwa-en-nah.
Thy "	Sa-en-nah.
His "	Ra-o-en-nah.
Her "	Ah-ko-en-nah.
Her or its	A-o-en-nah.

In this example we find that precisely the same rule applies as in

the first instance given, and we need go no further than the singular, as the formation of the dual and plural is quite regular. Take the next word, arrow.

My	Arrow,	Ah-kyen-kwi-reh.
Thy	"	Sa-yen " "
His	"	Ra-o-yen " "
Her	"	Ah-ko-yen " "
Her or its	"	A-o-yen " "

		Dual.	*Plural.*
	Our Arrow,	Un-ke-ni-yen-kwi-reh	Un-kwa-yen-kwi-reh
	Your "	Se-ni- " " "	Se-wa- " " "
Male,	Their "	Ra-o-di- " " "	Male, Ra-o-di " " "
Female or neuter	Their "	A-o-di- " " "	Female or neuter. A-o-di " " "

Here we have a slight change in the first person singular, by the coalescing of the last syllable of the pronominal with the first of the substantive element, and instead of having *Ah-kwa-yen-kwi-reh*, as we should, we get *Ah-kyen-kwi-reh*. We also have a change in the dual, and in all probability, this form of the dual is the primary, as far as the two given are concerned, and the more correct form. I think we shall find hereafter, in various forms of the verb, that the *ni*, in the first and second persons and *di* in the third person, are the proper dual element, which we may hereafter be able to trace to *De-ke-nih*—two.

The following are the possessive forms for the remaining three words:—

	Tommahawk.	*Knife.*	*Shoe.*
My	Ah-kwa-do-kenh,	Ah-kwa-sa-reh,	Ah-kwah-dah.
Thy	Sa- " "	Sa- " "	Sah- "
His	Ra-o- " "	Ra-o- " "	Ra-oh- "
Her	Ah-ko- " "	Ah-ko- " "	Ah-koh "
Hers or its	A-o- " "	A-o- " "	A-oh "

The formation of the dual and plural follow thoughout, the same rule as the first example given.

It will be seen that in the 3rd person plural there is a variation from the English in there being a distinction made in the Mohawk with regard to the gender of the possessor, when such possessor is of the human species. That arises from their being two forms—a masculine and a feminine—for the pronoun *their*. When in speaking of

both genders, as a boy or girl, in the expression—"their book," we would use the masculine form. There is no distinction beween the nominative and accusative forms. Reference has already been made to a masculine, feminine and neuter gender.

We shall find that the masculine and feminine are confined entirely to mankind, and that the initial R seems to be in some way connected, as already mentioned, with the masculine, while with the feminine K and Y are used, *e.g.*

R-on-kwe—man.	*Y*on-kwe—woman.
*R*ih-yen-ah—my son.	*K*he-yen-ah—my daughter.
*R*ax-ah—boy.	*K*ax-he—girl.

We have already pointed out the existence of two forms of the feminine, confined I believe to the singular. There is one form applied to those whom we esteem as to a mother, and there is a general form which, perhaps, may be more properly regarded as a *common gender*, as it is the form used when speaking of the beasts of the field, and applied without distinction of gender. This form is used when speaking in general terms of the female sex.

The common gender is confined entirely to the brute creation, where no masculine or feminine exists, as I stated in the formation of the possessive case, whenever we are speaking of both sexes as man and woman we use the masculine dual or plural form as the case may be.

There are in nouns, contrary to what we should expect from what we have seen of the pronouns, only two numbers, the singular and the plural, there being no dual.

The formation of the plural is quite simple and uniform, being effected in two ways, according as the word represents an animate or inanimate being. For the former we add to the singular the termination *o-konh*, *e.g.* Ya-ko-sa-tens = horse, Ya ko sa tens-*o-konh* = horses, On-kweh = mankind On kweh-*o-konh*. For the inanimates we add *o-kon-ah*, *e.g.*: ah-sa-reh, knife; ah-sa-reh-*o-kon-ah*, knives; ah-dah, shoe; ah-dah-*o-kon-ah*, shoes.

There are a few exceptions where the animate form is applied to inanimates, and we may be able, after a more extended observation, to point out the rules that govern these exceptions.

With this brief introduction I leave this subject for some future occasion, and shall close by translating one or two words whose signification may interest you.

The name *Oh-nya-ka-ra*, "on or at the neck," is applied to the whole stream of water between Lakes Erie and Ontario, and is derived from *O-nya-ra*, "neck" or *contraction* between head and trunk.

The Mohawks applied this name to the *neck-like* contraction between the two lakes, and hence we have *Niagara*.

In one of the excursions of the Mohawks they are reported to have found themselves in the Bay of Toronto. Casting their eyes, they saw as it were, in every direction, trees standing in the water, hence they called the place *Ka-ron-to*, "trees standing in the water," and from which, doubtless, you get your *Toronto*, while Ontario is supposed to be from *Ken-ta-ri-yoh*, "placid sheet of water."

ON THE COMPOSITION, STRUCTURE AND DEVELOPMENT OF BONE.

BY M. BARRETT, M.A., M.D.

It cannot fail, I trust, to prove interesting, at the present time, to collect and compare the several observations and experiments which have been made within the last few years upon the development and mode of growth of bony tissue. My especial purpose, however, in the following remarks, is to bring before the notice of the meeting some important experiments made within the last few years by Dr. Ollier, and which are fully recorded in the Journal de Physiologie for 1859, edited by Brown Séquard. I am persuaded that their important bearing on histology, and the kindred sciences, will ensure their due consideration. To most members of the medical profession these observations are already known, having reached them through the several journals specially devoted to medical science. No points of histological enquiry are at the present day unworthy of our most earnest attention, since it is only by carefully exploring the ground, which we seem or may be thought already to possess, that any real advance can be made in that science upon which rests the whole superstructure of physiology.

Before entering, however, more especially upon the consideration of

the subjects in view, it may not be amiss to give a very brief account of the general structure of bone, in order that every one may be enabled to form an opinion of the nature and importance of the observations and experiments about to be submitted.

Bone varies in density according to its situation and the purpose it has to fulfil, being, in some parts of the same bone, light and porous, whilst in other portions it is exceedingly compact and heavy: thus the diaphysis or shaft of a long bone is compact, while the extremities are light and porous. The specimens before you illustrate these extreme conditions existing in separate bones; the heavier is from the head of the Greenland whale, the other is a lumbar vertebra from the adult human subject. The contrast between the two is most striking. Although great diversity exists between bones, in respect to their density, yet there is a wonderful similarity of internal structure throughout the bones of mammalian animals. Dismissing, however, minor peculiarities, it will be well, for the purposes of description, to assume as a type of bony tissue, the shaft of the human femur of the adult.

We find the shaft of the bone to be invested by a membrane which, in some places, is more firmly adherent than in others. This membrane consists externally of white fibrous tissue, having a subjacent layer of cells, termed the periosteum. It sends numerous processes into the deep structure of the bone, affording sheaths to the capillary vessels and nerves, so that when torn from the bone, these lacerated processes give to the attached surface of the periosteum an appearance of roughness. The external surface of the periosteum gives attachment to the fibrous tendons of muscles which interlace with the fibres of the periosteum. Cutting through the fresh or living bone, at right angles to the direction of the axis of the shaft, we find a large central space called the medullary canal, and which is occupied by a fatty substance, the medulla or marrow. We observe, also, that the cut surface of a living bone bleeds from several pores, that is, from the mouths of the vessels contained within their respective canals. If the bone be submitted to the long continued action of fire, all the organic matter of the bone, consisting of fibrous tissue, blood, fat, &c., is burned away, the earthy matter alone remaining; the bone, however, still preserves its original shape, but has lost about 20 per cent. in weight, so that the earthy matter in the femur of the human adult constitutes about 80 per cent of the total weight of the bone.

A chemical examination of the inorganic residuum shows it to con-

sist of the triple phosphate of lime together with carbonate of lime, and a small quantity of phosphate and carbonate of magnesia.

But we may proceed to analyze the bone by another method. If we submit it to the prolonged action of dilute hydrochloric or nitric-acid, then all the earthy matter is set free from the organic matter, and still the bone retains its original form, but is now pliant. By this means we preserve the organic constituents of bone separated from the earthy matter.

The next step in our enquiry into the structure of bone must be by the aid of the microscope. A transverse, thin and transparent section shows it to be perforated by numerous canals, each of which gives passage to a blood vessel; around each of these canals, called Haversian, as from a centre, we witness a number of concentric lamellæ, the position of which is marked out especially by certain bodies or minute spaces, in shape somewhat like a melon seed, and known as lacunæ. Proceding from the margins or borders of these lacunæ, we notice a number of exceedingly fine waving lines, indicating the presence of minute canals, termed canaliculi.

If we make a thin section of the bone, parallel to its axis, we no longer see the mouths of these Haversian canals with their surrounding lamellæ; but we find the same canals running longitudinally, and the lacunæ presenting their longer axes. We observe also that these canals communicate freely with one another, or in other words frequently anastomise. We learn, from the presence of these numerous canals, that a free circulation exists in bone; that while the blood, as such, finds ready passage through the Haversian canals, the plasma of the blood, or the blood without its larger particles (the blood corpuscles) can be readily transmitted to the ultimate constituents of the bony substance; so that all and every particle of bone is so situated as to be able to receive nutrition from the sanguineous fluid, and also can remit into the general current certain portions of its waste.

If we make a transverse section of bone, reduce it by grinding to a transparent condition, and then, resting it upon a piece of platinum foil, subject it to a degree of heat sufficient to dissipate the organic matter; we may observe, by the aid of the microscope, that the lacunæ have been rendered very indistinct, and that the canaliculi have for the most part disappeared. If, on the other hand, we submit a transverse section of the same bone to the action of dilute acids, nitric or hydrochloric, we shall find, on examination, that the lacunæ

and canaliculi are still distinctly visible. In the former case we destroy the organic tissue of the bone, retaining only the earthy matter, while in the latter we have removed the earthy matter and preserved the organic only. This obliteration of the lacunæ and canaliculi, by the action of heat, is a proof that the lacunæ, with their canaliculi, are lined with an organic membrane, in other words that an organized tissue permeates the deepest portions of the bone.

Thus the supply of blood to the bone is furnished by means of the periosteal capillaries. The marrow of the bone possesses a circulation independent of the periosteal vessels. We notice in the diaphysis or shaft, a foramen which gives passage to an artery, this artery, on reaching the medullary canal, divides into two branches, one to supply the upper, and the other the lower portions of the medulla. The foramen or aperture is usually styled the nutritious foramen of the bone, a misnomer, as you perceive, since the vessel to which it gives passage is not destined to supply the bony tissue, but simply the contents of the medullary canal.

Let us now proceed to the special consideration of the periosteum; before doing so, however, it may be well to mention that, in reference to the structure and purpose of this tissue, much difference of opinion exists. Todd & Bowman, in their work on Physiological Anatomy, a deservedly received text-book with the medical profession, say: "Perhaps few questions have more divided the minds of physiologists than that regarding the share taken by the periosteum in the growth and regeneration of bone." Dr. Sharpey was probably the first to advance the opinion that (Carpenter's Principles of Human Physiology, p. 279, 1853, American Edition,) "bone continues to increase in diameter, by the formation of new layers upon its exterior, and that these layers are formed, not, as usually stated) in a cartilaginous matrix, but in the substance of a membrane that intervenes between the proper periosteum and the surface of the bone, consisting of fibres and granular cells."

The following experiments fully establish this idea of Sharpey's, they were conducted by Dr. Ollier during the year 1858, and may be found recorded in the January number for 1859 of the Journal de Physiologie, edited by Brown Séquard.

The idea was generally entertained, previous to the observations of Sharpey, that bone always originated in a cartilaginous matrix, and that cartilage of necessity preceded the formation of bone. Now it

is well known that bone may be developed from fibrous tissue, a familiar instance of this fact is witnessed in the case of the long tendons of the foot of many birds, which, although consisting of white fibrous tissue in the young bird, become converted into true bone in the aged. Again, the bones constituting the vault of the human skull are not developed through the medium of a cartilaginous matrix, but have their origin in a fibrous membrane. I do not wish to adduce instances of bony formations dependent upon pathological changes; these, although very numerous and striking, only testify that such changes may take place in tissues consequent upon irritation and disease; it is the physiological or healthy function of tissues which now engages our attention, and not the abnormal change these tissues may undergo consequent upon some morbid condition.

Experiments have been made in reference to this subject upon rabbits of various ages and under different sanitary conditions, and, as we might expect, the most satisfactory results have been obtained when the animal operated upon was young and placed under circumstances favorable to health. The question for solution is, what is the function of the periosteum in reference to the generation of bone, and is it the formative organ. The following experiments afford a satisfactory solution to the question: a portion of periosteum was detached from the tibia of a living rabbit, one end remaining adherent to the bone, the other end being securely attached by means of ligature to the internal surface of the skin; the wound being closed, union of the divided integument was speedily accomplished. Three or four days after the operation the periosteum became perceptible to the touch, had increased in size and firmness, becoming daily more and more distinct; seven weeks after the operation, having killed the animal, the detached portion of periosteum was found to have developed a piece of bone—in form corresponding to the position in which the periosteum had been placed—that is to say, somewhat circular. When a precisely similar operation was performed upon an old rabbit, (five years old) no such results were obtained; but, on the other hand the wound suppurated, a serous pus or rather a pus resembling tubercular matter was effused, without the slightest discoverable attempt towards the formation of bone. We may therefore infer that the osteo-genetic power diminishes with age—and also that any form may be given to the bone by simply placing the detached periosteum in the position we desire the future bone to assume.

In another experiment the rabbit operated upon was eight months old, the periosteum was detached as in the former experiment, but was coiled around the bone, and its detached extremity kept in position by means of a ligature. Four days after the operation the wound was re-opened and that portion of the periosteum which had been left attached to the bone was now severed from it. At the end of twenty-three days, the periosteum had become wholly converted into bony matter.

In a subsequent experiment a portion of periosteum from the tibia was dissected off, and placed beneath the skin of the back; thirteen days afterwards, complete ossification had taken place.

The bones thus obtained have all the characteristics of normal bone. Examined microscopically, they exhibit the lacunæ and canaliculi, and the Haversian canals are disposed in the direction of the axis of the bone.

These experiments prove to demonstration that cartilage is not absolutely necessary for the formation of bone, and are strongly corroborative of the opinion set forth by Sharpey, that the shaft of the bone increases in diameter by the direct ossification of the subperiosteal layer. An examination of this layer by the microscope reveals the presence of a blastema composed of cells and free nuclei, such as are to be met with in embryonic tissues, together with some exceedingly fine fibres.

When the periosteum is transplanted this subperiosteal layer is the germ whence bony tissue is developed.

In proof of this assertion it has been found experimentally that if the inner surface of a detached piece of periosteum be scraped with a scalpel and the sub-periosteal layer of nuclei, nucleated cells and accompanying fine fibres be thus removed, the osteogenetic power of the membrane is thereby wholly destroyed.

It may be asked whether bone thus developed continues to grow indefinitely. To be able to satisfactorily answer this question would require the experience of several years; but, reasoning from analogy, it may be presumed that these heterotopical bones would continue to increase in size so long as the normal osseous framework is augmenting in volume.

From a surgical point of view the importance of the knowledge obtained by means of these experiments is very great, and must have

an important bearing upon resections and rhinoplastic operations. It suffices, however, for our purpose to allude merely to this subject.

The periosteum, therefore, by virtue of its deep layer is most conclusively shown by these experiments to generate bone, and it is by virtue of this property that bone normally increases in diameter; its increase in length being provided for by means to which we shall presently refer.

Paul Broca speaking of these experiments says, "Ollier, with great ingenuity, has revived a subject, in regard to which it was thought that nothing remained to be discovered, and it has yielded a rich harvest of entirely new facts; the discoveries which he has made with reference to the functions of the periosteum, may be numbered among the most important of our age. The idea of transplanting portions of this membrane, of burying them in the midst of the fleshy tissues, of grafting them in positions distant from the skeleton, of transferring them even from one animal to another,—this idea is peculiarly his own, and, thanks to him, we now know that the periosteum does not require, for the production of bone, to be in contact with osseous tissue. This membrane carries with it wherever it may be placed among living tissues its special osteoplastic power, its inherent property. The fact had long been suspected, yet not positively known, and to Ollier belongs the merit of having demonstrated the truth in a manner both rigorous and striking."

We conclude that the periosteum is composed of two essentially distinct portions having wholly different properties—that the external or fibrous layer is the medium of connection between the tendons of muscles and the bony levers to which these muscles give motion, and moreover, serves as a basis of support for the capillary bloodvessels which go to the nutrition of the bony tissue; that immediately beneath this fibrous envelope there exists a cellular layer having osteogenetic or bone producing power; that this layer may be transplanted to a distance from its original site, and while among the living tissues of the animal is capable of producing perfect bony tissue, that is possessed of Haversian canals, lacunæ and their accompanying canaliculi; and that it is by virtue of this layer that bone increases in diameter. It is also manifest that a continuation of this periosteum is to be met with in the densest structure of bone lining these canals lacunæ and canaliculi; for, as heretofore remarked, if we submit a thin section of bone to the prolonged action of heat, all trace of the

acunæ and canaliculi disappears, due to the fact that the organic matter lining these lacunæ and canaliculi has been dissipated by the heat to which the section of bone has been subjected; while, on the other hand, if a similar section of bone be submitted to the continued action of an acid, which shall dissolve the earthy matter of the bone, we find upon microscopical examination that the lacunæ and canaliculi are still plainly visible, the organic matter which lined these spaces not having been dissolved by the acid. In the long bone of an adult, such as this femur, there exist a large central canal containing a substance called marrow. It has been universally held up to the present time that this canal is lined by a membrane continuous (by means of processes traversing the substance of the bone) with the external periosteum, this membrane is said also to be fibrous or of precisely the same character as the external membrane, and by way of distinction it is spoken of as the endosteum and sometimes as the medullary membrane. Ollier, however, has called attention to the fact that the very existence of this membrane is due solely to an effort of the imagination, that in fact no such membrane exists. So startling a statement on the part of Ollier, one so contrary to all that we had hitherto learned from what were deemed reliable sources, Duhamel, Troja, Flourens, Carpenter, Todd and Bowman, of necessity required verification or negation. I have made such enquiry and now submit to you a fresh bone from the ox, in which it is manifest that no endosteum or medullary membrane can be shown to exist. It is as important to remove error as to set forth truth, the former is usually the more difficult task, and no doubt our text books will continue for many years to speak of the endosteum, its nervous supply, &c., &c.

The marrow or medulla of the shaft or diaphysis is found therefore in this medullary canal unsupported by any investing membrane, but frequently preserving the form of the canal in which it lies as in a mould.

Marrow consists essentially of cells and nuclei. with blood vessels and a few fibres of areolar tissue, together with fat in variable quantity. Marrow varies in appearance and structure according to the age of the individual, being red in early life, and whitish or pale in the adult. In old age the marrow consists largely of fat. It varies in quantity in an inverse ratio to the thickness of the surrounding bone, and takes the place of the osseous tissue removed by absorption.

It may therefore be looked upon as the last stage in the process of bony development. Bones at the earliest period of ossification have no medullary canal; but, as condensation of the osseous tissue takes place, so the medullary canal becomes apparent. Marrow is thus a secondary product in the evolution of osseous tissue.

The account given of marrow by the authors f works upon physiology is generally exceedingly brief and sometimes altogether wanting.

By Havers it was held that marrow serves to preserve the temperature of bones—that it lubricates the articular extremities, &c., &c.; of late, however, some have maintained that it possesses osteogenetic power; but the glance we have given to its anatomy favours no such idea, and numerous experiments fully establish the fact that marrow does not develop bone unless under peculiar pathological conditions, and even then the ossific matter is due either to the fibrous element of the areolar tissue which enters to a very limited extent into its composition, or is derived by a process of growth from the bony walls of the medullary canal.

The bones of birds have their canals filled with air, in order to diminish the weight of the body, and in other animals these same canals are filled with a substance whose specific gravity is less than that of any other organized tissue. When, for the purpose of experiment, we fracture the long bone of a bird, marrow is formed in its interior, subsequently osseous union by growth, from the internal surface of the bone, takes place, and after a time absorption of the medulla above the point of fracture, finally, after a prolonged period absorption of the medulla below the seat of fracture, and the bone is thus restored to its original condition.

Having thus learnt that the increase of the diameter of a long bone is dependent upon the osteogenetic power of the sub-periosteal layer, we have now to enquire by what means a bone increases in length. It might be supposed that this could be effected by interstitial growth, but further experiments prove conclusively that bone increases in length by addition to its extremities, and that the shaft or diaphysis once ossified increases in diameter only, without any corresponding growth in the direction of the axis.

Before entering upon the consideration of this portion of our subject, permit me to give a very general account of cartilage. Cartilage or gristle is the term applied to two structures which, in composition, are

very widely different, and it is to be regretted that distinctive names should not have been assigned to each. The simplest form of cartilage, spoken of as permanent cartilage, is met with in the external ear, the nose and the eyelids, &c. It is remarkable for flexibility and preservation of form. This property of permanent cartilage admirably adapts it for maintaining the identity of the features of the individual throughout life. In ultimate structure it is one of the most simple of the living tissues. A slight modification of this form of cartilage is applied to the investment of the extremities of the long bones, and also for the covering of those portions of bones which, in other situations than the joints, are subject to attrition, thus the tendons of many muscles play in bony grooves, such grooves being lined with this form of articular cartilage. These forms of cartilage are spoken of as permanent cartilage and are not prone to ossify, their ossification when it does take place being due to pathological change, and not to the development of a physiological property. But, under the name of temporary cartilage, we have to make ourselves acquainted with a tissue whose intimate structure is widely different from that of which we have just spoken, and whose physiological function is to serve as a nidus for the development of bone. It differs from permanent cartilage, inasmuch as the cells which enter into its composition are not irregularly dispersed through the surrounding fibrous tissue, but are so disposed as to assume a linear direction, corresponding with the axis of the bone undergoing development. Moreover, the fibres constituting the fibrous tissue have a similar direction. We have already seen, that white fibrous tissue is especially prone to ossification, as exemplified in the case of the tendons of the legs of many birds. The fibrous tissue of the cartilage is the especial seat of ossification, the cells leaving interspaces constituting the cancellated structure of bone.

The axial extremities of bones being covered with cartilage, and the fibrous element of this cartilage being the seat of the osteogenetic power, it is manifest that the increase in the length of a bone is effected by addition to its extremities.

Another question, however, arises as to whether a long bone increases in length equally at both extremities. John Hunter, Duhamel and Flourens, had previously made numerous experiments in reference to this subject; more lately Ollier has devoted himself to the enquiry. Without entering into all the details of his experiments, made upon rabbits, it will suffice to say that in the case of the humerus

the increased length was almost wholly in favour of the superior extremity, being in the ratio of seven to one. As regards the radius and ulna, the very reverse was found to be the case: the bones had increased in length 10 millimetres at the superior extremity, and 27 millimetres in the direction of the carpal articulation. In the case of the bones of the lower limbs, the increase in length of the femur was observed to have taken place principally at the lower extremity; thus the latter had gained 17 millimetres, while the superior had gained but 6 millimetres. An inverse condition was found also to exist in regard to the tibia; the inferior extremity being less augmented than the superior.

These facts are of great practical importance from a surgical point of view, leading us to infer that resection of the head of the humerus, in the case of a growing child, will be attended with a considerable arrest of development and consequent shortening of the limb, and that a similar result will follow from the resection of the inferior extremities of the radius and ulna. As regards the bones of the lower limb, the contrary rule would hold good.

THEODORE II. AND THE NEW EMPIRE OF ABYSSINIA.

(*Translated from the Revue des deux Mondes, Nov.*, 1864.)

(*Continued from page* 156.)

About this time an English missionary arrived at the court of Theodore, and his name has a great notoriety in a certain religious circle. This was the Rev. Mr. Stern known by a famous voyage in Yamen, and by an excellent work on Abyssinia: "A Mission amongst the Falashes" The Emperor received him coldly at first, and said: "I am tired of your bibles!" He obtained permission to return to Ma-sanna, and he committed the imprudence of not availing himself of it at once, so that on his presenting a second demand in Oct., 1863, the Negus said severely: "You have gravely offended me in not using the permission I gave you. As you are a stranger, I pardon you; but those of my subjects who could and ought to have enlightened you will be punished." The two confidential servants of Mr. Stern were beaten so cruelly that one died the next night, and the other some days afterwards. Mr. Stern had been necessarily a silent witness of

this savage scene, and had involuntarily bitten the thumb of his irritated hand. This gesture signifies anger in the mimicry of the Abyssinians. Theodore saw it and was so little affected by it that when Mr. Stern returned home he sent him, as usual, his supper from the imperial table, but the courtiers did not allow the missionary to escape so easily; they demanded the punishment of the audacious stranger who had threatened his majesty, after having first alleged that Mr. Stern meant nothing by his gesture, yielding probably to the false shame of appearing to shrink from ill treating an English subject. Mr. Stern was summoned, brutally laid flat upon his face, and beaten less severely than his unhappy servants, indeed, but to such a degree that he was confined to his bed for a long time. A domiciliary visit, paid, in consequence of these deeds, to the houses of the English Bible Societies, led to the discovery of many letters and notes, written in German and in English, and relating to the late events in Abyssinia. Theodore had them translated; and these notes, written, without any object, by people desirous of preserving a remembrance of what had happened before their eyes, provoked him to a terrible rage.

He arrested three of the most prominent of the accused: the soldiers, not knowing them, deemed it proper to put in irons all of the Europeans connected with the missions of Djenda and Darna, amongst whom were two young women, Mmes. Flad and Rosenthal. The Negus questioned the former alone, hoping to obtain from her a confession by intimidation. She answered him simply "that it was the custom of the Franks to take notice of everything which interested them in their travels." Not being able to derive any further information, Theodore released the two ladies and M. Flad, and, to give the appearance of impartiality, he assembled at Gondar, as in a kind of superior court, all the Europeans in Abyssinia. MM. Stern and Rosenthal were cited before it as the greatest discoveries had been made at their houses. The points of accusation were read, and the Negus demanded of the jurymen what punishment the laws of Europe inflicted on men who spoke thus of the sovereign. "Death, answered the president of this commission, without hesitation; but we invoke the clemency of your majesty in favour of strangers who are guilty more by misunderstanding than by intention." This apparent abandonment of the accused was in the opinion of those who were acquainted with the Negus, much more skilful than a speech, which would only have irritated him, and have ruined at the same time the accused, the lawyers and the judges. "I will be merciful," said Theodore, "I commute the punishment which you have pronounced to that of irons for MM. Stern and Rosenthal." Turning to the latter, he said: "How have you been so rash as to judge a prince you do not know and facts which you have learned only by hearsay?" This was logical; but M. Rosenthal might have objected that there was only crime where there was publicity. "You are ignorant perhaps," added the Negus, "that the law of the empire offers you a recourse of which I would like to see you take advantage like a courageous man. You have the right to say of me whatever evil you please, provided you are ready to maintain your words, on horseback with your sword in hand, against one of my champions." We may easily imagine how this proposition was received by M. Rosenthal, who had never handled anything but the spiritual arms of theology.

What had most deeply wounded Theodore II., in the papers that were seized, was not the recital of the useless barbarities committed during two years, but the fact,—public, however, and known by the Abyssinians—that he was the son of a merchant of *Konsso*. "Who has revealed it to these strangers?" he asked with feigned simplicity, "Doubtless some person of Gondar, a city of priests, who do not love me. On to Gondar!" He laid upon the unfortunate city, already exhausted by the three months sojourn of the army, an enormous tax which was immediately paid. Next day he demanded twice as much, and as the inhabitants could not comply with the request sufficiently soon, he sent his troops against the town, with orders to *eat* it, that is, to pillage it at pleasure. Nothing was respected, not even the churches; the old capital of the Neguses was reduced so as to envy the most wretched villages. The Mussulman quarter, Islambiet, the centre of the commerce of Upper Abyssinia, and as yet free from all the revolutions, was sacked and almost destroyed, some time after, an arbitrary act, the cause of which has not yet been well explained, added to the sorrow of the Europeans who were residing in Abyssinia. The English consul, Mr. Cameron, was put in irons. This violation of the right of nations, has given rise to more or less romantic versions which the journals of Europe have received and which show in some degree the talkative and jesting spirit of Alexandria, where they had their source.

The most reasonable explanation is this. Mr. Cameron, on leaving Abyssinia in Nov. 1863, had taken with him an agent which the Negus had attached to him, undoubtedly as a spy. The consul had dismissed him after crossing the frontiers, and this act had deeply offended Theodore. Moreover, he made a long excursion into the cotton districts of Sennâo and Gallabat, in order to study them with a view to the political and commercial interests of England. Theodore II., who did not understand that a diplomatic agent could be interested in commercial matters, supposed that Mr. Cameron had gone to make arrangements with his mortal enemies the Egyptians, and assailed him in consequence. Lastly, he had been offended at receiving from the *foreign office*, a letter signed by Lord Russell and not by the Queen herself, "I wrote to Victoria," he said humourously, "and not to this Mr. Russell, whom I do not know." This was probably only a pretext, for in January he had received with joy a letter from the French government, signed by M. Thouvenel; it is true that in delivering this letter to Theodore II. I had hastened to declare that M. Thouvenel was the *afa-Negus*, (1 Literally, *mouth of the Emperor*, orator of the crown. It was formerly the first office of the court. Theodore II. suppressed it as being a sinecure) of Napoleon III. However it may be, Mr. Cameron was enchained, shut up, and guarded night and day in a tent near the quarter-general on the banks of the river Kaha. It does not appear that during the last ten months this frightful situation has had an end. His servants and his clerks have shared his fate. Among them was a young Irishman, 18 years old, who, after having led for some months a perilous life, hunting elephants in Nubia, had been seized with an irresistible desire of seeing Abyssinia and its sovereign, knowing that the Negus loved scenes of war and of the chase, he brought as a present for him a very fine carpet on which was represented the well known scene of the Spahi Jules Jenard chasing the lion; he

had shewn it to me at Adona with satisfaction, and expected wonders from it. He arrived just at the time Mr. Cameron was arrested, but was not any less well received. The hunter presented his carpet. "How impertinent these English are!" said Theodore to his officers. "Here is one who foretells by a picture that the Turks will slay me! Do you not see this man with a *tarbouch* (1) this Turk who fires at a lion? Who is the lion of Ethiopia, if it be not I? While the Turks kill me, put this Englishman in irons!" The poor youth asked with surprise: "What have I done?" "You have done nothing," said the Negus who was softened; "but as I have put your consul in chains, you cannot love me, *and he who does not love me must not be free.*" Two months afterwards, Mr. Cameron received another companion; it was the favorite, he, having been absent at the time of the arrest, had yielded to a good feeling by going the next morning to the audience of the Negus and asking him, in the name of his honour as a civilized sovereign, to set Mr. Cameron and his friends at liberty. Unfortunately he spoke the Amharic language very badly, and it appears that in his confusion he substituted a word of command for a term of advice or prayer. "Do you hear this *ass*," said Theodore, "who pretends to dictate to me his orders? since he has so much interest in the consul, chain him with him!"

While the relations of the Negus with the Europeans were becoming more and more delicate, the condition of the empire continually grew worse. The senseless and numberless acts of severity on the part of Theodore produced of necessity anarchy and rebellion. Motionless at Gondar, the Abyssinian emperor saw increasing around him insurrections the extent of which threatened to crush him. In Tigré was Kassa Goldja, the son of that Goldja whom the people of Adona had killed in 1860, as we have already mentioned.

He had no political standard, but a *vendetta* to execute upon the people of Adona, to avenge the death of his father, which is a sacred obligation in the East; he held the country from Takagge to Mareb, and had attempted a bold attack on Adona. He had been beaten, but the inhabitants had lost in the action two of their chief generals; a son of the English Coffin, an ancient prince of Antitcho and Koleb, the goldsmith of the crown, and the richest citizen of Adona. Goldja remained strong enough to disturb all Lower Tigré until the end of 1863. Of more importance was the rebel chief of Kolla-Voggara, Terso Gobhesié, whose bands infested the country within two halting places of Gondar. Terso received as soldiers only those who proved, by showing their hands torn with stones and thorns, that they were men to suffer want and continue to the last extremity the life of insurgents, under the ban of the law, and tracked to the depths of ravines and caves. The merchants, however, praised loudly the generosity of Terso, and his conduct towards the caravans which contrasted with the arbitrary seizures of the emperor Theodore. "The Negus is very strong this chief used to say, and perhaps God reserves victory for him; if that happens and if we must perish let us leave, at least, the name of honest men, free from every theft." Thus he rose rapidly in public opinion whilst the popularity of the Negus hourly waned. This unpopularity, which he felt very much, rendered him still more harsh and violent.

(1) Gerard the hunter was in the uniform of a *Spahi* and had his head covered with a *turban*.

A woman came to complain of excesses committed by the soldiers; he told her with ironical abruptness: "I care nothing for such trifles, you had better complain to God." "He is too far away to hear me," replied the woman, "he is at Godjam," that is to say with the rebel Tedla Gualu. This man had shaken off since the campaign of Feb. 1863, the involuntary terror with which the Negus had inspired him until then, and sent to him ironical and provoking messages which exasperated him to frenzy. From this violent and tragical condition originated a measure foreseen long before, and one of the most deplorable of the reign. By a decree of April, 1864, Theodore II. proscribed Islamism throughout the whole extent of his empire, and declared all the Mussulmans rebels who did not apostatize by eating meats called impure by the Koran. This measure was so much in accordance with Theodore's policy that we are surprised at its not being passed before. Yet this act, even laying aside the question of toleration, was extremely impolitic and unjust. The Mussulmans in Abyssinia occupied the same inferior condition as the Christians of the East do in the Mussulmanish states. Strangers for centuries to the use of arms, they had taken no share in the troubles of the empire, and were satisfied to enrich themselves by commerce which they had partly monopolized. Therefore, almost all the towns of Abyssinia were Mussulmanish, either wholly as Derita, Empras, Haussa, or partially as Gondar or Mahdeva-Mairam. The private character of the Mussulmans was in general superior to that of the Christian population. They could be reproached only with the trade of slaves, which is perhaps the basis of Islamism. If the Negus had the right of punishing those convicted of trading in slaves, he had not that of proscribing entirely a religion. Besides, by his injurious repeal of the laws against this trade, he had shown himself the first upholder of this social crime.

However this may be, the decree met with no armed resistance anywhere, as the Mussulmans did not think for a moment of the possibility of such a struggle. The greater part submitted as at Gondar; others (the people of Derita for example) left their homes and their little fortunes painfully gained, and took refuge in the woods. I knew at Massaona a good Mussulman of Gondar, called Adem-Kourman, whom I saw last July a prey to sorrow which was explained to me. He had left at Gondar considerable property and a very pretty wife whom he loved very much. Theodore, seeing that he persisted in not returning to Abyssinia, found amusement in punishing this exile by confiscating his property and seizing his wife. What seemed to grieve the unhappy Kourman was, not that his wife had passed into the hands of the emperor, but that he had converted and baptized her.

III.

The events which I have just related have sufficiently shown the character of Theodore, so that at the end of this history I need not dwell long upon his physical and moral character. The man on whose head rests to-day the fate of Abyssinia is 46 years old. He is of medium size, has an imposing carriage, with an open and sympathetic countenance. His features, less regular than those of most Abyssinias, are expressive and moving, and have nothing of that borrowed

dignity which marks some oriental faces with the stamp of solemn insignificance His look is lively and piercing; the fixed lines of the profile express well the firm will which has subjected to his yoke the freest and the least docile people of the East. Rigorous towards others in point of etiquette, the Negus violates it in his dress, and affects an air of negligence which, however, never amounts to bad taste. The simple cloak of a soldier, a pair of trowsers and a sash in which are his pistols and an English sabre, and over all a *chama* or embroidered toga form his usual attire. Europeans, on being presented to him, show sometimes hesitation in distinguishing him in the crowd of silk doublets (*halakamis*) which surround him, and commit mistakes which amuse him very much. This disdain for all luxurious studied elegance rules all his acts: the furniture of his tent is of the most simple character, while his residences at Magdola and Devra-Tabor are filled with silks and the cloths of France and India. Engaged in a campaign, he carries the black and coarse shield of the foot soldier, while a page bears at his side the state shield, which is covered with blue velvet and strewed with imperial fleurs-de-lis.

What strikes one most in Theodore, is a happy union of suppleness and force, especially the latter. Naturally haughty, violent, and addicted to pleasure, he rules his passions in this respect, that they never cause him to go beyond the bounds he has formed. He has been unjustly charged with drunkenness, and I have received on this point information which I had reason to believe more true. He is temperate, eats little, and never drinks to an excess, still less to a brutal state of intoxication, more worthy of a Jolof or Mandingo king than of a sovereign of Christian Abyssinia. As for women they have never had the least influence over his public life. I except, however, his first wife, the good and regretted Tzoobedji, for whom he had a sort of worship. She was, besides, the faithful companion of his days of suffering, and when he lost her, seven or eight years ago, he saw in this death a punishment which heaven inflicted on him for having burnt a woman alive at Godjam. Tzoobedji had kept him in the simple life and in the pious customs of an Abyssinian of ancient times, and when she died, he lived 18 months in the most strict continence.

An ambitious marriage has been the indirect cause of the disorders which have since arisen. To settle the claims of the house of Oubie, he married, about six years ago, the daughter of Oubie, the young and beautiful Toroneche, who had, throughout all Abyssinia, the name of an accomplished princess. Witty, educated, and charming, she had scarcely any defect, but an obstinate pride, which is a failing common enough among the Abyssinians of a certain rank. For two or three years the most perfect concord prevailed in their home. Theodore had for his charming companion a tenderness mingled with a large amount of pride, and when she presented him with a son, he assembled all the grandees in a theatrical fête, where he showed them the new-born, and said: "Here is he who will rule over you!" It is doubtful whether the persons present took this remark in earnest, against which the elder sons of the Negus might justly have protested. One day at the feast of Easter, the princess asked her husband for the pardon of some chiefs of Tigré, who had been kept in irons for their attachment to Oubié. This proper request excited the suspicions of the Negus to the highest pitch.

"Do you say," he replied, "that you prefer your father to me?" "Perhaps so," answered the proud princess. She had scarcely spoken when she received a violent blow upon her cheek. Bell, who wished to interfere, received another. Oubie, who, since the marriage, had regained favour, was put in irons, and has not yet recovered his liberty. Moreover the Negus, to sting his wife to the quick, took immediately four favorites from the lowest ranks. This first freak having passed, he dismissed them all, except one, a woman of Jedjo-Gallas, who has none of the physical or moral charms of Toroueche, but who skilfully retains her capricious lover by many cares and attentions which the haughty Toroneche was so imprudent as to despise. What shows clearly the debasement of the national character is, that the people who surrounded the Negus have sided with him in this scandalous act. The church alone protests by the voice of some bold priests. At Easter, Theodore II., obliged, for the sake of decorum, to receive the sacrament, obtains absolution only on condition of changing his conduct. He then goes and seès the *iteghe*, who still has some influence over him, for he is proud, in spite of his faithlessness, of being the husband of a woman so much admired. He passes an hour listening to the most biting and harsh truths, and if sometimes he becomes angry and threatens, the iteghe coolly reminds him that a negus has never killed his wife, and that she is well assured that he will not begin.

Theodore then returned somewhat ashamed to his little court, makes a public confession, declares "that he is the most scandalous sinner in Ethiopia, that he is so in spite of himself, that it is a victory of the demon, a victory which should make us all feel our weakness and our nothingness." Finally he promises that he will try to do better, and dismiss the favorite. Easter over, he retakes her, and adds sometimes another.

In these faults, everything with the Negus is destined for effect. He is theatrical, *fakerco*, as the Abyssians say; the shade of meaning is rendered in the great Latin comedy by *gloriosus*. No one has more than he the attitude, the gesture, the voice of royalty which commands; he presides admirably over an assembly, and his eloquence, lively and colored, rarely fails in its object. With an assumed contempt for literary men, whom he calls *azmari* (stage players), he is himself one of the first order; he has cultivated very much the Amharic, the common language of Abyssinia (1), and competent judges have assured me that his letters are models in this language. He likes to write; his letters, of a mystical form and often obscure, are master-pieces of African diplomacy. In them it is very necessary, as it is said, to read between the lines.

The name of Cromwell has often occurred to my mind when hearing the Negus speak or when reading his letters. He recalls the famous protector by the theological pathos in which he envelopes the inspirations of his mysterious policy. He evidently retains, without his knowledge, the impressions of his early scholastic and monachal education. With him, the theologian has dictated to the sovereign impolitic acts and useless deeds of severity, as the affair of Azago at the beginning of his reign. I have said that Azago was a little town of theological merchants, who held upon the nature of Christ a very subtle opinion slightly

(1) The language of books is especially the *ghiz*, a dead one which the clergy and lawyers speak and write. It is the Latin of Abyssinia.

affected with heterodoxy. The upper commerce of Gondar belonged to this sect, whose ideas, little dangerous to the state, offended the Negus. He assembled at Gondar a council, over which he presided, and where the dissenters argued warmly against the ignorant *Aborina* and his orthodox courtiers. Theodore resumed the discussion, and asked the people of Azago: "Do you recognize the *Aborina*, yes or no, as your regularly appointed head?" "Yes," answered they without hesitation. "In that case, my children," replied the Negus, "you are seditious persons if you think otherwise than the *Aborina*, the regular head of the church, and I, the temporal protector of the same church. Go, therefore, and abjure your error, or else the executioner will cut off your heads on this very spot." In fact, the executioner of the state was there, armed with his heavy sword. The dissidents, out of countenance, observed that some time was requisite for such an action, and requested three days for reflection. Theodore granted them, dismissed the assembly, and had them confined in the council chamber without provisions and without water. I have not heard that any one of them waited until the evening of the second day to abjure. It is said, and I easily believe that they abjured only with their lips. There is in the mountains near Gondar a half savage race, but timid and inoffensive, the last remains of a population which probably preceded the present Abyssinians in the possession of the soil. The Kamantes, (this is the name of the tribe) practice, under the shelter of their forests, a mysterious paganism, and have no other employment but that of supplying the capital with the needful amount of firewood. Theodore thought once of having them baptised by force and en masse; but a courtier, to whom he communicated this idea, judiciously observed to him: "that whenever the Kamantes became Christians, they would be the equals of the other Abyssinians, and would disdain to bring any longer their fagots to the city, so that Gondar would be no longer inhabitable" This worldly prudence saved these poor people from an unprovoked persecution. About three years ago, the French government demanded, by the voice of its Consul, the free preaching of the Roman Catholic religion in his empire. Theodore answered by a curious letter, the meaning of which is as follows: "It is truly scandalous for Christianity that it should be divided into five or six hostile communities, whilst Islamism presents a well disciplined body. Why should not an ecumenical council be held to draw up a doctrine which all the Christian world should be bound to adopt? The pontiffs holding the five equal patriarchates of Christianity, Alexandria, Antioch, Rome, Constantinople and Jerusalem, would settle without dispute the question of knowing whether the church ought to have a head, and if this head should be at Rome or somewhere else. I am ready to submit to the decrees of such a council; but until it is convoked, I will remain in my ancient faith, which is that of my fathers, and I will not allow any other to be preached, for there ought not to be two religions in a well governed state" Faithful to this programme, Theodore permits no attack against the official church, whether it comes from the Protestants or from the Catholics. While showing his obedience to the national church, Theodore considers himself bound in no respects to a clergy whose influence hinders his policy, and whose head, *Aborina* Salama, is an incorrigible and notorious conspirator. Salama, during the six first years of his pontificate, treated the Abyssinian princes with

the arrogance of an upstart who feels himself supported by the masses. It was reported to him one day that the *itegh*é Menena, in a humorous moment, had called him a slave, in allusion to the sum paid to the patriarch of Alexandria for his nomination. "Yes," said Salama, "I am a slave, but a valuable slave, since I paid 7,000 talaris. If the *itegh*é were exposed for sale in the market of Metamma she would not bring 12 talaris." With Theodore affairs took a different turn very quickly, as the following anecdote proves which has too much of the Abyssinian character for me to substitute my recital for that of the narrator, a simple *bacha* (captain) of the guard.

One Sunday morning I was summoned to the presence of the Negus, about six o'clock. I went trembling, for it was a bad sign to be called to him so early. His majesty said to me: "Bacha George, go and find the *Aborina*; call him an ass, call him a dog. Go!" I bent my head to the ground, and replied: "Sire, I am ready to obey; but deign to consider that I am merely a captain, and that your sacred words will have more power through the mouth of a *ras* (1) (colonel).

"You are right," said the Negus gracefully to me, and he summoned the colonel on duty. I know Salama, and I do not doubt that he answered with a strange, deep tone to this message. Such a state of affairs could not but have a bad issue for one of these two cunning, circumspect, and irreconcileable enemies. Not three years go the *aborina* was confined some time at Magdala, and the strictness of his imprisonment has only been partially concealed by the outward attentions which are bestowed upon him. The Negus is an educated man in an Abyssinian point of view, that is to say, he is versed in national history and theology, while he is very well acquainted with the contemporary state of Europe. He appears to esteem our civilization very highly in the material point of view, whilst in the moral he placed it low enough. These prejudices will be easily explained when we consider that five-sixths of the Europeans whom the love of travelling or the desire of making their fortunes, attracted into Abyssinia, have left behind them remembrances little calculated to cause the name of Frank to be either loved or honored. The trouble of Tigre, by rendering the name of Abyssinia more familiar to our ears, had drawn into this country a large number of adventurers, engineers, founders, drill officers, with problematical certificates. I knew one who, having made large advances of guns to Negousié, had the audacity, after the death of the pretender, to go and present to the victor the account of the manufacturing expenses. Theodore laughingly gave 1000 talaris to this man and sent him away. Now such an action would have very different consequences. It is not astonishing that, with such ideas, the Negus should be little inclined to favour the temporary emigration of his subjects either to Europe, or to the Mussulmanish countries. He finds it advantageous to strengthen among his people the proud idea that Abyssinia is the centre and the jewel of the earth, but he knows perfectly well where to stop. If he does not dare to prevent the faithful Amharas from making the pilgrimage to Jerusalem, he does what he can to bring it into disfavour, and when they return he likes to question them publicly upon the beauties of the Holy Land, as compared with Abyssinia. The pilgrims quickly declare that the land of Israel is arid, bare, naked, and accursed, with a large

(1) *Ras*, a civil title, means constable, and in the military hierarchy is translated colonel.

marsh, salt and leady, and a river in comparison with which the Takazze would be a sea. Theodore then turns to the audience: "If it be so," says he, "with the Holy Land, with the soil which God himself chose for his people, what must be the other countries of the west? Let us thank God, my friends, for being born in this terrestrial paradise called Abyssinia

The personal courage of the negus has never been called in question; he is only too ready to expose himself in a battle, and in one of those brilliant duels where his superiority as a soldier has always gained him the victory. Without speaking of those I have mentioned, he has had more recent ones, that, for example, in which he killed with a ball in his forehead, the best general of Tedla-Gualu, 4 years ago. He presents a magnificent appearance at the head of a squadron and at full gallop, when intoxicated by the movement and by the smoke, he utters, with a full and quick voice, his battle-cry: *Abba Langhia*. His talents as a general and a strategist are more disputable. The campaign of Godjam, of which I was a witness, was so desultory and so pitiful that I have felt like inquiring if Theodore did not make the war last by calculation. His tactics, mysterious and sinister, are well calculated to strike the imagination. Then, after some days repose, the army receives orders to be in readiness to march the next day in a given direction, to the south for example. Two hours afterwards, at sunset, the negus mounts his horse, impassive and taciturn Thirty chosen fusileers are grouped around him, five or six sure horsemen follow him five paces behind; he marches to the north or to the east no one knows where, and is not anxious to be informed. Some days pass without any news, then people hear that Theodore has surprised, after a long forced march, in which he has received reinforcements scattered among the cantonments, a rebellious province, and has massacred many of its inhabitants. At last an imperial proclamation is issued in all the districts. Listen to what Djaw-Hoe says: "I have punished the wicked, I have killed 22,000 men. Peace be unto honest men, and let no one be disturbed!" By a contrast which will be understood by those who have known him intimately, this terrible man loves acts of kindness, adopts orphans, takes care of their future life, gives them in marriage, and never loses sight of them. He adores children attends to them, and affords them as much amusement as a grand-father; they undoubtedly make him forget the base and treacherous persons who surround him. "Not one of you loves me," he says sometimes to the courtiers who encircle him. "Those who fill my prisons are happier than I, for there are persons who love them and think of them; when I die, not one of you will throw a handful of earth upon my grave." To this the answer might be given, that he has done everything to render himself an object of terror, and has done nothing to gain the affections of his subjects. His systematic mistrust has cast into chains almost all the representatives of the feudality of the empire. This feudality has engendered all the evils which have precipitated Abyssinia into the abyss where she has rolled for more than a century yet, individually, the most of these great vassals were men naturally proud, worthy and estimable. I will mention only two, who still live, Belgada Aræa and *ras* Oubie (who must not be confounded with him of Derestie who was conquered). The latter is a fine old man with a soft and gentle figure, who under-

stands and loves the Europeans. The companion of his long life came to share his chains; the Negus tried to intimidate and separate them by a divorce, but his efforts were in vain. "Your majesty," said the noble woman, "can put us to death; you cannot separate us, for heaven remains to us."

The arrest of Balgada was characteristic. Under the pretext of coming to render homage to the Negus, he had presented himself before him at the head of an army of Tigreens, as if to brave him. Theodore was not a man to be provoked in this way; graciously he received Balgada, invited him to dine with him, took him by the arm to show him the interior of his camp, and at the end of this promenade put him in irons, Balgada became enraged, insulted Theodore, who stood by unmoved at the execution of the order, and demanded of him what crime he had committed. "None," answered the Negus, "I arrest you because Tigré loves you and because you are strong and foolish enough to excite a new revolution." "Give me a horse and a sword," said the exasperated Balgada, "and prove to me with a sword in your hand that you are worthy of the throne!" "God preserve me from that!" replied Theodore without any emotion. "Abyssinia has had brainless paladins enough like you, and they have been her ruin, she needs now a master and order, go, *and may God deliver you!*" This saying was not, as some might think, a bitter jest, it should rather be translated thus: "Pray to God that he may bring about days so peaceful that I may, without endangering the public peace, restore you and similar ones to liberty."

We have led the reader into the very heart of cotemporaneous events. How will we conclude this series of confused struggles which we have endeavoured to relate? It is very certain that for nine years the whole of Abyssinia has been under the sway of one man. Of all the more or less factious rivals of Theodore, not one has been a serious pretender. The strongest, Agau Negnisie, was indecision itself and the plaything of a thousand intrigues. The last of the idle kings, Johannes, who has been the object of the thought of some European politicians, is a man of gentle manners, a literary character, a poet, but a prince without prestige and without a name. The terrible sovereign before whom all Abyssinia trembles speaks to Johannes with submission, calls him *my master*, would not dare to sit before him, but coldly leaves him to die in misery, in the depths of the lonely palace of his ancestors which the ironical generosity of the Negus has left him. There remains Tedla Gualu, of whom the supporters of the insurrection seek to make a great man; he is merely a little skilful prince, who does full justice to himself by avoiding every pretension to the crown, and who only desires to live as a sovereign in his fief of Godjam, without having to pay tribute to any one.

Theodore II. deems it of the greatest importance to perpetuate his dynasty and with it the empire which he has restored. He pretends to have an unshakable confidence in this: is it well founded? however, this is how he reasons: "God has promised the future to the house of David. Of this house, I am the only heir among all the cotemporary sovereigns; the future then belongs to me, or at least to my line. I may succumb, but my line must triumph, for the prophecies cannot be false" He has two adult sons by his first wife. The older is a kind of vulgar caliban, despised and detested by his father, who carefully re-

ves him from every political transaction. His ferocity would render even a king of Guinea jealous; at the end of some trifling disturbance with the suppression of which he was charged, he sent to his father a basket full of *torn* out eyes.

Sometimes he introduced into the ears of the sufferers cartouches to which others set fire to blow out their brains. Given to drink and fond of talk, he used to drink hydromel with some of the superior officers and to speak ill of the Negus to them. The latter being informed, put him under arrest for some time in an ass-stable, saying to him that he would be with his kind. Quite different is the second son, *Dedjaz* Mechecha, a young prince twenty-two years old, who has rendered himself so popular in the government of Dembea, with which he was invested about 1861, that Theodore has thought prudent to recall him. "What means this seeking for popularity?" said he harshly to him. "Do you think of acting like Absalom, of gaining the favour of the people to supplant your father?" The influential men, whom Theodore's unbridled acts of violence terrify, hope much in Mechecha, and undoubtedly, in case of the death of the Negus, the wisest would rally around this brave and sympathetic young man, but will he have his father's iron hand to govern this people? It is, at least, doubtful.

Considering the almost total incapacity of the Abyssinians to govern themselves, good minds, desiring, above all, peace and order, have spoken of foreign intervention. This is too great a step; there are extreme remedies to which we should have recourse only when social order is deeply injured. It was thought also that the English government, out of patience, was preparing to act vigorously against the sovereign of Abyssinia. *Information*, which there is every reason to believe, permits the assurance on the contrary, that *the foreign office* uses every means to obtain amicably the liberty of its subjects, and carefully avoids everything which might urge the Negus to commit one of those bloody acts of foolishness which unhappily would surprise no one. This prudence is praiseworthy and has the advantage in preparing a desirable solution without involving the future; but, whatever may happen, this question of the future will always engage the attention of the great powers whom the course of events has created arbiters of the destinies of the Christian East. It is an extreme contractedness of ideas which sees the question of the East only upon the Bosphorus or in the Holy Land; it is a question with a thousand faces, positive for some, philosophic for others, imminent for all. It slumbers and threatens to break forth wherever there is involved a great European interest, commercial, human, religious, for every Christian question which enters into the arena of politics becomes of necessity a European one. The Levant has kept for us surprises which have often taken us unawares; this is not the fault of the government, occupied with a thousand different cares; it is that of informers, of diplomatic agents, of missionaries, and of scholars, who have neglected to seek the truth or have more or less innocently concealed it. It is mine also, if I have not succeeded by this study in fully showing an indisputable *fact* and a *conviction* which every one may discuss. This fact is, that the Abyssinian people, in whom the majority of mankind sees a sort of negro race scarcely less ferocious and less brutal than the rest, is a strong, lively and intelligent nation, allied with Europe by physical traits and still more by its strange civilization, which carries us back to the most

curious times of the middle ages; it is that Theodore is one of the most remarkable men of this century, a man of genius buried in the midst of barbarism, and whom a fatality, sometimes merited, urges on to an abyss. The conviction which I would like to give to serious minds is, that a people, which has had the energy to preserve in the depths of Africa, and surrounded by the double barbarism of Mussulmans and pagans, so many great and noble things, to begin by Christianity, deserves the effective and restoring protection of Europe.

To remove paltry rivalries, narrow questions of sects, or of pretended acts of legitimacy, to aid Abyssinia in recovering order and unity without despotism, to obtain an energetic government, enlightened and friendly to Europe, to seek within herself the elements of her renovation, following the programme (too long forgotten) of Theodore II. Here is certainly a policy liberal and noble, by no means chimerical and sentimental, with all due deference to those who regret that France saved Greece in 1827. This policy has never been lost sight of by the two representatives of France and England whom chance and their own desire have connected with the cotemporaneous affairs of Abyssinia. I will add that these very misfortunes have in no degree altered their faith in the future of a nation which has not without some secret design of Providence remained alone free and christian in the midst of this degraded and lost Africa. Let me be permitted to say so at least for myself.

GUILLAUME LEJEAN.

ENTOMOLOGICAL SOCIETY OF CANADA.

The annual general meeting of the Society was held in the rooms of the Canadian Institute, on Thursday, February 16th, at 3 o'clock, p.m; the President, Wm. Saunders, Esq., in the chair. The report of the Council for the past year was read and accepted: as were also the reports from the branch societies at Quebec, C. E., and London, C. W.: from all of which it is gratifying to learn that the Society is making very satisfactory progress. The following gentlemen were proposed, and unanimously elected members:—James Bovell, Esq., M.D., Professor of Physiology, Trinity College, Toronto: Rev. W. A. Johnson, Weston, C.W.; John Macoun, Esq., Belleville: Johnson Pettit, Esq., Grimsby; Rev. W. F. Clark, Editor of the *Canada Farmer*, Toronto; C. W. Lloyd, Esq., H. M. 16th Regiment, Toronto: J. E. Orange, Esq., H. M. 16th Regiment, Toronto. Francis Walker, Esq., F.L.S. of the British Museum, London, England, was elected an Honorary member; and Beverley R. Morris, Esq., M.D., London, England (late of Toronto), a corresponding member.

The following donations to the cabinet were announced, and the thanks of the Society ordered to be transmitted to the donors:—From F. Walker, Esq., F.L.S., a very large and valuable collection of European Insects, comprising several thousand specimens, chiefly of the orders Coleoptera, Lepidoptera, and Neuroptera, with a few Hymenoptera. From Rev. F. O. Morris, Nunburnholme

Yorkshire, England, a number of English Lepidoptera. From Mr. Prest, York, England, ditto. From Mr. McLachlan, London, England, a valuable collection of typical forms of Trichoptera, being the British species enumerated in his recent monograph on this order. From Mr. Pettit, Grimsby, 137 specimens of Canadian Insects, chiefly Coleoptera and Lepidoptera. From Mr Saunders, London, C. W. several specimens of the same orders. From Mr. Orange, a few Lepidoptera.

The following works were presented to the Library by the Rev. H P Hope, Toronto:—Gosse's Romance of Natural History; Broderip's Zoological Recreations: Elements of Natural History, vol. 2; a copy of the "Carte de Visite" of Mr. H. Ulke, Coleopterist, Washington, D.C.: and a photograph of a new species of *Alypia* (*A. Langtonii*, Couper) were also announced as having been received from Mr. Wm. Couper, Curator of the Quebec Branch.

The following officers were elected for the year 1865:—President, Rev. Prof. Hincks, F.L.S.; Vice-President, William Saunders, Esq.; Secretary-Treasurer, Rev. C. J. S Bethune, M. A.; Curator, Robert V. Rogers, Esq., Jr., B.A. Mr. Harbottle was also requested to assist Mr. Rogers in the duties of the Curatorship during the year.

The standing Committees on the various Insect orders were re-arranged as follows:—On Coleoptera, Prof. Croft, Messrs. B. Billings and Couper. On Lepidoptera, Messrs. Bethune, Reed, Saunders, and Bowles. On Orthoptera and Neuroptera, Prof. Hincks, Dr. Cowdry, Mr. B Billings. On Diptera, Messrs. Rogers, Couper, and Clarke. On Hymenoptera, Messrs. Saunders, Beckett and Bowles. On Insect-architecture, Messrs. Couper, Sangster, Hope, and H. Cowdry.

Mr. Saunders reported, on behalf of the Committee on Canadian silk-producing moths, that during the past year he had succeeded in getting two of the best of our silk-producers (*Attacus cecropia* and *A. polyphemus*) to breed in captivity, and that there is not the slightest difficulty in raising them in any numbers.

Mr. Bethune, on behalf of the Committee on Lepidoptera, presented a list of upwards of three hundred Canadian species not enumerated in the list already published by the Society. He was authorized to proceed with its publication immediately.

Mr. Hope suggested that the Society should send a collection of the more conspicuous Canadian Insects to the Exhibition about to be held in Dublin, in order to afford naturalists at home an opportunity of seeing some of the insect forms of this country. After some discussion, in which the suggestion was approved of, it was decided to defer any action in the matter till it was learnt whether the Government intended to make any grant to meet the expenses of forwarding articles from this country.

The Secretary informed the meeting of what had been done in order to procure German entomological pins for the Society. English ones had been imported in mistake by the merchant to whom the order was entrusted, but measures had been taken to send them back and obtain the desired quality as soon as possible.

Papers were read (1) by Mr. Bethune, on "Some New Species of Canadian

Nocturnal Lepidoptera;" (2) by Mr. Saunders, "Observations and Notes on Insects during the past season."

The meeting also assembled in the evening for the purpose of examining specimens, comparing notes, &c, and adjourned after a couple of hours spent very pleasantly.

THE ENTOMOLOGICAL SOCIETY OF CANADA.

REPORT FOR 1864.

The Council of the Entomological Society of Canada, in presenting their *Second* Annual Report beg to congratulate the members upon the very satisfactory progress that has already been made by the Society. During the past year, two branches have been formed in conection with it; one at Quebec, C. E; the other at London, C. W., both of which are now in active operation. This is a course that will, we trust, be followed by entomologists in other parts of Canada, and thus a strong society will be formed, which may successfully carry out the study of the insect fauna of Canada. The Quebec Branch now contains *twelve* members, and has already formed a goodly collection of native insects; four papers were read during the year, and meetings were regularly held in the rooms of the Literary and Historical Society; its proceedings are published in the "Canadian Naturalist and Geologist." The London Branch was organized on the 1st of July, 1864, and now numbers *fifteen* members: monthly meetings, at which five papers were read, were held at the houses of members in rotation, and during the season, the mornings of every Monday were devoted to field excursions. The Parent Society, exclusive of the Branches, is now composed of *twenty-one* members; the whole number is, therefore, *forty-eight*, an increase of *twelve* during the year. Three general meetings of the Society have been held, and several field-meetings also, during the summer months. Six papers have been read, and several valuable contributions to the library have been received. The number of donations of specimens of insects to the Cabinet of the Society, is particularly gratifying,—the whole number now amounting to upwards of 2,500. Moreover, in addition to these, a large number of European insects, of various orders, has been brought out for the Society by the Secretary,—the gift chiefly of Francis Walker, Esq., F.L.S., of the British Museum, London,—these have not yet been arranged in the cabinet provided for them by the Canadian Institute, but will ere long be put in their proper places. A list of Canadian Lepidoptera, embracing all the Rhopalocera, and the groups Sphingina and Bombycina of the Heterocera has been published; the remainder is under preparation. The Council, in conclusion, cannot refrain from expressing their regret that the Society has been deprived of the active co-operation of Dr. B. R. Morris, of Toronto, who lately left this country for England. His interest in our proceedings will, we trust, be continued as a corresponding member.

CHARLES J. S. BETHUNE,
Secretary.

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—FEBRUARY, 1865.

Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 m. 33 s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of mean above Normal.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Result. Direction.	Velocity of Wind.					Rain in inches.	Snow in inches.
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M	2 P.M	10 P.M	M'E'N		6 A.M	2 P.M.	10 P.M.	M'N	6 A.M	2 P.M.	10 P.M.	M'N	6 A. M.	2 P. M.	10 P.M.		6 AM.	2 PM.	10 P.M.	Result.	M'E'N		
					°	°	°	°	°																			
1	29.936	29.941	30.092	30.0052	31.3	33.4	25.2	28.33	+ 4.45	.152	.160	.107	130	.86	.84	.79	.82	W N W	W N W	N	N 25 W	3.0	7.4	9.0	6.28	6.94	...	...
2	30.173	30.152	30.057	30.1233	11.4	22.6	24.1	18.77	— 5.08	.062	.089	.114	.087	.85	.72	.87	.82	N b E	E	E b S	N 82 E	8.0	10.0	10.2	8.11	9.51	...	...
3	29.855	29.661	29.480	29.6445	28.7	31.3	33.8	31.27	+ 7.50	.145	.129	.173	.154	.92	.73	.89	.87	E b S	E b S	E S E	S 82 E	11.0	6.5	4.8	4.80	4.83	0.240	Inp.
4	.332	.434	.542	.4477	34.5	39.2	32.7	34.93	+11.23	.192	.180	.135	.164	.96	.75	.73	.80	E b S	W b N	W b N	N 84 W	0.4	17.0	14.8	13.89	14.59	0.050	...
5	.470	.609	—	—	24.1	19.7	—	—	—	.093	.064	—	—	.72	.61	—	—	W	W N W	N W b W	N 56 W	17.0	21.5	2.0	14.60	15.28	...	Inp.
6	.797	.801	.793	.7965	11.4	19.0	17.9	16.20	— 7.32	.062	.078	.079	.073	.85	.76	.80	.80	N W b N	N W	N N E	N 5 E	7.5	0.8	3.8	2.73	3.33	...	...
7	.750	.635	.436	.5385	16.8	19.4	16.8	17.67	— 5.77	.080	.087	.085	.086	.85	.83	.91	.89	N E b N	N E	N b E	N 23 E	5.0	8.0	10.8	9.73	10.23	...	2.5
8	.199	.171	.232	.1997	17.6	18.3	15.1	16.87	— 6.50	.088	.093	.080	.087	.92	.94	.93	.93	N	N W b N	N W b N	N 37 W	8.2	20.8	20.0	17.26	17.41	...	6.5
9	.346	.421	.484	.4270	11.4	14.7	15.1	14.22	— 9.05	.063	.067	.068	.067	.91	.78	.79	.81	N W b N	N W b N	S W b W	N 66 W	17.0	18.4	8.5	9.77	12.78	...	...
10	.261	.311	.481	.3612	20.5	23.3	21.2	21.80	— 1.47	.093	.082	.099	.090	.85	.65	.86	.78	S W b W	N W b N	W N W	N 60 W	10.0	20.4	13.8	13.03	14.89	...	0.4
11	.705	.721	.649	.6918	6.4	13.2	9.6	9.55	—13.72	.056	.060	.059	.057	.95	.75	.89	.85	N N W	Calm.	N b E	N 21 E	6.0	0.0	9.0	5.19	5.47	...	0.3
12	.772	30.040	—	—	4.6	6.7	—	—	—	.048	.052	—	—	.90	.88	—	—	N b E	N	N N W	N 17 W	16.5	10.0	5.0	8.07	8.29	...	...
13	30.174	30.132	.979	30.0095	—7.0	13.2	9.6	5.33	—17.90	.031	.060	.053	.047	.96	.75	.77	.81	Calm.	S W b W	W b S	S 74 W	0.0	7.0	2.5	2.83	2.96	...	...
14	29.906	29.744	.681	29.7670	1.0	21.2	15.0	13.13	—10.13	.041	.079	.075	.066	.88	.70	.87	.80	Calm.	Calm.	N b W	N 16 W	0.0	0.0	2.0	1.77	1.93	...	...
15	.600	.465	.287	.4302	14.0	21.5	20.1	19.20	— 4.05	.074	.104	.098	.094	.91	.89	.92	.90	N b E	E N E	N E	N 56 E	7.5	14.2	10.0	10.32	10.61	...	2.0
16	.217	.253	.353	.2837	19.7	28.0	23.7	24.25	+ 0.88	.103	.117	.118	.116	.97	.76	.93	.89	N E b N	Calm.	Calm.	N 29 E	5.0	0.0	0.0	0.96	0.96	...	0.6
17	.373	.322	.375	.3610	26.2	31.3	28.4	28.73	+ 5.38	.131	.136	.142	.136	.92	.77	.90	.86	N N E	E b N	E N E	N 69 E	4.2	10.8	2.5	5.14	5.32	...	...
18	.468	.466	.552	.5078	27.3	32.7	28.4	29.12	+ 5.68	.118	.165	.148	.142	.79	.88	.95	.87	Calm.	S S W	N W b W	N 78 W	0.0	3.3	13.2	5.22	6.14	...	1.5
19	.683	.748	—	—	16.1	31.3	—	—	—	.074	.129	—	—	.83	.73	—	—	W b N	W b N	N W	N 51 W	1.2	8.0	7.0	7.04	7.42	...	...
20	.972	30.033	30.088	30.0428	17.9	28.0	19.4	21.47	— 2.15	.085	.117	.080	.095	.87	.76	.76	.82	N	N N W	N N W	N 8 W	5.0	2.0	6.5	2.51	2.69	...	...
21	30.161	30.103	29.938	30.0582	24.8	28.0	29.8	27.62	+ 3.88	.112	.124	.147	.126	.84	.81	.88	.83	E b S	E b N	E b N	N 57 E	5.8	12.0	8.8	8.27	8.37	...	...
22	29.773	29.673	.697	29.7157	30.9	39.6	35.3	35.62	+11.80	.143	.194	.189	176	.86	.79	.92	.84	E	S W b S	S W	S 35 W	5.2	7.0	7.8	5.74	7.90	0.035	...
23	.720	.721	.849	.7698	20.8	34.5	24.1	29.35	+ 5.42	.125	.114	.098	.107	.75	.57	.66	.66	S W b W	W	N W b W	N 80 W	0.8	15.5	7.8	9 51	9.86	...	...
24	.952	.972	.974	.9628	14.7	27.3	17.6	20.83	— 3.30	.072	.111	.076	.091	.84	.74	.79	.79	N W b W	S W b S	S S W	S 25 E	0.8	1.4	0.8	0.77	2.02	...	...
25	.916	.748	.366	.6558	18.3	29.8	32.7	27.83	+ 3.50	.087	.133	.172	.131	.87	.80	.92	.86	N E	E b N	E b N	N 78 E	6.5	18.0	18.0	13.11	13.36	0.435	...
26	.082	.207	—	—	36.0	40.7	—	—	—	.206	.196	—	—	.97	.77	—	—	E b N	W S W	W b S	S 89 W	2.8	17.0	18.0	10.71	13.93	Inp.	...
27	.984	30.058	30.035	30.0258	20.5	25.9	24.8	23.43	— 1.30	.093	.093	.098	.096	.85	.66	.73	.75	N W b N	E S E	E	N 67 E	6 0	6.2	13.5	7.88	9.60	...	1.0
28	.860	29.866	29.968	29.9022	14.7	25.2	22.3	21.13	— 3.77	.078	.122	.101	.100	.93	.90	.85	.87	N E	N b W	Calm.	N 15 E	14.6	2.8	0.0	3.72	3.98	...	2.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
M	29.7262	29.7002	29.6832	29.7024	18.45	25.86	22.61	22 36	— 1.31	.096	.112	.107	.105	.88	.77	.85	.83	.....	.....	.....	.....	6.25	9.50	8.22	.....	8.23	0.810	16.8

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR FEBRUARY, 1865.

NOTE.—The monthly means do not include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer . . . . . 30.232 at 11 a.m. on 2nd. } Monthly range=
Lowest Barometer . . . . . 29.082 at 6 a.m. on 26th. } 1.150 inches.

Self-registering Ther.
- Maximum temperature . . . 42°.2 on p.m. of 22nd, 23th } Monthly range=
- Minimum temperature . . . —10°.0 on a.m. of 13th } 52°2
- Mean maximum temperature . . 23°61 } Mean daily range=13°12
- Mean minimum temperature . . 15°52
- Greatest daily range: . . . . . 26°0 from a. m. to p. m. of 13th.
- Least daily range . . . . . 3°3 from a. m. to p. m. of 8th.

Warmest day . . . 22nd ..Mean Temperature . . . 35°62 } Difference=30°.27
Coldest day . . . 13th ..Mean Temperature . . . 5°35 }

Maximum {Solar . . . . . 104°0 on p.m of 24th } Monthly range=
Radiation {Terrestrial . . . . . —19°0 on a m. of 13th } 123°.0

Aurora observed on 4 nights, viz.:—on 20th, 21st, 22nd, and 23rd.
Possible to see Aurora on 13 nights; impossible on 15 nights.
Snowing on 11 days; depth 16.8 inches; duration of fall, 78.4 hours.
Raining on 5 days; depth 0 810 inches; duration of fall, 29.8 hours.
Mean of cloudiness=0.71; Most cloudy hour observed, 8 a.m; mean=0.79; least cloudy hour observed, midnight; mean=0.65.

Sums of the components of the Atmospheric Current, expressed in Miles.

North.	South.	East.	West.
2545.62	446.47	1539.74	2472 27

Resultant direction, N. 23° W.; Resultant Velocity, 3.95 miles per hour.
Mean velocity 8.23 miles per hour.
Maximum velocity 29.0 miles, from 3 to 4 p.m. on 5th.
Most windy day 8th—Mean velocity 17.41 miles per hour. } Difference 16.45.
Least windy day 16th—Mean velocity 0.93 miles per hour. }
Most windy hour, 1 to 2 p.m.—Mean velocity, 9.74 miles per hour. } Difference
Least windy hour, 6 to 7 a.m.—Mean velocity, 5.82 miles per hour. } 3.92 miles.

2nd. Solar halo during the forenoon.
3rd. Rain, freezing as it falls, from noon to 6 a.m.
8th. Stormy day, snowing and drifting heavily.
18th. Snowing from 9 a.m. to 8 p.m., melting as it falls.
20th, 21st, 22nd, and 23rd. Auroral light in the north.
25th. Rain from 4h. 50m. p.m., freezing as it falls. Very squally.
4th. Dense fog, 8 a.m.
13th. Solar halo, 4 p.m.

The month of February, 1865, was comparatively cold, dry, and calm, and the amount of cloudiness equalled the average of the last 12 years.

COMPARATIVE TABLE FOR FEBRUARY.

YEAR.	TEMPERATURE. Mean	Excess above Average (=0).	Maximum observed.	Minimum observed.	Range.	RAIN No. of days.	RAIN Inches.	SNOW. No. of days.	SNOW. Inches.	WIND. Resultant. Direction.	WIND. Resultant. Velocity.	WIND. Mean Force or Velocity
	°		°	°	°							
1840	28.0	+ 5.0	49.1	— 8.3	57.4	8	1.475	6	...	...	...	...
1841	22.4	— 0.6	43.4	— 0.3	43.7	1	Inap.	9	...	...	...	0.61 lbs
1842	23 9	+ 3.9	48.7	+ 2.3	46.2	8	3.625	9	...	...	...	1.03 "
1843	14.5	— 8.5	37.5	—10.2	47 7	1	0.475	21	14.4	...	...	1.05 "
1844	26.0	+ 3.0	47.1	— 0.4	47.5	4	0.430	7	10.0	...	...	0.43 "
1845	26.0	+ 3.0	46.6	— 3.9	50.5	5	Imp.	9	13.0	...	...	0.99 "
1846	20.4	— 2.6	41.4	—16.2	57.6	0	0.000	13	46.1	...	...	0.65 "
1847	21.5	— 1.5	42.2	— 1.0	43.2	2	0.550	13	27.3	...	...	0.69 "
1848	26.6	+ 3.6	46.9	— 0.6	47.5	4	0.775	8	10.8	N 65 W	2.53	5.69 ms
1849	19.5	— 3.5	41.1	— 9.2	50.3	2	0.240	13	19.2	N 41 W	1.48	6.58 "
1850	26.0	+ 3.0	49 2	+ 1.3	47.9	7	1.235	9	23.1	N 80 W	3.43	7.61 "
1851	27.6	+ 4.6	50.2	+ 1.3	48.9	7	2.600	4	2.4	N 64 W	1.99	6.94 "
1852	23.4	+ 0.4	41.2	— 3.2	44.4	3	0.650	11	13.0	S 75 W	3.31	6.42 "
1853	24.1	+ 1.1	43.4	— 0.6	44.0	4	1.030	15	12.6	N 49 W	2.51	7.30 "
1854	21.1	— 1.9	42.7	— 5.7	48.4	5	1.460	15	18.0	N 7 E	1.73	6.91 "
1855	15.4	— 7.6	37.3	—25.0	62 3	2	1.770	14	21.8	N 40 w	4.31	8.17 "
1856	15.7	— 7.3	35.3	—18.7	54.0	0	0.000	8	9.7	N 81 w	7.70	10.71 "
1857	28.5	+ 5.5	51.2	— 5.9	57.1	11	3.050	11	11.7	S 78 W	3.68	9.82 "
1858	17.0	— 6.0	40.9	— 6.6	47.5	1	Inap.	16	26.7	N 72 W	3.22	9.12 "
1859	26.0	+ 3.0	43.3	+ 3.9	39.4	6	0.455	14	8.3	N 54 W	2.72	8.50 "
1860	22.8	— 0.2	48.1	— 8.4	56.5	7	1.330	13	18.8	N 61 W	3.28	8.73 "
1861	26 1	+ 3.1	44.6	—20.4	65.0	4	0 815	17	29.7	N 77 W	3.86	10.58 "
1862	22.5	— 0.5	35.6	— 3.7	39 3	3	0.180	17	23.1	N 55 W	3.93	8.52 "
1863	22.4	— 0.6	38.9	—19.8	58.7	7	1.450	12	22.0	N 23 W	2.27	10.13 "
1864	24.3	+ 1.3	43.9	—13.0	56.9	2	0.397	14	9.5	S 84 W	6.48	10.11 "
1865	22 4	— 0.6	41.0	— 7.0	48.0	5	0.810	11	16.8	N 23 W	3.95	8.23 "
Results to 1864.	22.99	...	43.59	—6.88	50.48	4.2	1.000	11.9	18.05	N 70 W	3.15	8.34
Exc. for 1865.	—0.63	...	—2.59	—0.12	—2.48	+ 0.8	— 0.190	— 0.9	— 1.25	...	...	—0 11

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—MARCH, 1865.

Latitude—43 *deg.* 39.4 *min. North. Longitude*—5 *h.* 17 *min.* 33 *sec. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of mean above Normal.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Resultant Direction.	Velocity of Wind.				Rain in Inches.	Snow in Inches.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M	2 P.M.	10 PM	ME'N		6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P. M.		6 A.M.	2 P.M.	10PM	Resul't.	ME'N		
					°	°	°	°													°							
1	30.016	30.042	30.000	30.0163	23.3	27.0	24.8	25.10	— 0.12	.103	.121	.112	.115	.82	.82	.84	.85	N b W	E	E b S	S 89 E	3.0	11.5	17.0	10.88	11.57	...	Inp
2	29.753	29.670	29.658	29.6513	29.1	34.2	35.6	33.20	+ 7.82	.133	.185	.203	.176	.82	.93	.97	.92	E	E b S	E S E	S 87 E	15.8	8.3	0.5	5.12	5.28	0.580	...
3	.734	.728	.706	.7127	34.5	37.4	32.0	34.40	+ 8.68	.136	.103	.106	.116	.68	.46	.58	.58	N N E	N N E	N E b N	N 22 E	1.2	0.5	4 0	3.67	3.71	...	1.0
4	.465	.455	.375	.6063	28.4	31.3	20.1	25.27	— 0.73	.148	.152	.079	.119	.91	.86	.73	.84	N b E	N W b N	N W b W	N 33 W	14.0	30.0	9.4	13.80	14.71	...	5.0
5	.961	.956	—	—	3.9	27.3	—	—	—	.045	.090	—	—	86	.60	—	—	Calm.	S E	S E b S	S 23 E	0.0	5.2	4.2	3.25	3.32	...	...
6	.875	.850	.752	.8278	13.2	33.1	32.0	26.73	+ 0.30	.071	.138	.151	.122	.90	.73	.83	.82	Calm.	S b W	S S E	S 85 W	3.2	17.8	5.5	4.90	10.57	Inp.	...
7	.615	.434	.390	.4900	23.7	39.6	38.1	35.55	+ 8.73	.098	.184	.191	.160	.76	.75	.83	.75	S S E	S W b S	S W b S	S 85 W	3.2	17.8	5.5	4.90	10.57	Inp.	...
8	.800	.861	.712	.7962	14.7	24.1	23.7	20.70	— 6.53	.072	.071	.118	.090	.85	.54	.93	.80	N W b N	N E	E	N 67 E	8.0	11.5	19.0	12.03	13.52	...	2.0
9	.419	.276	.271	.3240	30.2	36.0	33.8	33.15	+ 5.63	.157	.196	.183	.178	.93	.93	.95	.94	E b N	E b N	W b S	S 83 W	12.0	5.0	13.5	3.39	10.03	0.100	5.0
10	.500	.602	.695	.6108	12.5	19.4	15.4	15.70	—12.12	.062	.068	.077	.067	.80	.65	.87	.74	W b S	W	W b S	S 78 W	15.5	19.0	11.5	11.84	11.97	...	...
11	.651	.500	.619	.6073	13.6	27.7	12.2	17.88	—10.35	.072	.100	.053	.078	.90	.70	.70	.76	W b S	S W b W	N W b N	S 88 W	3.0	16.8	27.5	12.61	16.73	...	1.0
12	30.040	.907	—	—	—0.1	11.4	—	—	—	.037	.068	—	—	85	.94	—	—	Calm.	S E b E	E	S 78 E	0.0	9.5	10.0	6.37	6.74	...	2.5
13	29.671	.904	.986	.8742	23.3	28.0	22.3	24.12	— 4.85	.116	.109	.085	.097	.93	.71	.71	.75	Calm.	N W b W	N E	N 22 E	0.0	8.0	4.2	5.18	7.82	...	1.0
14	.895	.796	.684	.7895	25.2	30.2	34.5	30.27	+ 0.95	.115	.136	.163	.143	.85	.80	.82	.84	E N E	E b N	E N E	N 75 E	13 S	11.0	3.2	7.53	7.55	0.022	...
15	.610	.527	.512	.5478	37.8	47.5	41.0	42.17	+12.45	.217	.283	.246	.249	.95	.86	.96	.92	E b N	Calm.	E N E	N 63 E	1.8	0.0	5.5	3.13	3.15	...	...
16	.610	.527	.512	.5478	37.8	47.5	41.0	42.17	+12.45	.217	.283	.246	.249	.95	.86	.96	.92	E b N	Calm.	E N E	N 63 E	1.8	0.0	5.5	3.13	3.15	...	...
17	.320	.347	.075	.2477	30.9	40.3	37.0	36.32	+ 5.87	.149	.185	.193	.176	.86	.73	.87	.81	N E b E	E b N	E N E	N 75 E	13 S	11.0	3.2	7.53	7.55	0.022	...
18	.460	.725	.821	.6012	33.1	39.9	33.1	35.37	+ 4.52	.138	.121	.167	.140	.73	.49	.88	.69	W N W	W b S	S W b W	S 81 W	27.5	24.5	6.5	14.46	14.74	...	...
19	.880	.778	—	—	30.2	41.7	—	—	—	.149	.167	—	—	89	.62	—	—	W	S S W	Calm.	S 48 W	4.0	6.2	0.0	2.26	2.58	...	...
20	.616	.533	.462	.5288	36.3	39.6	37.4	38.02	+ 6.35	.168	.183	.196	.184	.78	.75	.87	.80	Calm.	S S E	Calm.	N 72 E	0.0	4.0	0.0	1.98	2.41	0.250	...
21	.342	.166	28.801	.0937	35.6	43.5	43.5	42.33	+10.25	.193	.250	.278	.254	.93	.89	.98	.93	E b N	E b N	E N E	S 25 E	0.8	1.0	4.0	1.77	4.03	0.660	...
22	28.736	28.746	28.887	28.7997	36.3	36.0	33.1	34.90	+ 2.42	.185	.165	.167	.170	.86	.77	.88	.83	S S W	W	W b S	S 71 W	24.2	15.5	20.2	17.15	18.88	0.245	1.0
23	28.974	28.975	29.094	29.0045	36 3	42.8	32.4	36.62	+ 3.83	.176	.213	.131	.168	.82	.77	.71	.76	W	W b N	W	N 85 W	18.0	24.8	12.0	16.06	16.35	...	...
24	29.075	29.182	.393	.2317	30.9	36.0	33.1	33.63	+ 0.47	.134	.162	.160	.152	.77	.76	.85	.79	W b N	N W	W b N	N 56 W	12.8	19.5	7.0	11.27	11.64	...	0.1
25	.460	.488	.672	.5605	31.3	34.5	28.8	31.35	— 2.22	.160	.144	.129	.145	.90	.72	.81	.82	N W b N	W b N	N W b N	N 40 W	4.0	6.5	15.0	10.97	11.14	...	...
26	.817	.913	—	—	27.3	37.0	—	—	—	.133	.124	—	—	89	.56	—	—	N W b N	W b N	N W b N	N 58 W	10.0	8.0	1.0	4 90	5.72	...	...
27	.976	.879	.857	.9017	31 6	46.4	39.6	39.43	+ 5.03	.156	.259	.176	.192	.87	.82	.72	.78	Calm.	S b W	Calm.	S 53 E	0:0	6 5	0.0	1.14	3.66	...	...
28	.861	.823	.747	.8093	37.4	42.1	40.7	39.77	+ 5.05	.196	.152	.143	.162	.86	.56	.56	.66	N E b E	E N E	E b N	N 73 E	10.5	16.0	10.0	10.87	10.89	...	...
29	.710	.630	.588	.6437	36.7	45.7	41.4	41.02	+ 5.92	.188	.211	.250	.217	.86	.68	.95	.84	E b N	E	Calm.	N 59 E	0.4	4.8	0.0	0.94	1.24	0.420	...
30	.527	.469	.842	.4507	39.6	54.4	45.0	45.67	+10.17	.194	.174	.230	.203	.79	.40	.77	.67	N b W	N E	N b E	N 15 E	2.2	7.0	7.2	6.64	6.91	...	...
31	.306	.233	.126	.2067	40.3	54.0	39.6	45.78	+ 9.87	.159	.191	.185	.161	.63	.45	.75	.52	N b E	S E b S	S W	N 30 W	10.5	7.2	0.5	5.76	8.68	...	...
M	29.5482	29.5116	29.5190	29.5277	29.94	37.71	32.85	33.55	+ 3.17	.147	.170	.160	.159	.84	.72	.82	.79					7.44	10.68	8.08	.....	8.80	3.050	18.9

NOTE.—The monthly means do not include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely at 6A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer..... .....30.958 at 8 a.m. on 1st } Monthly range =
Lowest Barometer... .....28.707 at 11 a.m. on 22nd } 1.351 inches.

Self-registering Thermom.
- Maximum Temperature .... 55°6 on p.m. of 30th } Monthly range =
- Minimum Temperature ... .—3°5 on a.m. of 12th } 59°1
- Mean maximum Temperature .... 39°29 } Mean daily range =
- Mean minimum Temperature ... . 25°11 } 14°18
- Greatest daily range .....26°8 from a.m. to p.m. of 5th.
- Least daily range ..... 4°3 from a.m. to p.m. of 4th.

Warmest day .....31st... Mean temperature..... 45°78 } Difference = 30°08
Coldest day ....11th... Mean temperature .... 15°70 }
Maximum Solar.....109°0 on p.m. of 19th } Monthly range =
Radiation. Terrestrial.....—12°5 on a.m. of 12th } 121°5
Aurora observed on 3 nights, viz:—15th, 20th and 30th.
Possible to see Aurora on 11 nights; impossible on 20 nights.
Snowing on 12 days; depth 18.9 inches; duration of fall, 56.4 hours.
Raining on 10 days, depth 3.050 inches; duration of fall 59.5 hours.
Mean of cloudiness = 0.78.
Most cloudy hour observed, 4 p.m.; mean = 0.84, least cloudy hour observed, midnight; mean, = 0.72.

Sums of the components of the Atmospheric Current, expressed in miles.

North.	South.	East.	West.
1899.17	1124.68	1868.64	3274.06

Resultant direction N. 61° W.; Resultant velocity 2.16 miles per hour.
Mean velocity .....8.80 miles per hour.
Maximum velocity ..... 34.2 miles, from 2 to 3 p.m. on 4th.
Most windy day .....22nd.....Mean velocity, 18.88 miles per hour. } Difference =
Least windy day.....29th..... ..Mean velocity, 1.24 ditto } 17.64 miles
Most windy hour ..... 2 to 3 p.m .....Mean velocity, 10.88 ditto. } Difference =
Least windy hour ..... 6 to 7 p.m.....Mean velocity, 7.43 ditto. } 3.45 miles.

5th. Lunar halo during evening.—6th. Lunar halo very perfect.—9th. Dense fog during evening.—15th. Dense fog at midnight.—16th. Dense fog all day.—20th. Thunder storm with heavy rain (first of season).—20th. Solar halo in afternoon.—21st. Solar halo in morning.—23rd. Solar halo during forenoon.—30th. Solar halo during forenoon.

The month of March, 1865, was comparatively warm, wet, and cloudy.

COMPARATIVE TABLE FOR MARCH.

YEAR.	TEMPERATURE. Mean.	Excess above average (26°2)	Max. observed	Min. observed	Range.	RAIN. No. of days.	Inches	SNOW. No. of days.	Inches	WIND. Resultant. Direction.	Vs.	Mean Force or Velocity.
	°	°	°	°	°							
1840	33.3	+ 7.1	56.9	— 8.7	48.2	8	1.64	8	...	...	...	.....
1841	27.7	— 2.2	53.5	— 6.9	60.4	5	1.170	7	...	...	...	0.51 lbs.
1842	35.8	+ 5.9	68.7	14 9	53.8	4	3.150	8	.	...	...	0.70
1845	21.3	— 8.4	38.6	— 2.8	41.4	2	0.623	18	.	.	...	1.18
1841	31.3	+ 1.4	50.3	9.6	40.7	8	2.470	8	.	...	...	0 57
1845	35.4	+ 5.1	61.7	9.9	51.8	5	Inap	8	2.8	...	..	0.66
1846	33.1	+ 3.2	49 3	7.6	41.7	9	1.965	5	2 3	...	..	0.30
1847	26 2	— 3.7	44.3	4.8	39.5	5	0.856	6	4.2	...	...	0.71
1848	28.6	— 1.3	58.9	0.9	58.0	5	1.220	6	9.7	N 63° W	2.63	5 80mls.
1849	33.5	+ 3.4	53.4	15.4	38.0	7	1.525	2	2.3	N 3° W	1.48	5.37
1850	29.8	— 0 1	46.0	6.0	40.0	2	0.745	7	11.2	N 52° W	2.62	7 62
1851	32.4	+ 2.5	58 7	13.1	45.6	3	0.770	9	8.8	N 21° W	1 93	7 65
1852	27.7	— 2.2	41.8	— 3.2	48.0	8	3.08	12	19 5	N 8° W	0.77	5 81
1853	30.6	+ 0.7	56.3	— 0 1	56.4	6	1.080	8	7.1	N 58° W	2.60	5.96
1854	30.7	+ 0.8	52.8	10.4	42.4	9	2.42	3	2 8	N 53° W	3.39	8 03
1855	28.5	— 1.4	48.6	— 2.9	51.5	5	1.48	11	18.1	N 88° W	4.76	9.95
1856	23.1	— 6.8	39 3	—13.6	52.9	0	0.000	12	16.2	N 71° W	7.68	11.59
1857	27.8	— 2.1	56.5	— 3.9	60 4	4	0.335	15	11.3	N 63° W	6 63	10.84
1858	28.4	— 1.5	54.1	— 5 5	59.6	10	0.917	6	0.2	N 58° W	5.45	8.56
1859	36 3	+ 6.4	53.7	10.4	43.3	15	4.054	8	1.0	N 64° W	1.96	10.39
1860	34.5	+ 4.6	66.4	14.2	52.2	5	0.88	11	2.4	N 64° W	7.61	12 41
1861	26 9	— 3.0	43.2	— 4 1	47.3	8	2.12	14	7.1	N 54° W	4.33	10.56
1862	28.8	— 1.1	41.4	9.3	32.1	8	2.56	11	18.5	N 12° W	2 50	9 38
1863	25.8	— 4.1	41.4	— 3.4	44.8	4	0.68	17	11.4	N 27° W	2.62	9.27
1864	29.1	— 0.8	45.7	3.5	42.2	9	1.62	12	3.7	N 53° W	2.29	8.41
1865	33 6	+ 3.7	54.4	— 0.1	54 5	10	3.07	12	18.9	N 61° W	2.16	8.80
Results to 1864.	29 86	...	51.38	3.69	47.69	6.2	1 55	9.3	9.10	N 57° W	3.35	8.67
Excess for 1864	+ 3.69	...	+ 3.02	—3.79	+ 6.81	+ 3.8	+ 1.49	+ 2.7	+ 9.80	.....	...	+ 0.13

BRITISH REVIEWS.

L. SCOTT & CO., NEW YORK.

I. THE LONDON QUARTERLY [Conservative.]
II. THE EDINBURGH REVIEW [Whig.]
III. THE NORTH BRITISH REVIEW [Free Church.]
IV. THE WESTMINSTER REVIEW [Liberal.]
V. BLACKWOOD'S EDINBURGH MAGAZINE [Tory.]

EARLY COPIES.

The receipt of ADVANCE SHEETS from the British publishers gives additional value to these Reprints, inasmuch as they can now be placed in the hands of subscribers about as soon as the original editions.

TERMS:

	Per ann.
For any one of the four Reviews	$3.00
For any two of the four Reviews	5.00
For any three of the four Reviews	7.00
For all four of the Reviews	8.00
For Blackwood's Magazine	3.00
For Blackwood and three Reviews	9.00
For Blackwood and the four Reviews	10 00

Payments to be made in all cases in advance.

CLUBBING.

A discount of twenty-five per cent. from the above price will be allowed to Clubs ordering four or more copies of any one or more of the above works.

POSTAGE.

In all principal Cities and Towns, these works will be delivered, FREE OF POSTAGE. Mail Subscribers in Canada will receive the works FREE OF U. S. POSTAGE

N.B.—The price in Great Britain of the five Periodicals above-named is $31 per annum.

CONTENTS.

PAGE

I. Remarks on Professor Boole's Mathematical Theory of the Laws of Thought. By GEORGE PAXTON YOUNG, M.A..... 161

II. The Mohawk Languarge. By ORONHYATEKHA 182

III. On the Composition, Structure, and Development of Bone. By M. BARRETT, M.A., M.D..... 194

TRANSLATED:

Theodore II. and the new Empire of Abyssinia..... 204

ENTOMOLOGICAL SOCIETY OF CANADA 216

Entomological Society of Canada, Report for 1864..... 218

METEOROLOGY:

February Meteorological Table for Toronto..... 219

Remarks on " " 220

March Meteorological Table for Toronto..... 221

Remarks on " " 222

***** The Annual Subscription, due in January, Country Members, $3; in Toronto, $4.**

The next Number of this Journal will be issued in July.