MINUTES

OF THE

SIXTEENTH ANNUAL CONVENTION

OF THE

Ontario Association,

FOR THE

ADVANCEMENT OF EDUCATION,

HELD IN THE

Theatre & Normal School Buildings,

TORONTO.

ON TUESDAY, 8th AUGUST, 1876.

HAMILTON:
R. Raw & Co., Steam Printers, 26 King William Street.

1876.

TORONTO SCHOOL OF MEDICINE

IN AFFILIATION WITH

THE UNIVERSITY OF TORONTO.

FACULTY.

HENRY H. CROFT, D.C.L., F.L.S., *Professor of Chemistry and Experimental Philosophy, University College*, Emeritus Lecturer on Chemistry.

WM. T. AIKINS, M.D., *Surgeon to the Toronto General Hospital and to the Central Prison, Consulting Surgeon to the Children's Hospital, 78 Queen St.* West, Lecturer on Principles and Practice of Surgery and Clinical Surgery.

H. H. WRIGHT, M.D., L. C. P. & S. U. C., *Physician to Toronto General Hospital*, Lecturer on Principles and Practice of Medicine and Clinical Medicine.—197 Queen Street East.

J. H. RICHARDSON, M.D., M.R.C.S., Eng., *Consulting Surgeon to the Toronto General Hospital and Surgeon to Toronto Jail*, Lecturer on Descriptive and Surgical Anatomy.—46 St. Joseph Street.

UZZIEL OGDEN, M.D., *Consulting Surgeon to the Children's Hospital, Physician to the House of Industry and Protestant Orphans' Home*, Lecturer on Midwifery and Diseases of Women and Children.—57 Adelaide Street West.

JAMES THORBURN, M.D., Edinborough and Toronto Universities, *Consulting Physician to the Toronto General Hospital and Boys' Home, Consulting Surgeon to the Children's Hospital*, Lecturer on Materia Medica and Therapeutics.—Wellington and York Streets.

M. BARRETT, M.A., M.D., *Medical Officer for Upper Canada College, and Lecturer on Physiology Ontario College of Veterinary Medicine*, Lecturer on Physiology.

W. W. OGDEN, M.B., *Physician to the Toronto Dispensary* Lecturer on Medical Jurisprudence and Toxicology.—242 Queen Street West.

M. H. AIKINS, B.A., M.B., M.R.C.S., Eng., Lecturer on Primary Anatomy.—Burnhamthrope.

W. OLDWRIGHT, M.A., M.D., *Physician to the Newsboy's Home*, Curator of Museum, and Lecturer on Sanitary Science.—50 Duke Street.

L. M. McFARLANE, M.D. *Physician to the Toronto Dispensary*, Demonstrator of Anat.—7 Crookshank Street.

GEORGE WRIGHT, M.A., M.B., *Physician to the Toronto Dispensary*, Demonstrator of Anatomy.—154 Bay Street.

ALEX. GREENLEES, M.B., Practical Chemistry.—123 Church Street.

R. ZIMMERMAN, M.B., L.R.C.P., Lond., *Physician to the Toronto Dispensary, Physician to the Children's Hospital*, Demonstrator of Microscopical Anatomy.—107 Church Street.

F. H. WRIGHT, M.B., L.R.C.P., Lond., *Physician to the Toronto Dispensary, Physician to the Children's Hospital*, Demonstrator of Microscopical Anatomy.—197 Queen St. E.

J. E. GRAHAM, M.D., L.R.C.P., Lond., *Surgeon to the Toronto General Hospital*, Lecturer on Chemistry.—66 Gerrard Street.

R. A. REEVE, B.A., M.D., *Surgeon to Toronto Eye and Ear Infirmary, Opthalmic Surgeon to the Toronto General Hospital and Children's Hospital*, Lecturer on Diseases of the Eye and Ear, and on Botany.—22 Shuter Street.

Clinical Lectures will be given at the General Hospital by DRS. H. H. WRIGHT, AIKINS, RICHARDSON, THORBURN, GRAHAM and REEVE.

Classical Instruction will be given at the Toronto Dispensary by DRS. McFARLANE, GEORGE WRIGHT, F. H. WRIGHT, and Zimmerman.

LECTURES, in the building opposite the Toronto General Hospital, commence on the First October each year and continue six months. Further information may be obtained by application to H. H. WRIGHT, M.D., *Secretary*, 197 Queen St., east; or to W. T. AIKINS, M.D., *President*, 78 Queen St. west.

MINUTES

OF THE

SIXTEENTH ANNUAL CONVENTION

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FOR THE

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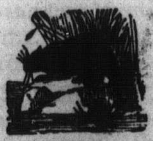

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FOR THE ADVANCEMENT OF EDUCATION,

HELD IN THE THEATRE OF THE NORMAL SCHOOL BUILDINGS, ON TUESDAY, THE 8TH AUGUST, 1876.

The First Vice-President, Mr. R. McQueen, in the Chair.

At 3 o'clock in the afternoon, Mr. A. Macallum, at the request of the Vice-President, read a portion of Scripture and led the Convention in prayer.

The Roll of Officers was called by the Secretary.

John Campbell, of Toronto, aided as Minute Secretary.

Moved by Mr. Strang, seconded by Mr. McIntosh,

That the Minutes of the last Meeting, having been printed and circulated among the members, be considered as read and be adopted as correct.

The Treasurer, Mr. S. McAllister, read his Report, which showed that an addition has been made to the Funds during the past year, so that, financially, the affairs of the Association are in a very satisfactory state.

Mr. McAllister moved, seconded by Mr. A. Macallum,

That the Treasurer's Report be received and adopted. —Carried.

The President nominated the following Auditing Committee to examine the Treasurer's Statement: Messrs. A. Macallum and W. Anderson.

The Secretary stated that he had communicated with several gentlemen in reference to the delivery of addresses to the Association.

The Minister of Education had engagements which prevented his being present.

Principal Dawson, of Montreal, always laid out work for his holidays, which took him near the sea.

Mr. David Mills, M. P., had written to say that he had duties to fulfil which would render it impossible for him to be present this year.

Dr. Haanel, of Victoria College, would take the place of Principal McVicar, of Montreal, who had consented to deliver an address, but had afterwards asked to be relieved this year.

Dr. Ryerson had left an address, which would be read that evening; and the late President, Professor Goldwin Smith, kindly consented to address the Association.

The Secretary suggested that a minute should be prepared in reference to our regretted friend, the late J. B. Dixon, of Peterborough.

He moved, seconded by Mr. W. McIntosh,

That the following members be appointed a Committee to draft a minute, expressive of our esteem for the late J. B. Dixon Esq., M. A., late Head Master of the Peterborough C. I.: Messrs. E. Scarlett, W. Anderson, W. McIntosh and the mover.

A Copy of the Minute to be sent to the family of Mr. Dixon.—Carried.

Mr. R. Alexander introduced the first subject on the Programme.

The Method of preparing and revising "Text Books."

He said that instead of making any lengthened remarks on the subject, he would offer the following resolution, seconded by Mr. Suddaby:—

That, in the opinion of this Association, there should be provision made for the thorough examination of new Text Books, and the careful revisions from time to time of such Text Books as are or may be authorized;

Therefore be it resolved that the appointment of a Committee for the above purpose be respectfully urged on the attention of the Minister of Education; and further, that the Committee be selected from a list of names furnished by Inspectors, County Associations, or the Provincial Association.

Messrs. Miller, (Walkerton) Macallum, Sullivan, Suddaby, Moran, McIntosh, Scarlett, McMurchy, Strang, Brown, Dearness, McKellar, Campbell, Osborne, Smith, and the Mover, took part in the discussion, which was adjourned.

It was moved by Mr. H. Dickinson, seconded by Mr. A. McMurchy,

That the hours of meeting for this Convention be from 2 to 5 o'clock p. m., and from 7.30 p. m. to adjournment; the forenoon of each day being for Committee Meetings of the different sections of the Association.—Carried.

Evening Session.

The Vice-President took the Chair at 7.30 p. m.

PRESIDENT'S ADDRESS.

The Secretary read a communication from Dr. Ryerson, the President, expressing unabated interest in the work of the Association, together with an address to the Inspectors and Teachers of High and Public Schools, written by him at the time of his retirement from office, and then published in the "Journal of Education."

The Paper dealt with the qualifications, character and remuneration af teachers, and pointed out the great improvement which had taken place in these matters of late years.

Mr. J. H. Knight moved and Mr. Scarlett seconded a vote of thanks to Dr. Ryerson for his able address.

RECEPTION OF DELEGATES.

Mr. Strang reported on behalf of the County of Huron Teachers' Association, of which he gave an interesting account. He stated that about 160 teachers attended during the year, and that good work had been done.

Professor Goldwin Smith was then introduced, and explained that he had been called on during the afternoon to fill a gap, and hoped the Association would excuse him if his address was not of such interest as it might be.

He delivered a very interesting address on "A Tour in England."

The address was well received, frequently applauded, and listened to with the greatest attention.

Mr. W. Anderson moved, seconded by Mr. A. Macallum,

That a vote of thanks be given Prof. Goldwin Smith for his excellent address.—Carried.

Prof. Smith, on behalf of Mrs. Smith, invited the members of the Association to meet them at the Grange on the afternoon of Wednesday, *after* 5 o'clock.

Mr. White, ex-President of the National Teachers' Association of the United States, and Principal of the New York Normal School, addressed the Convention, on the invitation of the Chairman.

Mr. J. R. Miller moved, seconded by Mr. E. Scarlett,

That a hearty vote of thanks be given Mr. White for his kind remarks and friendly greeting.

Mr. White, in acknowledging the vote of thanks, stated that the next National Convention would probably be held at Put-in-Bay, Lake Erie, and hoped to see a large attendance of Canadian educationists.

The Convention then adjourned.

Wednesday, August 9th, 1876.

The Convention met at 2.30 p. m.

Mr. R. McQueen, First Vice-President, in the Chair.

Rev. Mr. Grant opened the Convention by reading a portion of Scripture and engaging in prayer.

The minutes of the previous meeting were read and confirmed.

The Auditing Committee reported that they had examined the Treasurer's books and vouchers and found them correct.

Mr. R. Alexander moved, seconded by Mr. McMurchy,

That the Auditor's Report be received and adopted. —Carried.

Mr. Richard Lewis (of Toronto) introduced the next subject on the Programme, viz:

"The Examination of Public School Teachers."

The discussion of the subject was participated in by Messrs. D. C. Sullivan, S. McAllister, A. Macallum, W. McIntosh, J. Seath, W. J. Connor.

Mr. Sullivan moved, seconded by Mr. Wadsworth,

That a vote of thanks be given to Mr. Lewis for his Paper on "Examination of School Teachers."—Carried.

The discussion on Mr. Lewis' Essay proceeded until the hour of adjournment, when the members of the Association repaired to the Grange, where they were warmly received and sumptuously entertained by Mr. and Mrs. Goldwin Smith.

Evening Session.

The First Vice-President in the Chair.

Mr. J. Seath, B. A., (of St. Catharines) read an admirable paper on the High School System, which was listened to with marked attention, eliciting a warm discussion, in which the following members took part: Dr. Crowle, Messrs. Dawson, A. Purslow, J. Strang, Brown, J. W. Connor, A. Miller, W. B. Harvey, McGregor, W. McIntosh, A. Macallum, W. Carlyle, D. J. McKinnon, A. McMurchy, J. C. Glashan and J. Seath.

Mr. Purslow (of Port Hope) moved, seconded by Mr. Strang (of Goderich), that a vote of thanks be given to Mr. Seath for his thoughtful and excellent paper.—Carried.

The Association then adjourned.

The Convention met at 2 o'clock p. m.

Mr. R. McQueen, First Vice-President, opened the Meeting by reading a portion of Scripture and engaging in prayer.

The Minutes of the previous Meeting were read and approved.

ELECTION OF OFFICERS.

The Nominating Committee, recommended the following names as officers for the ensuing year:—

President—Rev. Principal Caven of Knox College.

Recording Secretary—A. McMurchy, Esq., M. A.

Corresponding Secretary—James Hughes, Esq., P. S. I.

Treasurer—S. McAllister, Esq.

All were unanimously elected.

THE COUNCIL OF PUBLIC INSTRUCTION.

Mr. James Hughes addressed the Convention on the next subject on the Programme, viz:—

Should the Council of Public Instruction be continued, and made some valuable suggestion.

Mr. James Hughes moved, seconded by Mr. A. McMurchy,

That a committee consisting of Messrs. Seath, McMurchy and Dawson, of the High Section; *Messrs.* Johnston, McAllister and Alexander, of the Public School Section; and Messrs. McCallum, McIntosh, and the Mover, of the Inspection Section, be appointed to confer with the Minister of Education with a view to secure the establishment of a representative Board, to advise with him on Educational matters.

EXAMINATION OF PUBLIC SCHOOL TEACHERS.

The discussion of Mr. Lewis' paper, postponed from the previous day, was then resumed; Mr. McAllister introduced the following series of resolutions, which were the expression of the Public School Section in which they had been thoroughly discussed, they were not his resolutions but those of the Section.

The resolutions were taken up seriatim.

The first resolution was carried unanimously, without discussion. It read as follows:—

That in the opinion of this Association, extended experience in successful teaching, should be recognized on important element in grading first and Second Class Certificate.

The second resolution was then introduce.

The Candidates for the grades of first and second Class Certificate should be allowed the option of taking up the whole of the subjects at one examination, or of dividing them into the work of not more than two subsequent examinations. If they take up the whole at one examination and fail, they would require to be examined next year in those subjects only in which they failed.

Mr. Suddaby moved, seconded by Mr. Moran,

That in the opinion of the Association, it is advisable that candidates for first and second class certificate be examined in all the subjects at the same time as heretofore; that all persons holding third class certificate be required to write second class paper at the expiration of three years; that the Inspector be authorized to extend for one year the certificate of Candidates, who having failed to take a second class certificate, nevertheless made per cent in arithmetic and Grammar, separately and per cent on the whole.

As an amendment to the amendment,

Mr. McIntosh moved, seconded by Mr. Knight.

That all the words after "heretofore" be struck out.

An animated discussion ensued in which the following members participated, viz.: Messrs. Lewis, McIntosh, Dickenson, Brown, Smith, Slack, Knight, Phillips, Alexander, Johnston, Moran, Campbell, Scarlett and Anderson; several members referred to the evil system of cramming, others to the evil effects of the present system of examination.

The amendment and amendment to the amendment were put and lost.

Mr. Strang then moved in amendment, seconded by Mr. Smith,

That the resolution be amended by striking out the words "second class," and changing the words "two subsequent examination" to "one examination."

This amendment was also lost.

Mr. McKinnon moved, seconded by Mr. Lewis,

That the resolution be altered so as to read "No more than one Subsequent examination."

This amendment was also put and lost.

The original motion was then put and carried by 32 to 24.

The remaining resolutions were carried without amendment, and the Secretary was instructed to forward a copy to the Minster of Education

THE COUNCIL OF PUBLIC INSTRUCTION.

Mr. McMurchy, resumed the discussion on Mr. Hughes' motion respecting the Council of Public Instruction. He considered that there should be a large representation of Masters on the Central Committee. The right that they should be represented on the Council of Public Instruction had been granted to them after many years struggle, and had recently been taken away. He desired to see that privilege renewed.

Dr. Kelly thought it useless to create an advisory Board, because the Minister of Education was not bound to accept their advice.

Messrs. Dickenson, Seath and Scarlett, took part in the discussion of this motion.

Mr. Suddaby moved, seconded by Mr. S. Miller,

That the names of Messrs. Moran and Dickenson be substituted for those of Messrs. McAllister and Alexander.

He gave as his reason that the latter were opposed to representation in the Central Committee. Mr. McAllister explained that he was not opposed to it, but advised that the question be dropped for a year.

Mr. Alexander stated he would not work on the committee if elected after what had been said.

Mr. Knight advised the Association to give the Minister fair play, and not to hamper him with obstacles; but allow him his own way for some time.

The amendment was put and lost;

And the motion of Mr. Hughes was—Carried.

The Convention then adjourned.

Evening Session.

The Convention resumed work at 7.30 p. m.

The Vice-President introduced Dr. Haanel, of Victoria College, Cobourg, who read a most interesting, eloquent, and learned paper, on "The constitution of matter," in which he treated of the divisibility, atomic constitution of matter, and the molecular constitution of the elements. He concluded by claiming that they were all subjects to a first cause, a unique and universal God.

Mr. Moran moved, seconded by Dr. Kelly,

That a hearty vote of thanks be given to Dr. Haanel, for his very excellent and learned Essay.

The motion was unanimously—Carried.

CENTENNIAL TRIP.

Dr. May was called on by the Vice-President, to give some information regarding the contemplated trip to the Centennial. He gave particulars of his scheme, for the excursion at a cost of $25 per head, and offered to accompany them, introduce them to educationists in Philadelphia, and do all in his power to render the trip both profitable and agreeable. He stated that many of the Teachers in the United States did not know where Ontario was. The folk rather laughed at him when he spoke of the admirable school system in Ontario.

A committee was appointed consisting of Messrs. McMurchy, McAllister and Hughes, to wait on the Minister of Education, asking an extension of the Holidays for one week, such time to be considered as visiting days (by the Inspectors and Trustees), for those who would avail themselves of these in order to attend the Centennial and take advantage of this cheap trip.

Mr. Dearness moved, seconded by Mr. Brown,

That a vote of thanks be given Dr. May for his kind offer.—Carried.

The following delegates reported on behalf of their Associations:—

Mr. McIntosh, Hastings.
" Morgan, Stratford, Perth.
" Suddaby, Waterloo.
" Dearness, East Middlesex.
" Dawson, South Hastings.
" Coutes, Halton.
" McArdle, Ottawa.
" L. Clarke, Toronto.
" McQueen, Wentworth.
" Harvey, Gray.
" Brown, Peterborough.
" McIntosh, Northumberland.
" Dickenson, North York.

REPORTS OF SECTION.

The High School Masters' Section, and the Public School Teachers' Section presented their reports which were adopted.

The discussion on "Text Book" was dismissed, as the Association had not time to continue it.

Mr. Dickenson moved, seconded by Mr. McMurchy,

That Mr. Dawson be appointed a delegate to represent this Association at the Protestant Teachers' Association in Quebec.—Carried.

It was decided to hold the next Teachers' Convention in Toronto.

Mr. Seath moved, seconded by Mr. Dawson,

That this Association desire to record their appreciation of the courtesy of their former President, Prof. Goldwin Smith, and to give public expression of their thanks to Mrs. Smith and himself for their hospitality.—Carried.

Mr. McIntosh moved, seconded by Mr. Dickenson,

That votes of thanks be given to the Railroad Companies for reducing the fares; to the Education Department for the use of the Hall; and especially to the City newspaper for their full and accurate reports of the proceedings; and to Mr. McQueen for his able conduct in the chair.

The National Anthem was then sung, and the Convention closed.

ARCHIBALD McMURCHY, *Secretary*.

TREASURER'S REPORT FOR THE YEAR 1875-6.

RECEIPTS.

Deposit in Loan Society, $88 69. Interest on same $5 40	$ 94 09
Cash in hand	6 22
Members Fees	44 50
Copies of Annual Report Sold	41 20
Advertisements in Annual Report	30 00
	$216 01

EXPENDITURE.

Printing Annual Circular $20 75. Annual Report $74 91	$ 95 66
Secretary's account for Postage etc., $6 50. Treasurer's postage $1 00	7 50
Advertisements $2 00. Caretaker of Normal School Buildings $4 00	6 00
Balance on Deposit $94 09. In Cash $12 76	106 85
	$216 01

Audited and Found Correct. { WM. ANDERSON. A. MACALLUM.

PROCEEDINGS OF PUBLIC SCHOOL SECTION.

Wednesday, August 9th, 1876.

First Session of P. S. Section, held this morning in the Theatre of the Normal School, R. McQueen, (Kirkwall), in the chair.

At the request of the Chairman, Mr. Dickenson the Secretary opened the meeting with reading Scripture and prayer.

Minutes having been printed were held as read and approved.

A communication from Dr. May was laid on the Table.

Moved by Mr. McAllister, seconded by D. Johnston,

That the Secretary be requested to enquire at the Department whether any instructions or regulations exist to guide the action of the Central Committee, and, if any such exist, that a copy be supplied for the use of this Section.—Carried.

The following series of resolutions was introduced by Mr. McAllister:

1.—That in the opinion of this section, extended experience in successful teaching should be recognized as an important element in granting first and second class certificates.

2.—That Candidates for the grades of both first and second class certificates should be allowed the option of taking up the whole of the subjects at one examination, or of dividing them into the work of two subsequent examinations—if they take up the whole at one examination and fail, they should be required to be examined the next year in those subjects only in which they failed.

3.—That means of appeal for first class Candidates should be provided as in the case of second and third class Candidates.

4.—That the Central Committee should be required to assign the limits for each class of Candidates at the Commencement of each year, and to indicate, as far as it can, the means to be used in the preparation of the various subjects of examination, for the guidance of the Candidates who have not the opportunity of attending a Normal School.

5.—That the Central Committee should be required to adopt some effectual means to prevent the recurrence of such

serious errors as the papers at recent and previous examinations, and which have caused serious inconvenience and loss to many Candidates.

The discussion on the above was participated in by Messrs. Alexander, Dickenson, McKellar, Osborne, Suddaby, and others. The greater part of the session was spent upon them, and on being voted on, (seriatim) were carried. Mr. McAllister being requested to present them before the general Association at the afternoon session, immediately following Mr. Lewis' paper on the "Examination of Public School Teachers."

Mr. Dickenson moved, seconded by Mr. McAllister,

That the Summer Vacation for Public schools be the same as that for High Schools.—Carried.

On motion the Secretary was requested to ascertain and have it announced at the afternoon Session, whether Mr. Kirkland would be able to take up the subject assigned him at our next Session.—Carried.

Section adjourned.

Thursday, August 10th, 1876.

Second Session of P. S. Section opened in the usual form by the Chairman, Mr. McQueen.

Minutes read and confirmed after slight amendment.

Mr. Dickenson reported that on making enquiry at the Department, no instructions or regulations for the guidance of the Central Committee are in existence.

Mr. Moran moved, seconded by Mr Moir,

That the Secretary be instructed and empowered to put himself in communication with local Associations with a view (1) to getting them to work in connection with this, (2) to securing names of Officers, times of Meeting, Rules, Subjects discussed and the results arrived at in their Meetings and that managing Committee be instructed to submit all the questions to be discussed in the General Association and the various sections to the Local Associations throughout the Country, at least four months previous to the Meeting of this Association, and that the Local Associations be requested to send delegates to the Annual Convention, to represent their views or the subjects set

forth in the programme, or any other that such delegates may bring before the Convention. After remarks upon the above by the mover and seconder, also by Messrs. Johnston, McAllister, Dickenson, Campbell and Alexander, the motion was put to the Meeting and—Carried.

Mr. Dickenson then moved, seconded by Mr. McKellar, That Public School Masters and Teachers be granted similar representation on the Central Committee, as they formerly had on the Council of Public Instruction.

The motion was supported briefly by the mover and seconder, Messrs. Moran and Johnston. Messrs. Alexander, McArdle and McAllister opposed the motion. On a vote being taken the motion was lost.

The Election of Officers for the Ensuing year was then proceeded with and resulted as follows :—

R. Alexander, of Galt, Chairman.
H. Dickenson, of Newmarket, Secretary.

Executive Committee.
- Mr. Clarke, of Toronto.
- " Dearness, of London.
- " Moran, of Stratford.
- " Johnston, of Cobourg.
- " Dickenson, (the Secretary.)

Mr. Alexander, moved, seconded by Mr. Johnston, that a vote of thanks be tendered to Mr. McQueen, for the able manner in which he discharged the duties of Chairman of the section. The resolution was briefly supported by Mr. McAllister, and—Carried.

Moved by Mr. McAllister, seconded by Mr. Moran, that a hearty vote of thanks be also passed to the Secretary for the efficient manner in which he had discharged his duties. —Carried.

Messrs. McQueen and Dickenson responded.

Moved by J. Campbell, seconded by Mr. Johnston.

That in the opinion of this section it is desirable that the distribution of the Superanuation Fund be according to a certain Classification, so that each Teacher incapaciated or retiring from the Profession after teaching twenty-one years, may receive a proportionate amount to that paid in annually.

After the discussion had been continued for some time by the mover and seconder, Messrs. McQueen and Osborne, it was suggested that the further discussion be postponed, and that if time permit the matter be brought up in the General Association.

The Secretary reported that owing to Mr. Kirkland's, absence from town and the illness of Mr. Hughes' Child, both those gentlemen were unable to fulfil their appointments with this section. Section finally adjourned.

H. DICKENSON, *Secretary*.

PUBLIC SCHOOL INSPECTORS' ROOM.

Educational Department.

August 9th, 1876.

In the absence of the Chairman and Secretary, Messrs. Macallum and MacKintosh were appointed to fill these positions *pro tempore*.

The subject of School Registers was taken up.

A form of Register and Class Book, used in the County of Wentworth, and the form of Daily Register in use in the Schools of Hamilton, were laid before the section by Messrs. Smith and Macallum. At the request of the section Mr. Smith, gave full explanations in regard to his "Forms."

After an informal discussion it was in motion resolved to consider the form of General Register issued by the Department of Education in detail—column by column.

An animated discussion ensued in which the following gentlemen took part, viz: Messrs. Dr. Wadsworth, Knight, Dearness, Little, Harrison, Scarlett, Macallum, MacKintosh, McKinnon, Carlyle, Brown.

August 10th, 1876.

The section met at the usual time and place.

The minutes of the previous meeting were read and confirmed.

The consideration of the General Register was resumed and after further discussion the subjoined specimen sheet of a General Register was adopted.

Register Number.	65
Pupil's Name.	John Jones.
Date of Birth.	1860
Parent's Name.	Absalom Jones.
Residence.	
Date of Admission to School.	1875

CLASSIFICATION.

ADMISSION AND PROMOTION.

I	First Reader. Part I. / Second Reader. Part II. / Second Reader.
II	
III	
IV	
V	
VI	

ATTENDANCE (from Half-yearly Reports) AND TEACHER'S NAME.

(Teacher's Name to be placed below this, vertically.)

187....	1st half.	John Squeers.	108	187....	1st half.	Jas. Sampson.	119	187....	1st half.	.....		187....	1st half.
	2nd half.	John Squeers.	92		2nd half.	Jno. Currie.	101		2nd half.	.....			2nd half.

London. Apprenticed to a Printer.	General Remarks, showing destination on leaving School, Occupation, &c.

It was also resolved, (1) that the General Register of School Population, as formed on the last page of the Departmental General Register, should be retained, but that the date of birth should be substituted for the age; and (2) that all School Registers should be manufactured of good paper, be strongly bound with boards, and provided by the Department of Education, free of charge, to Inspectors for distribution.

The daily Register at present in use in Public Schools, was then taken up for consideration, but, after some discussion it was resolved to postpone any action in regard to it until the meeting of the section in 1877.

The following were elected Officers of the section for the ensuing year, viz: J. H. Smith, Inspector of Wentworth, Chairman; W. MacKintosh, Inspector of N. Hastings, Secretary.

Executive Committee:—D. J. McKinnon, Inspector of Peel; A. Macallum, Inspector of Hamilton; J. H. Knight, Inspector of East Victoria; Hugh J. Strang, Principal, Goderich High School, and the Chairman of the section *ex officio*.

A discussion followed on the blank form provided by the Department for Rural School Trustees' Annual Reports.

The following Gentlemen took part in the discussion during the session:—Messrs. Slack, (Lanark), Smith, (Wentworth), Dr. Wadsworth (Norfolk), Dearness (Middlesex), Knight (Victoria), Mackintosh (N. Hastings), Dr. Agnew (Frontenac), Little (Halton), McKinnon (Peel), Hodgson (York), Scarlett (Northumberland), Carlyle (Oxford), Brown (Peterborough), Henderson (Paris), Harrison (Kent), Dr. Kelly (Brant), Macallum (Hamilton).

Section adjourned until 9 a. m. Friday.

August, 11th, 1876.

Mr. Carlyle in the chair.

The minutes of the last meeting were read and confirmed.

The consideration of the blank form for Trustees annual report was resumed, and after careful deliberation it was resolved to recommend a form differing in a number of its details from the departmental form.

The following are the changes recommended to be made, viz. (the columns referred to are those in the form *now* used):

In columns 29 to 32 the words "with or without board" to be omitted; 33, 34, 35 and 36 to be replaced by one column headed "Religious denomination of teachers;" in 45 and 46 the word "general" to be struck out; 50, 51, 52, 53 and 54 to be struck out; 61 to be replaced by two columns for "The number of resident children between the ages of 7 and 12, who have not attended any school," and "The number of resident children between 7 and 12 who have attended school less than 70 days;" 78, 79 and 80 to be replaced by one column for the "Number in geography;" 83 and 84 by one column for the "Number in grammar;" 87, 88 and 89 by one for "Number in history;" in 92 the word "collier" to be omitted; 93 and 94 to be struck out; an additional column to be inserted after 102 for answers to the question, "Are the Scriptures read in school?" It was further recommended that separate volumes be provided for the length and "breadth" of school house; that 114 be headed, "How many rooms for recitation?" and that 122 be headed "How many privies?" The column for "Total number of maps in school" was recommended to be placed after that for "Number of other maps;" column 139 to be replaced by two columns headed "Are tablet lessons used?" and "Are object lessons taught?" respectively; 149 to 154, both inclusive, to be struck; in 160 the words "text books and" to be struck out; in 163 the words "and merits cards used" to be omitted; in 165 and 166 the words "and by whom delivered" to be omitted; 168 to 176, both inclusive, to be struck out, and that a column be provided for the "Name of the teacher engaged for next year."

The forms provided for the Inspectors' "statistical" and "special" reports were taken into consideration, and after discussion the following resolutions were adopted *nem con.*

(1.) "That the columns of the Inspector's "annual statistical" report should be sufficiently wide to receive easily the numbers to be placed in them, and should correspond exactly in numbering and order with the columns of the Trustees' annual report, all columns in the Inspector's report

asking for information not required in the Trustees' annual reports to be placed at the end of the former, so as to facilitate the labour of copying the latter."

(2.) "That the time at which Inspectors' 'statistical' and 'special' reports are required to be forwarded to the Minister of Education should be changed from the 1st of February to the 1st of May, so that Inspectors may be able to avail themselves of the facilities for traveling which are usually afforded in the winter months, and devote themselves to the labour of compiling these reports, when the roads are broken up in the Spring."

(3.) "That while, as Inspectors, we are anxious to discharge thoroughly the duty of supplying the Department of Education with the results of our official visits, we would respectfully state that, in our opinion, the form for the Inspector's "detailed report" should be materially modified with a view to its abbreviation, such modifications not to affect the necessary requirements of the Department."

(4.) That Messrs. Carlyle, Hodgson and Wadsworth be and are hereby appointed a committee to confer with the Minister of Education with reference to all resolutions adopted by the Section at its present meeting."

The following gentlemen took part in the discussions during the day, viz: Messrs. Brown, McKinnon, Dr. Wadsworth, Harrison, Mackintosh, Carlyle, Dr. Agnew, Scarlett, Dearness and Hodgson.

Meeting closed at 1 p. m.

W. MACKINTOSH,
Secretary.

HIGH SCHOOL MASTERS' ROOM,
Education Department,
August 9, 1876.

The High School Section met this morning at half-past nine o'clock.

The meeting having been called to order,

It was moved by Mr. Seath, and seconded by Mr. McMurchy,

That Mr. Sullivan act as Chairman ot the Section.—Carried.

Moved by Mr. Seath, seconded by Mr. Miller,

That Mr. Strang act as Secretary.—Carried.

Mr. McGregor brought up the question of the assimilation of the matriculation examinations for the various universities and professions. Mr. Anderson having stated that the Chairman of the Committee appointed last year to act in the matter would be prepared to report before the adjournment of the Section, the matter was allowed to stand over.

Mr. Dawson took up the subject of "Intermediate Examination." A discussion followed which was participated in by Messrs. Miller, Seath, Strang, McMurchy, Connor, Grant, Crowle, Tamblyn, Whighman, McGregor, Spotton and Rathwell. The discussion was brought to a close by Mr. Dawson,

Who moved, seconded by Mr. Rathwell,

That a Committee consisting of Messrs. Seath, Strang, Miller, McMurchy, and the mover, be appointed to draw up a series of resolution on the subject of Intermediate Examinations, and report at the meeting of the section to-morrow Thursday morning.—Carried.

The section then adjourned to meet again to-morrow morning at 8 o'clock.

August 10th, 1876.

The section met again this morning at half past eight o'clock. In the absence of the Secretary who was engaged with the Committee appointed to consider the question of Intermediate Examinations, Mr. W. B. Harvey was appointed temporary Secretary.

The minutes of yesterday's meeting were read and confirmed.

Mr. Purslow, then took up the subject of "High School Programmes," and a discussion followed which was participated in by several members.

It was finally moved by Mr. Strang, seconded by Mr. Spotton.

That in the opinion of this section, it is desirable that before any changes in the University Matriculation, Examination is made, in future a draft of the proposed changes should be sent to each Head Master, in order to obtain an expression of opinion on these changes; and that a copy of this Resolution be forwarded to our Representative on the University Senate.—Carried.

The Secretary then presented the report of the Committee appointed to consider the question of Intermediate Examinations. The four resolutions submitted in the Report having been discussed, and voted upon Seriatim, were all adopted either unanimously or by very large majorities.

The report was as follows.

The Committee appointed to consider the question of Intermediate Examinations, beg leave to report

That in the opinion of the High School Section, it is desirable,

1.—That having passed the Intermediate Examinations, shall be considered as equivalent to having passed the Junior pass Matriculation Examination of the University, the Examination for a teacher's certificate, and the preliminary Examinations of the Law Society and Medical Council, with such nodifications for such examination as may be deemed necessary.

2.—That pupils who have passed the matriculation Examination of the Universities, or the Examination for 2nd class certificates, shall be considered as having passed the Intermediate Examination next preceeding.

3.—That the masters be furnished with full information regarding the result of the examination of each pupil in each subject.

4.—That the test subjects for the Intermediate Examinations be grouped in the following manner: (1) Algebra, Arithmetic and Euclid. (2) English Grammar, Composition and Dictation. (3) History, Geography and English Literature. And that Candidates who obtain 40 per cent of the total in each group, and not less than 20 per cent. in each subject, shall be considered as having passed the Examination.

Some discussion then took place in regard to the fixed Grant and High Schools; and it was

Moved by Mr. Dawson, seconded by Mr. Tamblyn,

That, in the opinion of this section, the fixed Grant of $400 for each High School should be increased to $500, without however, reducing the amount distributed in other ways for High School purposes.—Carried unanimously.

Moved by Mr. Strang, seconded by Mr. Connor,

That a Committee consisting of Messrs. Seath, McMurchy, Dawson, Purslow, Miller and Crowle, be appointed to consider the best means of giving effect to the foregoing resolutions, and to take such action, in the name of the Section, as they may think proper.—Carried.

Moved by Mr. McGregor, seconded by Mr. Connor,

That the Executive Committee of the H. S. Section for the ensuing year consist of Messrs. McMurchy, Purslow, Dawson, Strang and Dr. Comfort.—Carried.

Mr. McMurchy then, on behalf of the Committee appointed for that purpose, reported, orally, what had been done towards securing assimilation of the Entrance Examinations for the various Universities and learned professions.

The Section then adjourned at noon.

PAPERS READ
BEFORE THE ONTARIO ASSOCIATION
FOR THE ADVANCEMENT OF EDUCATION.

PRESIDENT'S ADDRESS.

To the Teachers' Association of Ontario:

MY DEAR FRIENDS—Necessary absence from the country will prevent me from fulfilling the duties of the office to which you last year did me the honor to elect me as your President.

I need not say that I feel an unabated interest in the great work in which you are engaged, and in your own success and prosperity.

In my personal absence, I append a copy of a paper which I prepared and had published on my retirement from office, a few months since—addressed to the Inspectors and Teachers of High and Public Schools. I can add little to what I have said in that address, except to express my lively interest in your proceedings, and deep sympathy with and earnest prayer for your individual and collective welfare and happiness. I remain as ever

Your faithful friend and servant,

E. RYERSON.

To the Inspectors and Teachers of High and Public Schools:

In addressing to you a few words on the termination of my long official connection with you, I cannot address you wholly as *gentlemen* (as I have done Municipal Councils and School Trustees), since of the 5,736 teachers employed in the public schools, 3,135 of the mare females. I address you as friends and colleagues—having been myself a grammer school teacher two years before I commenced my public life.

(*Elevation of the Profession.*)—In devising a system of public instruction for our country, the first thing needful was to exalt the office of the teacher. To do this two things were necessary: first, to elevate the qualifications and character of teachers; secondly, to provide better and more certain remuneration for their services. I need not say, what so many of you know, how low, a generation since, were the qualifications of by far the greater number of teachers, and how lower still was their moral character, and how poor and uncertain was their remuneration, and how wretched the places in which they taught. There were noble exceptions in all these respects—but they were exceptions, to the general prevalence of ignorance, vice and neglect. Of course much allowance is to be made on account of the infancy of the country, and the sparseness and penury of its hard-working inhabitants. But all the old inhabitants will bear witness that the state and character of the schools and teachers were such as I have indicated.

(*Normal Schools, Teacher's Remuneration.*)—To improve the qualifications and character of the teachers two things were requisite—a school for the training of teachers, and competent Boards to examine and license them, making good moral character one element of qualification. A normal school trained and could train but a small proportion of the public school teachers; but it has furnished examples and given a standard for qualifications of teachers and of teaching, the influence of which has been felt in every part of the country. With the improved qualifications and character of teachers, naturally followed their better remuneration; and to aid in promoting and rendering this more certain, the laws were improved, investing trustees with larger powers and securing to teachers the prompt and certain payment of their salaries. Though there is still much room for improvement, a contrast, rather than comparison, may be instituted between the qualifications, character, remuneration, social position and place of labour of the teacher of the present day and the teacher of thirty years ago.

(*County Boards—Improved status of the Teacher's Profession.*)—For several years after the establishment of County Boards of Public Instruction for examining and licensing teachers, it was complained teachers were subject to examination by Boards, the members of which were not teachers themselves, and many of them incompetent for the office. That just ground of complaint has been removed by the qualifications of members of Examining Boards being prescribed by law, and none being eligible for the office except graduates of some English or Canadian University, with testimonial of experience as a teacher, and teachers holding Provincial life first-class certificates. Another just ground of complaint remained, namely, that the schools were superintended by persons who had not been teachers, and were not qualified for the work. *Now*, no person is eligible to be a public

school inspector who does not hold a certificate from the Educational Department of the highest grade of the highest class in his profession. Thus is the profession of the public school teacher placed upon the same footing as the professions of law and medicine. It now only remains that the school text-books (the copyright of which is public property, under the control of the Education Department) be subject as occasion may require, to the revision by select members of the teaching profession, and by them only.

(*Superannuation of Teachers.*.)—The heart almost recoils at the recollection of years of varied and often discouraging toil required to overcome the prejudices and obstacles in order thus to elevate the teacher's profession to its true standard of competence, dignity and performance, and you are all aware of the storm of opposition which was raised against the last and most humane step taken to give increased value and stability to the teachers profession by providing for the relief of its aged and disabled members—a provision now universally popular within and without the profession. In 1853 the Legislature was with difficulty induced to grant $2,000 a year, which was afterwards increased to $4,000 and then $6,000, in aid of superannuated and worn-out public school teachers. High school teachers are now included, and the Legislative grant for the last year reported (1874) was $23,100, nearly one-half of which was contributed by the profession itself.

(*Salaries of Teachers:*)—I am aware that the remuneration of the profession is not yet what it ought to be, It should be the aim of every teacher to add to the value of the profession and its labours by good conduct, diligence and increased knowledge and skill; and the experience of the past shows that the country will not be slow to increase the remuneration of labours thus rendered increasingly valuable; for while the amount of salaries paid to 2,706 public school teachers in 1844 was $206,856, the amount of salaries paid to 5,736 public school teachers in 1874 was $1,647,750. It is gratifying to reflect that whatever sums are provided and expended for any educational purposes are all expended in the country, and therefore do not impoverish it in any respect. but tend to enrich it in the highest respect and in various ways.

The High Schools.—In regard to High Schools, formerly called Grammar Schools, the law for their improvement and their administration by the Education Department dates back to only 1852, at which time their number was eighty-four, the number of their pupils 2,643, and the Legislative grant in their aid was $20,567; in 1874 there were 108 High Schools, 7,841 pupils, and the Legislative grant in their aid was $75,553, in addition to which a sum equal to half that amount was required to be raised by County and City Councils, all of which to be sacred for the payment of salaries of masters and teachers; and corporate powers in Boards of Trustees to provide additional means for the payment of teachers, and the erection, repairs and furnishing of buildings. In 1852 there were no Inspectors of High Schools; now there are three very able and efficient High School Inspectors. In 1852 the whole amount of salaries paid High School teachers was $38,533; in 1874 the amount of salaries paid High School teachers was $179,946. The improvements in the operations and efficiency of the High Schools have, I believe, kept pace with their finan-

cial and material improvements. In no part of our school system have more opposition and buffetings been encountered than in effecting these changes and improvements.

(*The New Minister.*)—In terminating my connection with the Inspectors and teachers of High and Public Schools, I feel that, with all the defects and mistakes of my administration—and no one can be more deeply conscious of them than myself—I have, under very many difficulties, rendered you the best service in my power. In my retirement and advanced years I shall feel unabated interest in your success and happiness, while I shall enjoy the satisfaction of knowing that the honourable gentleman who succeeds me, with the rank and title of Minister of Education, is animated with the warmest zeal, and possesses much higher qualifications and greater power than I have been able to command, to advance your interests and promote the sound and universal education of our beloved country.

Yonr faithful friend and servant,

(Signed) E. RYERSON.

TORONTO, March 2nd, 1876.

THE EXAMINATION OF PUBLIC SCHOOL TEACHERS.

BY RICHARD LEWIS, ESQ., TORONTO.

I propose to direct the attention of this convention to the following points, as bearing on the examination of public school teachers:

1.—The principle upon which certificates are now granted.

2.—The subjects of examination, especially for the award of the first class certificate.

3.—Suggestions as to alterations and remedies.

There is no question as to the necessity for the examination of public school teachers. The importance of the duties to be discharged demands fitness for the office, and the certificate granted by an authorized educational body gives the best evidence to the country that the teacher receiving that certificate possesses the proper qualifications. The difficulty, however lies in deciding what are the necessary qualifications. If the limited demands of the public school were made the standard and measure of the educational attainments of the teacher, there would be no difficulty in the question. In view of the extensive character of the work, and of the number to be educated—the masses of the people who are destined to follow industrial pursuits—more than what is called elementary education, will always be impracticable if not unnecessary. The subjects on the programme for the public schools of this Province are, in this view, ample and liberal; and already it is becoming a serious question whether we have not gone too far in this direction, whether, in our ambition to secure too much we are not losing our hold of the solid and the essential, A similar error was committed by the friends of public education in England

when, in 1846, the programme of studies was issued; and it was not until the Royal Commissioners had given their report, many years afterwards, in which they announced that in the schools under inspection more than three-fourths of the pupils left the schools destitute of the commonest elementary education; that the government lowered and narrowed the programme, wisely regarding thoroughness and excellence in the essential elements of education as more important beyond measure than the ambitious attempts which had so signally failed.

The qualifications of the teacher must embrace all that is demanded by the programme; and if the only reward open to the successful teacher, the office of inspector is to be still secured to him, he must possess those qualities of mind which general culture only can give. In those pursuits which we rank as the professions, this general culture is supposed to be secured by a University education. It should, however, be remembered that mere scholarly attainments are no security for professional success; and that evidences of large culture and ability mark the character of probably as many, especially if literature shall be regarded as a profession, who have never had the advantage of a University course as of those who have reaped its highest honors. When we select our medical or legal advisers, or our spiritual instructors, we never ask the question, what are their scholarly attainments—what degree have they won in collegiate studies? We ask do they understand their business, and we know that skill and ability in the work of their profession may or may not have been aided by collegiate studies, but must be the fruit of natural ability and experience. There is no intention here to disparage the importance of a collegiate course. All the mental discipline which that course secures prepares the student for his professional pursuits; though the subjects of scholastic study may never be required in the active work of life. In this regard, as a process of mental discipline, when the world shall come to understand the deep import of education—that to train and educate a human being and to cultivate the highest and holiest principles in the mind are duties pregnant with responsibilities and difficulties; that discipline may be regarded as necessary for the public school teacher as for the medical man, the lawyer or the clergyman. But when the public shall think fit to demand that preparatory culture in the public school teacher, it will no doubt attach the honors and emoluments to the office which shall induce young men and young women to pass through such a preparatory course. While other professions offer far higher rewards and hold a higher rank in society than that of the public school teacher, policy and justice unite to condemn a system which would raise the standard of attainments to that of the lucrative professions, but would allow the honors and emoluments to be so much below them.

The award of certificates at present is based on the principle that *attainments* constitute all that is necessary to professional excellence. Experience and skill in the work of education count for nothing. Education, it is true, forms one of some eighteen or twenty subjects, and ranks below more than half of them. But supposing a higher value were attached to it, as a mere subject of examination it only gives evidence of theoretical—of book knowledge. That practical skill of experience, which secures the highest honors and emoluments in other professions, is utterly

disregarded in that award of certificates which gives one teacher distinction over another, and which, in the award of the highest class of certificates, opens up to him the highest offices of his profession, and therefore supposes he is distinguished for skill and experience. The tendency of the present method of awarding certificates is practically to discourage professional skill, as it only demands intellectual attainments. I do not for a moment disparage the importance of attainments; but while the education of the public school teacher and public school inspector should be fully equal to the direct demands of the office, and while all liberal culture will tend to raise at once the man and the profession, the final object is the development of skill in teaching and in school management, and for all this in the award of certificates no provision is made, and the school system of Ontario refuses its highest reward to its best laborers.

THE CLASSES OF COMPETITORS.

The competitors for these certificates may be divided into two classes. One class consists of the students in Normal schools—young men and young women who probably have had no previous experience in the practical work of the school room, many of whom will continue only a brief period in the profession, some of whom no doubt intend to make that profession and the education they are receiving at the public expense a stepping stone to a better position, and none of whom can possibly be animated by the zeal and the spirit of the experienced and actual worker. There is nothing in the present system of examination to create that zeal, to sustain that spirit; and it is impossible for the students in the pressure of study and the imperfect practice allowed in the model school to train themselves for the actual labors of the school room, where they shall have no guides but their own judgment and ability. There is, however, especially to those who intend to make the profession the business of life, every inducement and every advantage to study. Successful study wins for them the highest honors of the profession, and if they accomplish that object they may enter upon their duties assured that if they possess the popular arts by which the votes of County and City Boards are won they may ultimately attain the higher office open to them. Thus from the beginning to the end of the enterprise, intellectual attainments only are necessary to success.

The second class consists of the practical teachers engaged in the actual work of the school room. Such workers when animated by the true spirit of their profession cannot fail, even without the aid of a Normal school, to become more or less skilful laborers. When their labors are successful, when their schools become distinguished for excellence of instruction and management, in that very success they give the highest evidence of personal improvement. No teacher can keep up with the demands of the times and with the competition around him without constant study. His mind must advance with the progress of the age, and it does advance. While many a holder of the Provincial certificate rests upon his laurels and considers that he has "finished" his education, there are uncertificated teachers who, in all that is requisite for successful school management and in that general culture which comes from constant study, reading and observation, are in no way inferior to the favored holders of the

highest certificates. I do not urge this in any respect as a plea for the exemption of this class from examination. The class I am describing are doubtless the most anxious to secure the highest degrees of honor awarded to their profession, and the numerous candidates engaged in actual work, who present themselves for examination, give evidence how earnest is the desire amongst the best uncertificated teachers of the Province to secure the legal sanction. They devote their leisure time to the studies necessary to success; but they are not supported and cheered with the satisfaction that the knowledge and experience which have made them distinguished in their profession shall be of any avail. The more they neglect their school duties the more they can devote themselves to study, and the nearer they are to success in the examination for a certificate. Thus again we see the principle of awarding certificates only encourages the acquisition of technical knowledge. It gives no value to that general and often higher culture which the ardent mind derives from intercourse with books and with men, and from the efforts of its own promptings and aspirations; it gives no value to professional skill and experience, and finally it shows no regard for the difficulties of the candidates who have been studying under the pressures of professional labors, for it makes no distinction between the Normal school student and the working teacher.

The Programme of Examination.

There is no doubt that great dissatisfaction exists amongst a large number of the Public School Teachers, and there is no reason to believe that the dissatisfaction proceeds amongst the Normal School Students, with the Programme of Examination. It is of very great importance as a question both of policy and of justice, that the character of that programme should be fully discussed by this Convention. The Board of Examiners, the awarders of the certificates, constitute so far as the Teachers are concerned, a very irreponsible and autocratic body, against whose decision there lies no appeal. That Board possesses and exercises the power of raising the standard to any extent, upon the subjects of examination. There is no limit to the exercise of that power. It may be raised with the view, at once, of raising the character of education in the Public Schools, and as a consequence the professional and social standing of the Teacher; or, it may be raised with the view of virtually closing the office of Inspector against all who have not passed through a University course. It is very natural for the Public School Teachers to be jealous and suspicious on this ground. That feature of the new School Law when it was first announced, which opened and almost secured to the school teacher the office of Inspector, gave the deepest satisfaction. It was not only felt to be a just reward for fidelity and success in professional work, but, to those who understand the matter best, it gave promise of the best fruits in the new educational system. It is only reasonable to believe that they who practically understand the nature of a business are the best fitted to overlook and superintend its operations; and, as far as the experiment has been tried, the country has no reason to regret this act of justice to its faithful and qualified teachers. Ontario stands alone in this act of justice to the Teacher. In other countries, without any good reason but that the office is well paid, honorable, and probably where best paid, the least laborious was, it is still monopolized by

a class which can secure to its favorites, the University Education. The Teachers of the Province see signs of a similar feeling here; and, when they know that the Board of Examiners consists largely of men who have passed through this University Course, they have some reason to fear and suspect its influence, however unjust their fears may be.

Subjects of Examination.

I first ask the attention of the Convention to the subjects of examination and the values attached to them in the competition for the First-Class Certificates. If I present them the form of Language, Art and Science, I find that for English Language and Literature 425 marks are given; that Art, represented by Drawing and Music, secures 150 marks; while Science, in which I include Arithmetic, Algebra, Geometry, Natural Philosophy, Chemistry, Chemical Physics, Human Physiology, Natural History, Botany and Agriculture, receives 1575 marks. For Mathematics more than one-third of the total number are given. Evidently Mathematics stood pre-eminently high, and English pre-eminently low. No doubt the scientific subjects, exclusive of Mathematics, are important, but it is a question whether these subjects can all be retained in the Public School programme. It is certain that the distinction given to Mathematics and Science in the examination is not in accordance with the necessities of the Public School itself. I have no intention to make any comparison between the abstract value of these studies. I only consider them in their relations to the Public Schools and the public school Teacher; and in their influence upon the character of the pupils and the culture of the teacher. It is generally admitted that the native language, literary composition in its broadest and highest sense, with something of a critical and historical knowledge of English Literature, together with Drawing and Music are more important and advantageous in their influence upon the character and pursuits of the common people than Mathematical Studies; yet for all these subjects only 575 marks are given, while Arithmetic, Mensuration, Algebra. Euclid and Natural Philosophy receive 1000. It is most important that the Inspectors should be educated not only up to the highest demands of the Public School; but to the special relations they have with the people. They are the highest representatives of popular education, and as its interpreters and supervisors they should possess these qualifications of culture, manners and judgment which would give influence and dignity to their work; while in their intercourse with the teachers, they ought to present examples of refinement and general intelligence which would secure the confidence and respect of the profession. Now, while general science enlarges, language and literature and art soften and refine the mind. But, while you make such ample provision for the studies which are supposed to strengthen, you almost leave out of sight those which elevate and refine; and a teacher having the necessary Mathematical qualifications might attain the highest prize of his profession, though he should be deficient in that knowledge by which language can be made an instrument of power, and destitute of that culture which educated taste and general intelligence secure. I admit that the end in view is the public good, and that all other considerations must be made subordinate to that end. But, here the claims of taste, as developed by the study of Art, and

especially of Language and Literature, are paramount. Our Schools are spreading the power and stimulating the taste to read. Are they with equal diligence and care directing that taste into the right channels? The love of fiction and of poetry is universal—it is the passion of children. Sabbath Schools and the religious world endeavour to satisfy that passion and to divert it from the grosser fiction and poetry that tempt the young on every side, with a special literature of their own. But, literature made to order with a special moral or religious purpose is never very successful; and dime novels are always more popular than the manufactured biographies and tales of good children which the churches so liberally distribute. Every school teacher knows how the craving for the lowest literature of fiction baffles every effort to prevent it; and the history of crime, and the mental characteristics of the young give often the saddest evidence that this species of fiction, which is so much in favor, corrupts and weakens the mind and perverts all just views of life. I believe that the cultivation of a healthy taste for reading is possible, and if the same ability were shown and care taken by the intelligent teacher to interpret a play of Shakspeare, or "Paradise Lost," or a fiction of Scott, or the story of "Little Nell," that is now taken to solve a mathematical problem or explain the laws of chemical compounds, you would satisfy and direct into right channels this natural craving of the imagination, and lay the foundations of a taste which in after life would become a source of the purest gratification, and form the safest barrier against the temptations of sensuality and vice.

Well, what provision in the education of the Teacher does the standard of examination or do our Normal Schools make for cultivating this healthy taste for reading? How many of the Teachers holding the highest class of Provincial Certificates are familiar with the literature of our Country, as they are with Arithmetic or the higher Mathematics? Before the last current year of examination studies, it was considered enough if the highest class of Teachers would tell us in whose reign Chaucer or Shakspeare lived, and who was the author of Paradise Lost. An essay on Human Understanding. As Thomas Fuller puts it "they only traded in the tables and contents of authors of consequence"; they learnt the titles of books, as "city cheaters learnt the names of country gentlemen that they might brag of their acquaintance." The programme of last year led us to understand that English and Literature were to take their rank in the examination of teachers. I cannot speak of the papers; but, when we learn that only 100 marks were assigned to Literature, and only 75 to Literary Composition, which, probably more than other study, gives evidence of culture; while for each of the four Mathematical subjects 250 marks were given, the views of the Board of Examiners, and the place that a high taste for reading are to have in the Public Schools of Ontario can easily be determined.

I am not prepared to examine the quality of the questions for examination, especially in the highest grades. The School Act defined and limited the subjects as far as an act of parliament could; but it did not define and limit the character of the questions. It is manifest that an irresponsible Board of Examiners may defeat the purpose of the Act, by making the questions too easy or too difficult. Constituted, as the present

Board is, chiefly of a class separated by pursuits and previous studies from the great body of School Teachers, they will probably view the duties of their office from their own stand-point, rather than from the circumstances and necessities of the public school The Teacher of the Collegiate Institute no doubt regards the Public School as subordinate to and preparatory for his own special work and studies; and studies which do not directly bear upon the Collegiate course he regards with indifference. Thus very recently a High School Teacher, in a newspaper letter proposed that for Candidates for the higher Certificates, English Literature might, with advantage, be substituted for Music and Drawing. While in a Collegiate course English Literature may be regarded as optional and of very subordinate importance compared with Classics and Mathematics, if I am right in the estimate I place upon that study, there is an imperative demand for its introduction into the course of the Public School; and as it might really take the place and standing of Classics in the education of the Public School teacher, it might and ought to be made one of the subjects of examination for the Second-Class Certificates. The writer of the letter from his stand-point views Music and Drawing as unnecessary. These subjects no doubt are of no importance in the preparation for University distinctions; but, the best and wisest friends of popular education plan Music, because it refines the mind and is associated with so much that is human and exalted, and holy in our nature, and drawing because it not only cultivates taste but is indispensable to the manufacturing and commercial prosperity of a Country, amongst the most important and necessary branches of Public School Studies.

The design of the Public School is not to prepare for the Collegiate Institute. The great body of its pupils will never enter the Collegiate Institute. They leave the Public School at once for the business of life; and although its course of instruction can never complete their education, it ought to send to them out into the world with the best culture for the sphere they are likely to occupy, and the best discipline for life which can be supplied. They leave the school for the mechanic's workshop, and the farm, for the manufactory and the counting house. Whatever is necessary for those positions should be in the programme of their education, and whatever room may be spared for subjects outside of industrial demands, ought to have reference to their duties as citizens and as moral agents, not to any possibilities of University education or professional life. There are studies considered necessary to professional life and the higher education which should have no place in the programme of the Public School, and therefore are not necessary to the Public School Teachers or their Inspectors; and there are studies, and there is a mental and moral discipline so necessary to the welfare of the masses, that to neglect them or make them only subordinate to the higher education of Colleges would be to defraud the people of their most sacred rights, and to inflict incalculable injury on the cause of National Education. In view of the tendencies to overlooking the necessities of the Public School, and of the possibility of preparing papers having a leaning towards that higher education which the University supplies, rather than to the development of a thorough Public School system, it is proposed that the Public School teachers should be more fully represented on the Central Committee, not only by

the appointment of Inspectors, but, also, of teachers holding the highest class of certificates. Whether suspicions as to the tendencies of the present Committe be just or not, the action of this amendment could not fail to have the best effect. The presence of men holding University degrees would be a security that the papers would be all that was necessary for sustaining a proper standard ; while the addition of a just representation of the parties most deeply interested in the examination would be an assurance to the teachers of the country that no unnecessary difficulties would be placed in the way of proper ambition, and that the studies of the Public School would not be diverted to favor the views of a special class.

The Recent Examinations.

The results of the recent Examinations, so far as they have been published cannot be regarded as satisfactory, We have had a very large increase in the lowest class of teachers. Of this class about fifty per cent have passed ; but, of the second-class not more than 20 per cent and in many cases not more than 10 per cent have succeeded.

The results of the highest examination have been announced; ten competitors have been awarded First-Class Certificates. I cannot state how many candidates were present; but I see no cause to wonder why only two of the successful competitors were not Normal School students, when we understand the difficulties under which they must labor who are engaged in the exacting and harassing labors of School Teaching while they are preparing for this examination. The object then of raising the standard with the view of securing a higher order of teachers for the country is being defeated. The public estimate of national education is still low. It is satisfied with teachers of low attainments, and, worse than all, it is satisfied with teachers destitute of experience and skill. It is an historical fact in educational reforms and progress, that governments are always ahead of the people, and wherever popular education has advanced it has been due to the wisdom and liberality of the rulers more than to the demands of the people. The immense preponderance of Third Class Teachers and the cheapness at which their services can be bought will drive out of demand a higher class of teachers, and the importance of adopting measures by which so great an evil can be stayed, presses itself upon the friends of education and demands immediate and decided action on the part of the government

The object of encouraging candidates to compete for third-class certificates is, I suppose, to form a reserve from whence prepared teachers of a higher order shall be drawn. The reserve is however becoming the main force, and Boards of examiners are distracted by the difficulty, and passing all kinds of resolutions to amend the evil. Here there is evidence of the want of more centralization in the system ; and as it is impossible for Boards of Examiners, scattered all over the Province, to act systematically and with unanimity, it is recommended by those who can be above and look beyond local influences and leanings, that the papers of the second-class, like those of the first, should be examined by the Central Board. This, however, will not diminish the preponderance now rapidly growing of Third-Class Teachers. Various suggestions have been made. It has been proposed to leave the power of awarding the Certificate in this

class to the Inspector, after the candidate has passed the examination; and if skill in teaching has its proper claim, this, under the circumstances, ought to be imperative. Then it is proposed to raise the minimum of per centage on the papers; a measure that might reduce the numbers very slightly, competing for the third-class certificates, but which would have no effect in preventing that class occupying our schools to the exclusion of a higher class. The third important suggestion is that Third-Class Certificates should not be renewed or if renewed that the second certificate should not be valid for more than one year.

The object of having a reserve of teachers preparing for the higher duties of the office is of the first importance. But the present method will certainly never accomplish that end. You still go on the wrong principle of regarding attainments as the highest and almost the only qualification of the teacher. If he has attended the Normal School he has had some instruction and a very small practice in methods of teaching, and may have caught some dim views of school management. If he has never had these advantages he may come to the examination with a few months experience in a small country school. But the guidance and example of an experienced and skilful teacher and an apprenticeship to the practical work and difficulties of School management are the only methods of training for the full demand of professional excellence. We want a system like that admirable one introduced into England, I believe, from Holland, where the economy of school management has been best developed,

The Pupil Teacher

System, which apprentices well qualified boys and girls to the Head Master or the Head Mistress for a term of years: secures for them adequate instruction and daily training for their office; completes their professional education in a Normal School strictly devoted to Public School development, not a Collegiate Institute which has other and quite different business to attend to, and then sends them to take charge of a school; but, even then does not award the certificate until the candidate after ample experience has shown his or her capacity to manage the school.

We need measures also to induce or compel school authorities to employ a higher class of teachers. There is no doubt but that when once a locality had experienced the value of superior skill and attainments in the employment of a higher class of teachers it would never return to unskilfulness for the sake of cheapness.

Encouragement for the Practical Teacher.

But, while it is the interest and duty of the Country to secure the engagement of the best qualified teachers, it is clear in every view of the question, that the best facilities should be offered in the methods of examination to the working teacher, studying for advancement in his profession. This class has learnt the art of teaching by sheer experiment, and when the experienced teacher has been guided by good sense, by an earnest desire to improve the school and to keep it up to the demands of the Country, you have the best evidence of skill and efficiency. Whatever

educational advantages the Normal School teacher may have secured, he has yet to learn the art of school management and teaching and can bear no comparison in that regard with the uncertificated teacher who has acquired skill by long experience. There should assuredly then in very policy, as well as fair play, be special arrangements for this class of teachers. There is no desire on the part of working teachers in the Country, to have a programme specially prepared for them, with all their disadvantages and with the pressure of heavy duties demanding their utmost energies. They are prepared to compete with the favored students of the Normal Schools for the higher class of certificates. But, it is suggested that a candidate for a second or first-class certificate should be permitted to divide his work into two years, or if he takes up the whole work the first year, and succeeds in some subjects, but fails in others, he should be required to pass the next year only in those subjects in which he has failed. As there can he no possible intention on the part of the education authorities to prefer Normal School Teachers ; but, as they manifest a desire only to develop and encourage the best teaching powers of the Province, it is earnestly trusted that this proposal may have due consideration.

Again, the late Council of Public Instruction prescribed certain text-books to be used in the preparation of most of the subjects. The advantages enjoyed by the Normal School students, might, very likely, make the fulfilment of this promise unnecessary ; but, again, reminding you that there is a large class of working teachers bravely struggling to advance in their profession, this promise of the late Council was judicious and considerate, and calculated to aid, without any show of favor, that portion of the candidates who were denied the advantages of the Normal School. But, one of the candidates who sat at the last examination, whose experience and skill and devotedness to his profession ought to place him in its front ranks, thus wrote to me on the subject :—

"The examiners, have paid little attention to this promise of the late Council. The Chairman of the Central Committee confessed to me that it is difficult for persons of even good capacity to prepare Philosophy, to answer the questions, without the aid of a teacher. The examiner in Chemistry in answering last year's questions to me, found it necessary to quote from four authorities, to show that his answers were correct ; and three of those authorities are not named in the list recommended by the Council."

I shall not say that in this regard the Central Committee has broken faith with the Teachers of the Province. But, I urge, that if it be the wish of the education authorities to retain in their Schools this important class of teachers who are at once faithfully discharging the duties of their office and endeavoured to raise themselves to its highest demands, they ought to insist upon a rigid observance of this promise. The managers of the middle-class examinations in England issue a carefully prepared list of text books, upon which the examination will be based, some months before it takes place ; and, as the working school Teacher stands in a very similar position to that of the middle-class Candidates, that is he studies during the intervals of labor, he is fully entitled to the same consideration.

I have urged the importance of making experience and skill a very necessary qualification to securing a high certificate. It was found by N. S. Inspectors in England that many teachers holding high Certificates were often deficient in skill and power of management, and that many teachers who had only taken third-class Certificates proved the most skilful and showed the best results in the training of pupil teachers. In view of these facts, the facts the Committee of Council resolved, that when teachers who were distinguished for skill and management, should be promoted without further examination,—wisely and justly concluding that the teacher who could keep his school up to the mark and prepare his apprentices for the examination of the Inspectors, must necessarily, himself, have kept up and advanced in culture. From that period on the united recommendation of the School Committees and the Inspector, many teachers were gradually promoted from the lowest to the highest ranks of Certificates. There may be reasons for not adopting that method in this Country. But, assuredly, the principle of attaching the highest value to experience and skill ought to have a higher recognition than it has in the examination of teachers.

Qualifications of Public School Inspector.

Although I have occupied your attention so long, I cannot regard my task as completed without some reference to the tendencies in the direction of the examination for Inspectors. I have stated that when the School Act gave such evidence of supporting the paramount claims, the undoubted right of the qualified working teacher to that office, it gave deep satisfaction, and was an assurance to the teacher of the Province, that professional skill and experience were to take their just rank in all claims to distinction. I have also stated that amongst a large number of teachers there are strong fears and suspicions entertained that this prize shall be taken from them ; that obstacles of such a kind shall be raised, as shall virtually exclude all practical teachers from being promoted to the office of Inspector. The character and method of the examinations of the highest Certificate, and the rapid and regular increase of difficulties in the questions give some evidence of the tendencies in that direction. The teachers of the Public Schools who have a correct estimate of their office, understand and admit that as the standard is raised the profession will rise. But, they feel, on the other hand, and none understand this better than the working teachers, that the highest success Public School education lies in the development of School management and the thorough instructions of the pupils in all that is essential to the instruction of the masses, rather than in the superior education of the teacher. They have no wish to evade all just demands of culture ; but, there is an opinion spread, and it is suspected by a class that would wish to enjoy the prizes of the office, without passing through its drudgery, that those prizes ought to be confined to men who have had the advantages of a University course. A leading journal has more than once advanced these views, probably echoing the views of the monopolizing class, and by way of feelers. It has been stated very recently that the standard for Inspectors is too low. One paper expresses the opinion that the next generation of Public School Inspectors will be men of more extended experience and higher literary qualification than those of the present class and that there can be no doubt

as the standard of qualification for Inspectors has already been raised, and in order to make the necessary distinction between their qualification and those of Public School Teachers it will soon be requisite to raise it a little more. The time is evidently fast approaching when a University degree in Arts will be deemed indispensible, in addition to the possession of a first-class certificate. As these views involve such serious consequences to the present rank of teachers and throw doubt on the qualifications and efficiency of the present Public School Inspectors, their correctness claims the serious consideration of the convention. I maintain that there should be no "necessary distinction" between the qualifications of the Public School Inspector and the first-class of Public School teachers, than that of longer experience or superior skill. Whatever "literary qualifications" the Inspector needs ought to be possessed by the teacher. There are qualifications that all Inspectors should have, but what no culture can give, and which may be common with the teacher as the Inspector. They are those moral and mental attributes of character, those broad and sound views of life and of duty, and those deep and earnest sympathies, which, independent of all culture, give men distinction and the power and the right to guide and to rule. I have endeavored to show what are the essentials of Public School education, and in that regard the Inspector should possess all necessary qualifications. But, in that view also should the best class of teachers be qualified, and when so qualified with all the advantages of skill they have acquired a knowledge of their duties by experience, they are pre-eminently the best fitted for the superior office of supervision and guidance. Now carry out these views and you break forth with the whole body of teachers who have won the best certificates, and you discourage all who are aiming for those certificates. For what advantage in a social or financial point will he then have who holds the highest class certificate over him who holds the lowest ? The people, especially in districts where intelligence is low, prefer a cheap teacher to a well qualified one. You, gentlemen, who hold the highest class will only enjoy an empty honor. The country is satisfied with teachers of lower attainments and you give warning to all future aspirants to consider if it would not be far wiser to acquire qualifications for success in other occupations. You may enter the profession of the ministry, of medicine, or of law without this university education; and may, as many before you have done, win affluence and rank in those professions, But, as school teachers, whatever ability you may have and whatever attainments, unless they agree with the carriculem of a university you shall never be promoted to the office which your country, in a momentary fit of justice and generosity of which it afterwards repented, promised should be the reward of your skill, your devotedness and your experience.

I cannot believe I am passing out of the limits assigned me in calling the attention of the convention to this subject. The knowledge that should constitute the qualification for the office of Inspector, had no doubt secured the fullest consideration of the framers of the School Law. They did not act under the impulse of mere generosity or justice—they acted on the suggestions of public expenditure and policy. No doubt they had the example of other countries, which have, by the difficulties of their qualification—their very costliness—succeeded in virtually closing the office from

the Public School teachers and securing it as a monopoly to a class favored by birth or wealth. But, as the powers of the Ontario School Act had invoked the best experience and the highest educational knowledge to make that act as complete as possible, legislating as far as they could for the future as well as the present necessities of the country, had they found it necessary to set a special standard that would require a special University Course in the preparation of the Inspector for his office, I have no doubt but that these conditions would have appeared in the act of Parliament. I am disposed to believe they took that view of a Public School education upon which I have based the arguments and opinions I have advanced, that they considered that education to embrace only what is necessary to the life of the common people to the life of manual labor and the industrial arts and to exclude very much of what is regarded as necessary to professional life. They intended the Public School to occupy one grand sphere of duties and the High School another; and while much of what is learnt in the Public School would be preparatory to the High School, there should be no perversion or sacrifice of its important duties to that end. They considered the standard necessary for the highest class of Public School teachers, and they wisely and justly concluded that standard sufficient for the higher office of Inspector. The standard was fixed with a view to the public good; but, we have reason to believe that the framers of the law, that the legislators of Ontario acted on principles of policy and justice, with a view to the future as well as the present educational prosperity of the country, that it was not only the best policy to select the Inspectors from the experienced, skillful and qualified workers,—that this policy would arouse and sustain new impulses to duty and a professional spirit which would in the highest degree be beneficial to the work of education; but, that it was an act of justice due to the Public School teacher, who, if he shewed himself qualified to satisfy all the demands of the school room, not only gave the best evidence of his fitness for the office of Inspector, but was the only one who had a right to that office.

In the spirit of that act, supported by that policy and that justice, I call upon the convention to maintain the claims of the Public School teacher, and I trust the country will be faithful to the conditions it laid down, and the hopes it created, and just to a class so zealously serving it, and so necessary to its present welfare and its future greatness.

THE HIGH SCHOOL SYSTEM.

BY JOHN SEATH, B. A.,

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When I selected as my subject to-day "The High School System," I had in view the fact that we should at this meeting be in a position to discuss intelligently, after a six month's trial of its operation, the probable effects on education generally of the new scheme to which our new High Schools are being subjected. Although High School masters are more

immediately interested in the question, and its salient features are to be discussed in their section, it is one which, on account of their relation to the Public Schools and the Universities, will naturally attract the attention of all classes of educationists. The matter is one, too, which, from its vital importance, may with advantage be considered from different standpoints. Those engaged in Public School work are in a position, as well as High School masters, to observe its effects, and apart from the interest all teachers naturally take in an educational experiment, the possibility of a similar course being adopted towards them will no doubt give the matter additional importance. In fact, by the annual reports of Public School Inspectors, we see that the grading system has been attempted in several counties, though as yet Government aid is given irrespectively of any classification. I propose, then, in the course of the following remarks, to discuss briefly what seem to me to be some of the tendencies in our High Schools; and, although it is in the critic's privilege to praise as well as blame, if I indulge in the latter more than in the former I hope it will not be attributed to my inappreciation of the rapid progress we have been making in education, but to a desire to provoke amongst the very men who have been mainly instrumental in effecting these improvements, that free expression of opinion which is the safeguard of our profession. I cannot hope that what I shall say will meet with general approval; many of my conclusions will no doubt be combatted; but I submit to you my observations during the past half-year as a contribution to the discussion of a problem which many besides myself regard as still unsolved.

I. Of all the relations of the High School, by far the most important is that it bears to the Public School. Hitherto the great source of trouble has been that in many localities the latter has been depleted to swell the attendance in the former. To meet this difficulty several schemes as you are aware have been devised. A year or so ago it was thought that a uniform entrance examination and more thorough and frequent High School inspection would effectually counteract this tendency; but, it was found that, though the plan was partially successful, the evil broke out with greater virulence than ever. After an unusually long period of incubation, a new scheme has been developed and this half-year put into effect—popularly known by the name of "Payment by Results." To use the words of the Inspectors' Report this experiment "*will* show the country what schools are really doing High School work and what nominally High School are doing only Public School work, and will ultimately force the latter to become what they profess to be or give away to more efficient Public Schools." I am inclined to believe that no one has been more astonished by the results of the "Intermediate" than the Inspectors themselves. I should be sorry to say, and I certainly do not believe that these results are to be taken as a safe criterion of the work the High Schools are doing; but no one will deny that of the 60 schools that passed none, and the 24 that passed from 1 to 2 each, there must be a considerable number that are doing elementary work. Besides, after this, unless a school has a reasonable prospect of passing four or five at this examination, there will be little inducement to run the risk of failure and incur the cost of the attempt. So that we are safe in saying that a very large number of the schools will be uninfluenced by the benefits said to

accrue from success of this examination; and, if the rest of the scheme be fairly carried out, the tendency will be to degrade rather than elevate their standing. In fact, as matters stand, the masters of some of the smaller High Schools have refused to do the work required for the Universities and the different learned societies of the Province.

It seems, then, to me that the longer this scheme is in operation the greater the tendency to develop two classes of schools with an occasional gradation form between—the High School proper, where the authorities will be able to maintain both an upper and lower school in a well organized condition; and the English High School, which in many localities will do mainly the work of the fifth and sixth classes, with occasionally modern languages and classics. Such a school as the latter will evidently be a necessity in places where there are a number of small Public Schools, the masters of which will not have the time at their disposal to take their senior pupils beyond the line which forms the lower limit of the High School. But in the larger towns and cities, where efficient fifth and sixth Public School classes may be maintained, there can be no possible excuse for the High School of the locality interfering with the proper functions of the Public School, if efficiently performed.

To any one who compares even the present High School programme with the Public School one, it will be evident that to a considerable extent the work of the lower school is similar to that of the 5th and 6th Public School classes, if you omit the optional groups, Modern Languages and Latin.

You will see, then, that the Public School is related to the High School in the same way that the latter is to the University. The High School course overlaps the University carriculum to the extent of at least one year's work, there being senior as well as junior matriculation. And it is maintained that the existence of the former examination will do a great deal towards raising the upper limit of the High School. No doubt it will in time. But why not apply the same principle to the Public School? Let us have a recognized senior as well as junior High School entrance examination.

It is evident that the relations between the High and Public Schools will differ in different parts of the Province, and that the standard of the entrance test will generally be determined by the actual efficiency of the Public School beyond a certain limit. So that in localities able to maintain a High School of the lowest grade only, the entrance test for all classes would naturally be the junior; and in more populous and richer places the same would be available for those desirous of studying classics and modern languages, while the entrant for English would take the senior examination. I am aware that when a higher test was prescribed for the English entrant at an earlier period of the history of our High Schools, it turned out to be a failure; but the situation is now different. Latin is not valued so highly as it used to be; and, if the system of payment by results were judiciously applied to the Public School, I am inclined to think that an impetus would be given to the Public School that would prevent its degredation in cities and large towns and be beneficial to education generally. As a matter of fact, so far as I have been able to

make out there has been little or no diminution in the number of High School entrants this last year; and I am inclined to believe that in the great majority of schools the new scheme will produce no material change in the present system of transference.

2.—FINANCIAL ASPECT.—It seems to me unfair that the strong and well-supported High Schools with large staffs of teachers and every internal facility for ensuring success, should compete for a share of the same grant with their weaker rivals. Justice to both demands that they should be placed on a different footing. The work in the lower grades must, on the whole, be lower than, though equally important with that in the higher; and in the long run, if the principle of payment by results be justly carried out, the small school cannot possibly hold its own with the larger. What can a school with two masters do in competition with a well organized and efficient school with six or eight, where there is a proper division of labour? For my part I feel sure that in the course of a short time the $14,600, or one-fifth of the whole grant, which is to be distributed on the basis of the "Intermediate" examination, will be divided amongst a very few schools, in addition to their share of the rest of the legislative apportionment. It can hardly, in the nature of things, be otherwise. Even at the last "Intermediate" seven of the 112 High Schools succeeded in carrying off almost one-half of the grants. The large, well manned and well equipped school must win in the end. Besides it will not pay the small ones to incur the expense of the examination for the sake of a possible $30 or $40 extra; and the glory that accrues from passing one or two candidates will be thought so inconsiderable as to be hardly worth the effort. In fact the inducement is so slight that, after this, many will fall out of the competition altogether. If the Inspectors try to make up for this out of that $10,000, the schools that have done well at the "Intermediate" must lose the proportion of it they are entitled to, and the examination itself be admittedly only a delusion and a snare.

So that, apparently, the scheme that was intended to diminish the resources of the larger schools, will fall short of its accomplishment in a number of instances at any rate, and will strengthen somewhat the smallest schools, but mainly at the expense of those of medium size.

The question then suggests itself whether it would not be to the interest of all classes to separate some of the larger schools from the rest and place them on a different basis, or allow them to compete amongst themselves for Government aid.

3.—Increasing cost of managing the details of the system.

I do not refer to this through any desire to find fault with wise expenditure for educational purposes; but the increase has of late years been so rapid, that it is well for us to consider it in connection with the improvements it is said to have produced. The following calculation will, I believe, be found to be below the mark. (It includes Local and Governmental expenditure):—

High School Inspection	$ 6,000
Entrance Examinations	3,200
Intermediate Examinations	4,000
Total for 1876	$13,200

Of this the only item in 1870 was High School Inspection, $2,000. By reference to Dr. Ryerson's Report I find the expenditure for masters' salaries from 1870 to 1874 to have increased 75 per cent., the total expenditure for the same period, including an unusually large sum for building purposes, about 100 per cent., whereas the expenses I have detailed above have increased from 1870 to 1876 between five and six hundred per cent. I may also add that the legislative grant for masters' salaries in 1876 is about 33 per cent. more than in 1870. No one will for a moment doubt but that many improvements—in fact as many as could fairly have been expected—have been produced by the introduction of a uniform entrance examination; but whether the largely increased inspectoral power has effected all the benefits anticipated by the gentlemen whose advocacy brought the additions about, is a question which, fortunately for me, these officials have answered themselves.

We now have a supplementary test to the tune of 4,000 a year, and whether the results of the Intermediate will justify the expenditure for this purpose, is a subject about which, to put it mildly, there is some difference of opinion.

4.—The system of payment, according to the results of an examination held at a certain time, tends to throw the whole responsibility on the masters.

There is little inducement for the pupil to exert himself, and, if he fail once, he will be chary of risking defeat a second time, when he can derive no personal benefit from success.

The desire to bring honor on himself and the school he attends may prove a strong inducement with some candidates; but many of the pupils who would naturally be expected to pass this examination, will not be influenced by this incentive when it conflicts with their own interests or the designs of their friends. Failure on the Algebra paper, for instance, will have a chilling effect on the enthusiasm of the boy whose young heart has been all aglow with a noble ambition to distinguish himself and bring credit on his teacher. It will be difficult for the pupil under such circumstances to appreciate the value of the arguments with which his indifference will be met.

Besides, the Intermediate lacks some of the elements that give importance to the ordinary schoolboy's previous examinations. He is anxious to pass the Entrance Examination, because it means transference from the Public School to the High School. His relations, as well as himself, value the certificate mainly for the material advantage it brings.

The "Intermediate," however, comes on at a period when the great majority have made up their minds to leave school for business or some other occupation, or when the student who intends to teach or join one of the learned professions is getting ready for his examination. What inducement will many of these have to change their course of study or delay their preparation to suit the convenience of the teacher? Or why should the ordinary student whose services may be required at home before the end of the half-year remain to obtain possession of what, in his case, will be a valueless piece of paper? In the very few schools where it will be possible to maintain a well organized upper school, which will form a separate part of the institution, the pupil may come to regard pass-

ing the examination as real promotion, particularly if the teacher apply moral suasion in the form of keeping him in the preparatory classes until he pass. That it will be possible to carry this out in any school, as we do in the case of the Entrance Examination, I greatly doubt, and of the injustice of such a course I am fully convinced. What particular privileges is the solitary individual to possess who lately passed at each of the thirteen High Schools ? How is the master to magnify the achievement of the pupil whom the Central Committee delighteth to honour ? It will be difficult to the teacher to make his fellow pupils realize that he has acquired any access of dignity.

Unfortunately the great desire on the part of pupils who have examinations to pass is to get through as soon as possible; and it would never do for a master to keep his pupil back because he failed to obtain 40 per cent. in geography, for instance—a subject not required for his special examination. In fact, the teacher will be perpetually on the horns of a dilemma. He must either do injustice to his pupil, by interference with his course of study, and so likely drive him away, or do injustice to his employers, by conniving at a loss of Government aid, not to speak of the injury he will himself sustain. The trouble arises from the fact, that while the strongest possible inducement is held out to the master to prepare candidates for the "Intermediate," there is in a great many instances no reason why the pupil should attach any significance to it. I unhesitatingly assert that a gross wrong is being done to the matter—one which will make itself felt with still greater weight when the novelty of the recent examination has worn off.

There can be no justification in placing the teacher at the mercy of the pupils and their friends. I could mention several instances that have come to my knowledge lately ; but no doubt your own observations will have shown you that difficulties of this nature will not be so exceptional as may be imagined. When the results of the "Intermediate" are published in the Toronto dailies, extenuating circumstances can have no effect on the public when they agree upon a verdict without a knowledge of the facts. No doubt a great deal will depend on what determines, to a great extent, the success of every teacher—the *entent cordiale* between himself and his pupils—but if this do not exist, the responsibility for its absence will be generally thrown on the master.

To obviate this difficulty, if the present system be maintained, and no change take place in the standard of the examination, I would propose a plan which will utilize the scheme and justify, to some extent, its existence. Most of you who have read Mr. Matthew Arnold's "Schools and Universities of the Continent" will remember that he refers to an examination which the German student passes before proceeding to the University—"the leaving examination." Such an examination I should like to see this become, only more extensive in its operation. Our "Intermediate" should effect four classes of students : (1) The ordinary pupil ; (2) The young man who is preparing for the University ; or, (3) for a preliminary professional examination ; or, (4) the young man or woman who, having taught the required time on a third-class certificate, desires to obtain a second.

(1.) In the case of the ordinary pupil this examination might take the place of the Oxford and Cambridge local examinations, to which, judging from the papers I have seen, it is about equal in difficulty. It should be acknowledged as such by our National University, which we regard as the proper source of educational honor so far as our High Schools are concerned. In this way the examination would acquire a value and significance it does not now, and never can, possess. The acquisition of such an act of competency, bearing the stamp of our highest educational institution, would be a legitimate object of ambition for every High School pupil, and would give an impetus to education where it is mainly needed.

(2.) If it were recognised as part of the junior matriculation examination, the University would be brought more immediately into contact with our school system, and benefits would accrue to both which it is unnecessary to enumerate.

(3.) If the "Intermediate" certificate were accepted as the preliminary examination for the learned professions, not only expense would be saved to the country, but the educational results to those directly concerned would be far from inconsiderable.

(4.) When, according to the High School Inspectors, the "Intermediate" is equal to the examination for second-class certificates, there should be no objection offered to examine candidates for Public School certificates of qualification on the same papers as our pupils.

Of course in all these cases modification would be made by experience, or to suit the actual requirements of particular professions; but some such adaptation of the system would, I believe, greatly advance the interest of education generally, and immeasurably relieve the master, whose responsibility will be great enough even under these circumstances.

Ladies' Colleges, denominational institutions and private schools in general have at present no means of testing the attainments of the great bulk of their pupils; so that the exact condition of these establishments is a matter of pure conjecture. This examination might be arranged so as to extend to them also, and the State would thus afford them a reliable means of testing the educational force of these schools. That this course would be productive of good to the institutions themselves I have no doubt; while, by making it an object for them to avail themselves of the privilege, the State would indirectly control their course of study, and bring about that homogeneity of culture which is essential in elementary education at any rate. When I read of the praiseworthy efforts that are being made to promote the higher education of women, I cannot help thinking that no real progress can be made so long as the elementary training of the majority of those who do not attend our National Schools is so lamentably defective.

V.—Increasing tendency to determine results by means of written examinations.

These tests have, within the last few years, become so prominent a feature in our educational system, that it is of the utmost importance to determine what influence they will have on High School education.

There is a kind of written examination to which, if judiciously conducted there can be no possible objection. When the teacher examines his pupils in this way in work he has gone over in the class, he is using

an educative instrument of inestimable value. There is no surer method of detecting imperfections in knowledge ; and the pupil is taught judgment and self-reliance, and acquires habits of accuracy in thought and expression. The teacher uses the written test as a means. The character of his teaching is not determined by the examination ; but the class work determines what the written examination will be.

It is highly objectionable, however, I believe, that the questions set by any Board of Examiners should be the teacher's guide in the schoolroom. It is, unfortunately, a fact that with both pupils and master, education is often turned into preparation for an examination, and what both aim at is not how to gain knowledge and intellectual power, but what will pay at the examination.

A few moments consideration will show you to what extent the master and pupil are now under this influence.

The High School entrant has to pass a written examination for which for some time at least he is prepared by the Public Schoolmaster. When he enters the High School the teacher there will have the "Intermediate" in view, and the pupil's education will be influenced more or less by it ; and when he has successfully undergone the "Intermediate," if intended for the University, a profession or teaching, the written examination again looms in view. As for the master, his life will be one never ending grind, from the beginning of one half-year to the end of the other—examinations every way he turns.

The great question, however, for us to consider is—Does all this tend to promote education ? With your permission I shall point out briefly what seem to be prominent objections to applying the written examination to determine the efficiency of a school, and we shall then be able to appreciate the gravity of the position.

When the pupil is preparing for an examination,he is led to acquire knowledge not on account of its own value, but for the sake of passing. He is in somewhat the same position as the man who marries a woman for her money. It is possible that affection may follow ; but the chances are against such a result, and the principle is universally admitted to be a bad one. The knowledge we obtain in preparing for an examiuation is valueless as mental culture compared with that pursued for its own sake. When we are anxious to master a subject, we devote ourselves to earnest investigation and consider it in all its bearings, and are not satisfied until we have made it our own. It is to be feared, however, that the candidate at an examination is more influenced by the desire to appear to possess knowledge, than to have that living acquaintance with it which alone can confer intellectual power. It is not the man who has excelled in passing brilliant written examinations that distinguishes himself in after life, and benefits most his fellow man.

Besides, the compulsory examination acts on a pupil's fears, not on his hopes. If he fails, he considers himself disgraced, and the little knowledge he has "crammed" for the occasion will certainly not be regarded with the feelings that should pervade the heart of every lover of the muses. It would not be difficult to estimate the amount of culture acquired by

such a process. In teaching, the theory is that we should win our pupils to the love of knowledge by kindling a noble enthusiasm in their breasts; the practice will be in too many cases to hold up before their eyes the fear of failure. So that they are forced to regard knowledge not as the lover does his mistress, but as a slave does an unreasonable and tyrannical master,

Every genuine teacher knows that the theory is correct, and no educational vageries will succeed in driving out of the hearts of many of us the earnest desire to do our duty faithfully; but it is so hard to always scare up the enthusiasm for over the forty per cent. in each of the thirteen subjects, and "cramming" is such an easy process and pays so well!

Again, does any one require to be told that there is no knowledge so easily forgotten as that we stuff ourselves with to pass an examination? Illustration is unnecessary.

It is well for us then to consider whether this is the kind of thing that should be systematically encouraged by our national system of education.

"In Austria, the country of examinations," says the French Commissioner" there is no intellectual work."

"The paramount aim in Prussia," writes the English Commissioner, "is to encourage a love of study aud science for their own sakes; and the Professors are constantly warning their pupils against Brodstudien—studies, pursued with a view to examinations and posts."

In Ontario, we say at one moment, "Education, pure and simple, is to be aimed at above all things," and at the next we dangle before the eyes of the men who have the intellectual future of our Province in their hands the greatest incentive we can devise to render them recreant to their trust.

It cannot be maintained, either, that written examinations produce habits of application. Most candidates take it easy until a month or so before the examination, and, when the spasmodic effort is over, relapse into lethargy.

The strongest argument of all against the present tendency, is forcibly brought out in the words of the Rev. Mr. Pattison, who, speaking of University examinations, says:—"The paralysis of intellectual action produced by compulsory examination is not more remarkable than its effect in depressing moral energy. For, as examinations have multiplied on the unhappy pass-man, the help afforded him to pass them has been increased in proportion. He has to lean more and more on his tutor, and do less and less for himself. The tutors do indeed work; they drudge. For they aim at taking upon themselves the whole strain of the effort. It is a point of honor with them to get their pupils through. The examinations have destroyed teaching, which may be said to be a lost art among us."

I should like to hear Mr. Pattison's opinion of the present tendencies in our High School system.

Such being the general tendencies of written examinations in the case of young men, even when the spring that moves the teacher is ambition or honor, there are two exceptional points in our case which I shall briefly state:—

1. The ages of the pupils affected by the "Intermediate" Examination are supposed to range from 12 to 16 or 17—in other words, students are to be subjected to the various influences of this mode of determining results at the time of life when the reflective powers should be trained and developed.

2. A very large inducement is held out to the teacher to prepare his pupils for the "Intermediate," in the shape of an annual grant of $60 per unit.

I think you will agree with me that it is unfair to the man, and bad policy on the part of those in authority, to make it his interest to pursue some other object than the real efficiency of his school. It should not be wondered at, nor can he be greatly blamed, if he sometimes sacrifice his duty. In this connection it is only necessary to remind you of the form taken by the revival of learning when the legislative apportionment was based on the average attendance in classics. I think that if we could only procure reliable statistics, it would be found that in the matter of morality our profession ranks as high as any other; but you know the old and sacred saying,—"Lead us not into temptation." I need not waste time shewing you why in the eyes of the master and the public this part of the scheme is the important one. I am not one of those who believe that $10,000 in the Inspectors hands is going to cure all the defects of this system, and the short comings of the masters and trustees of 112 High Schools.

You may reduce the evils of the system by great care in the perparation of questions. In mathematics, the objection is not so strong; but in some of the other subjects of examination the supply of questions that cannot be answered on "cram" seems to be limited. Why! it was only the other day that I saw in an educational journal the advice given to candidates to procure full sets of past examination papers, and the remark was made that if, having worked these through, the candidate failed, he had himself to blame. This I regard, when applied to the boys and girls of our schools, as vicious in principle and subversive of real education. The evil tendencies are just as great when the pupil knows the style of the questions as if he knew the questions themselves. There are no Examining Boards in the Province who can so vary their questions as to enable us to avoid this rock. I think it highly desirable that examiners should be frequently changed. In the matter of the "Intermediate," it would be advisable that the Inspectors should have something to say in the matter, but it is not in the interests of education that our examinations should run in a groove, even if it be a broad one.

If our education is to be what it should be, there must be more than mere working towards examinations. To pass written examinations is not the schoolboy's chief end, and the teacher has a nobler duty to perform than than the mere drudgery of a never ending grind.

There seems to have sprung up in these days a species of men with whom "examination" is king, and "Cram" is prophet. It has been said that "cramming"—that is, filling the mind with undigested knowledge—is better than nothing. I do not believe the doctrine.

A large assortment of facts is useful to any man, and professional education is largely of that nature; but in the school-room, cram has no place. The mental constitution of the boy who is perpetually subjected to this process is injured in the same way as the man injures his body who eats too fast or too much and sows the seeds of dyspepsia.

As a writer I once read says:—"The teacher's duty is not to impart information, but to teach children how to value, gain, and use information for themselves. The mind may be trained so that all his life long the boy can gain lore with ease and rapidity. We do not make good huntsmen by providing them with game at the outset, but by showing them how to hunt and handle their weapons. If in practising we can bring down game, it is well, but, in all the preparatory course, the main subject is practice, not prey."

I had intended to discuss the absence of any incentive to attach due importance to physical culture—to draw attention to the fact that if this branch of education be ignored, we shall have little chance in future of a "*mens sana in corpore sano*." The premium now set on forcing the bright pupil, and neglecting the dull and indolent one, also demands our intention, and might not be amiss to consider the prospect, if matters remain as they are, of a possible more extensive development of the private school. But I find that I have exceeded the limit I had set for myself, and I fear I have already overtaxed your stock of patience, No doubt I have said a good deal many of you will oppose. I should feel that I have imperfectly performed my task if I had not; but I am sure you will all join with me in wishing "a speedy haven of rest for our High School system."

DR. HAANEL'S ADDRESS.

Recent advances in science justify the generalization that the phenomena of the material universe are interpretable in terms of motion. But if motion constitutes the essence of a phenomenon, evidently this motion must inhere in something, and this something must be so constituted as to render possible all kinds of motion which are offered in explanation of the various phenomena. The constitution of matter becomes thus a fundamental problem, upon the solution of which the superstructure of the so called Physical Sciences rest. The importance which attaches to this subject—the constitution of matter,—and the profound interest which it awakens in all thinking minds, have led me to hope that it might not prove an inappropriate and unacceptable topic for a lecture before this convention. I have thought it undesirable to popularize the subject altogether, not so much because of Faraday's saying that "an instructive lecture is not popular, and a popular lecture is not instructive", but more because it is to be delivered chiefly before teachers. I crave, therefore, beforehand, your indulgence, if the subject should demand more attention in certain parts of its treatment than is usually expected to be given to a public lecture.

The first experience we make in connection with matter, which seems to afford us a clue to its structure, is that of its divisibility. No body is known to exist, which may not by the application of proper means be divided into parts. Let us cite an experiment in this direction, and see if we can learn anything from it which can aid us in our inquiry into the structure of matter. We take a piece of the polishing plate of Bilin—a stroke of the hammer will shatter it into fragments. We may continue the same operation with each successive smaller fragment until our hammer proves too coarse an instrumeut for finer division. We select two or three of the minutest particles thus obtained, and grind them in an achate-mortar until all grittiness has disappeared and the resulting powder has become impalpable. If now we examine this powder under a microscope, even a low power reveals it to be composed of particles of different degrees of fineness and of various shapes not differing in any respect from the original substance except in volume. By employing a higher power the appearance of these little grains becomes greatly altered. Each minute grain is seen to be composed of a great number of very regularly shaped little bodies, most of them perfect, some, however, broken. These little bodies have beautiful, delicate grooves chiseled upon their surface, and are recognized as belonging to the graceful diatom *melosira distans*. It would require 6720 of these little discs laid side by side to fill out a line one inch in length. A cubic inch of the polishing slate of Bilin, would consequently contain in round numbers, 303 billions, 420 millions distinct discs of this diatom, and yet we feel confident, that, even if we could separate the original rock into these individual discs, our division has but commenced! For our magnifying power detected among the discs composing each little grain of our inpalpable powder, some which had been fractured and fractured into very irregular pieces. However minute in size and regular in form, these discs, then, cannot represent the smallest particles into which the polishing slate of Bilin may be divided; on the contrary each disc is apparently as divisible as the whole rock, and we see no reason, why, had we the proper means, we might not continue the process of division in the case of each diatom into particles beyond even the range of microscopic power. From this experiment, which may be taken as typical, we conclude that our effort in dividing the slate has been limited *only* by the imperfect means at our command, and that each successive degree of subdivision attained by mechanical means furnished particles not differing in properties from the original substance.

Is matter then infinitely divisible? Our experiment seems to indicate such a conclusion. Or do we in our effort of division finally arrive at particles which can no longer be divided? Clearly we make these two assumptions. Our conception of the constitution of matter will depend upon which of these two assumptions we accept. If we accept the former, that matter is divisible without limit, then each part struck from the whole is only part of the whole, and no discrete particles can be assumed as existing in matter. Matter then fills the space it occupies continuously without a break. Of course this view of matter does not exclude the existence of pores or fissures, but no part can exist *per se* disconnected from matter in matter, for otherwise matter would be composed of these parts, which is contrary to the assumption. This conception of matter is very perplexing; but an analogy, however imperfect may aid

our imagination in realizing it. You have undoubtedly often admired the fairy little glass baskets turned out with such surprising rapidity before the blowpipe of Bohemian glass blowers. These frail ornaments are formed from melted drops of glass, which partially run into each other before cooling. The spaces which are thus left between the limpid drops give it much the appearance of wicker work. We have only to imagine our little basket to be filled with melted drops of glass, adhering to the sides of the basket and to each other in certain points only, to realize the conception of continuous substance. The space which the glass of this basket occupies it evidently fills continuously, for no drop exists singly and discretely by itself, but each drop is joined by some point of attachment to its neighbor, so that we may commence with any little drop whatever and proceed throughout the basket and its contents along the lines of juncture formed by the glass itself, without ever leaving the glass to reach a next particle. This conception does not, as you perceive, exclude the existence of pores or fissures, for these are represented by the spaces left between the drops, and may be as continuous as the glass itself.

If now, on the other hand, we grant a limit to the divisibility of matter, then matter must be conceived of as composed of indivisible particles which we may term atoms, the term signifying indivisible. These atoms we are then to imagine as the building material by the aggregation of which the substance is built up. To fit our former analogy to this conception of matter, it is only necessary to cut the joining threads between our little glass drops, and imagine them held together, not by the substance itself, but by immaterial dynamic bonds. Each drop will thus exist discretely by itself, having no material connection whatever with any other drops. This immaterial connection between the atoms renders this conception of the constitution of matter perhaps more difficult than the former, "but mere difficulties of conception," as Prof. Jevons remarks: "must not in the least discredit a theory, which otherwise agrees with fact." Our choice between these two assumptions will then evidently depend upon the agreement or disagreement of either with the facts of Natural Science. We shall conveniently consider some of the leading facts of chemistry first to determine our choice in accordance with this criterion.

If we place, as Morren has taught us, a globe filled with Sulphur Dioxide—a transparent colourless gas with a suffocating odour—in a dark room, and pass a beam of sunlight through it, at first no change will be observed, but presently a delicate faint blue will appear in the track of the sunbeam within the globe. This tint grows deeper, passes into sky-blue, gradually this fades to a whitish hue, and finally a white cloud will be observed floating within the globe. If the globe be now opened and the contents examined, it will be found that the suffocating odour so characteristic of the Sulphur Dioxide has disappeared. In fact this gas has vanished, and its place has been supplied by two other substances—Sulphur and Oxygen, the former floating in a state of minute division in the latter. This Sulphur and Oxygen, which were evidently in a state of union before the experiment, may easily be proven to be present in the weight ratio of 32 of the former to 32 of the latter. Reversing the experiment by heating the globe, the cloud will at a certain temperature disappear with

a lambent blue flash of light, and upon opening the glass globe our original Sulphur Dioxide will have made its re-appearance, every trace of the Sulphur and Oxygen having vanished. These two experiments of decomposition and recombination may be repeated any number of times without the least change of weight taking place in the contents of the globe. Evidently 32 parts by weight of Sulphur require exactly 32 parts by weight of Oxygen to form Sulphur Dioxide. This definite and invariable weight ratio existing between these elements in the formation of this compound we should find confirmed by every analysis made of the Sulphur Dioxide, whether we obtain it from an iron pyrites furnace of a sulphuric acid factory, or from the throat of an active volcano. I may without difficulty cause Oxygen to enter into combination with Sulphur in a higher weight ratio, namely, of 48 of the former, to 32 of the latter, to form the definite compound Sulphur Trioxide. This compound contains exactly one half as much more Oxygen, than the Sulphur Dioxide. But between these two compounds no intermediate compound can be formed, *i. e.*, none which shall contain the Oxygen in a weight ratio of more than 32 but less than 48 to 32 of Sulphur. These quantitative relations existing between elements to form definite compounds are inexplicable if we assume matter to be continuous. Upon this supposition the whole experiment is shrouded in mystery. Granting the possibility, that continuous substances are capable of combining by interpenetration, the conception of which is however exceedingly perplexing, we do not see why the Sulphur and Oxygen can only interpenetrate in such a definite weight ratio, as 32: 32, and if Sulphur does take up more Oxygen, why only one half as much more. On the contrary it would seem, that all possible intermediate compounds should be capable of formation between any definite quantity of Sulphur and Oxygen, forming an infinite series of compounds shading off imperceptibly in their properties from one to the other.

If, on the other hand, we assume that matter is composed of atoms, which for the same element are exactly alike, and possess exactly the same weight, but differ from those of another element in weight, the explanation of these quantitative relations becomes easy and unconstrained. The very operation taking place in chemical combination may be followed by the mind's eye. We see in the first place wherein chemical combination differs from purely mechanical mixture. In the mechanical mixture of the cloud of Sulphur particles floating in the Oxygen of our experiment, the different atoms of Oxygen exist side by side with the atoms of Sulphur or their aggregations, but with sufficient space between them to prevent the characteristic properties of one substance from being influenced by the presence of the other. At the instant of combination a general rush of atoms takes place. Every Sulphur atom seizes upon two Oxygen atoms and remains finally united to them. If now we bear in mind that the Sulphur and Oxygen atoms differ from each other in weight in the ratio of 32: 16, we readily see that the weight ratio in which these two elements combine must be definite, and that it must be as 32: 32, for 2 atoms of Oxygen weighing together 32 have combined with one Sulphur atom which weighs 32 to form Sulphur Dioxide. It also follows at once, since atoms cannot be divided, that if Sulphur combines with more than two atoms of Oxygen, it must combine with three and not $2\frac{3}{4}$ or $2\frac{8}{8}$ atoms

of Oxygen to form Sulphur Trioxide. We may further explain what otherwise would have been inexplicable—why in the act of combination of Sulphur with Oxygen a lambent blue flash of light was observed. The space existing between the Oxygen and Sulphur atoms previous to combination, though exceedingly minute, is in comparison to the actual size of the Sulphur and Oxygen atoms very great. The act of combination being completed in an immeasurably short period of time, the Oxygen and Sulphur atoms rushing together to engage in the melée acquire a very great velocity. The shock which they sustain in meeting is correspondingly severe, causing them to tremble in each other's grasp. It is this tremor which, imparted to the universal elastic ether, is just capable of throwing it into undulations corresponding to the blue light we witnessed.

Another and very striking argument in favor of the atomic constitution of matter may be derived from a consideration of a certain class of organic compounds, the metamerides. This interesting class of bodies, although possessing identically the same composition, differ in their physical properties, and furnish, if treated under exactly the *same* conditions with the *same* reagent, entirely *different* products of decomposition. Thus in the two metamerides valerate of methyl and butyrate of ethyl 72 parts by weight of Carbon are combined in each case with 12 parts by weight of Hydrogen and 32 parts by weight of Oxygen. If these two compounds be treated with potassium hydroxide decomposition takes place in each case. The one compound furnishing as products of the reaction potassium valerate and woodspirit, the other potassium butyrate and alcohol. How two compounds of exactly the same composition, and treated in exactly the same manner, can furnish entirely different products of decomposition, is absolutely incomprehensible, unless we assume that the products of decomposition into which they are capable of being separated exist *discretely* in these compounds. But if so they must exist spacially separated in each compound—an assumption of which the theory of the continuity of matter does not admit. We must relinquish all hope of explaining this very singular fact, or admit the theory of the atomic constitution of matter. In accordance with this theory the two metamerides would each contain six atoms of Carbon, twelve of Hydrogen and two of Oxygen, grouped for each compound into differently constituted twin molecules, something like twin clusters of grapes. A cluster of grapes does not ripen its berries all at the same time, but if we pluck it at a certain season we shall find among its purple ripe berries, red ones half ripe and entirely green ones. If, now, to help our imagination, we let the purple berries represent the Carbon atoms, the red the Hydrogen atoms, and the green the Oxygen atoms, we may easily arrange a definite number and kind of berries, say 6 blue, 12 red, and 2 green into a twin cluster representing our valerate of methyl molecule, so that one branch shall contain 4 blue, 9 red, and 2 green, berries, and the other branch 1 blue, and 3 red berries. For our butyrate of ethyl, twin cluster we may arrange exactly the same number and kind of berries in a different manner, so that one branch may contain 4 blue, 7 red, and 2 green berries, and the other branch, 2 blue and 5 red berries. Decomposition of each compound may now be likened, if we think only of one molecule, to the separation of the connecting stem of its respective twin cluster of ber-

ry atoms. This separation in the case of the 2 compounds results in 4 different single clusters, which correspond to the 4 different products of decomposition.

Convinced of the truth of the atomic constitution of matter, Liebig and Dumas sought to find an explanation of the properties of organic compounds in the structure of their molecules. Their brilliant imagination magnified these invisible molecules till they became real systems of atomic groups, which under the play of chemical affinity were made to marshal themselves into varying patterns of marvellous beauty and symmetry. Who has not beguiled in wondering amazement some of his leisure hours by looking at the beautiful forms presented by the arrangement of the colored bits of glass in a Kaleidoscope. Each turn of the tube presented a feast for the eye, in the new and unexpected form of beauty called forth as if by magic. Sometimes falling into patterns so unstable, that the slightest touch would break up their structure and result in a new arrangement. Sometimes clogging in forms so compactly grouped, that it required a vigorous shake of the tube to furnish a new pattern. In like manner we may assume the atoms to arrange themselves like the bits of glass in the Kaleidoscope into stable and unstable molecular structures. We may see in the unstable molecule of chloride of nitrogen, the cause of its ready decomposition with the slightest pressure while the resistance offered to decomposition by silicon dioxide is accounted for by the stable equilibrium of its molecular structure. The contemplation in this matter, of these dynamic systems of atom-clusters, afforded suggestions for experiment, and led to the many brilliant discoveries for which Liebig and Dumas are so justly renowned. One of the grandest results of this method was the enunciation by Dumas of the theory of Substitution. He questioned whether it might not be possible to remove from a complex molecular edifice some of the capstones and replace them by others without destroying the stability of the structure, whether in a compound consisting of Carbon and Hydrogen atoms complexly arranged, some of the Hydrogen atoms might not be replaced by Chlorine. He soon had the satisfaction of answering this query affirmatively by experiment. From purely speculative reasonings based upon the atomic theory Dumas was thus led to the enunciation of a theory, the fruitfulness of which we are as yet unable to estimate, for the impulse it has given to experimental investigation will long be felt. The extension of the theory of radicals to organic compounds and the enunciation by Laurent of the theory of types, as brilliantly generalized by Gerhardt, followed in rapid succession. This chain of theories based upon the assumption of the atomic constitution of matter has not alone enriched us with the discoveries of new and valuable compounds, but has furnished us with what is so essential in exact science—with a rational and natural classification of the ever increasing number of Carbon compounds.

We may now regard our choice between the two assumptions with which we started as sufficiently determined in favor of the existence of atoms, although an important argument in support of the atomic constitution of matter derivable from the specific heat of the elements has been omitted. A constitution of matter, however, which would make an infinite series of compounds between any 2 elements possible, is not inconceivable. With such a constitution of matter chemistry would never

have emerged out of the swaddling cloths of alchemy. Discovery would have been left to pure chance, and the mind of man would have in vain perplexed itself to wring from nature her secrets and render her forces his servants. The very fact, however, that matter has been so constituted, that in its combinations it is obedient to a few laws of exceeding simplicity, which furnish a lamp to the feet of the investigator in his search after new discoveries by enabling him to forecast them, is unmistakable evidence of purpose, and points undeniably to an intelligent First Cause.

Atoms, then, are the indivisible parts of elements. From the combination of atoms of the different elements molecules result. A compound is made up of such molecules—its constitution is molecular. We shall presently see, that from certain chemical considerations we shall be obliged to assume a molecular constitution also for the elements when in a free state; that Oxygen, for instance, does not consist of single atoms at equal distances from each other, but groups of atoms. The difference between a molecule of an element and a molecule of a compound will then consist in the fact, that the molecule of an element is composed of atoms of the *same* kind, while the molecule of a compound is an aggregation of atoms of *different* kinds. Arguments for the molecular structure of elements are derived from their behaviour when being set free from chemical combination. At the instant, namely, of liberation, they are known to possess a greater chemical activity than when in their ordinary free state. This active state of elements has very appropriately been termed the "nascent" state, to indicate that the activity is a result of the liberation. Thus Hydrogen and Sulphur in the nascent state enter with great activity into combination, forming Sulphuretted Hydrogen, while in the free state the combination takes place only with great difficultly and at a great elevation of temperature. This singular difference of activity between the elements in the free and nascent state has been explicable so far only on the supposition, that elements in the free and isolated state possess molecular structure. Thus Hydrogen, for instance, when in the free state may be supposed to exist of twin atoms, the bond which unites them is chemical affinity, which can not be regarded as inactive between the atoms of even the same elements. Their combining tendencies would by such union be partially satisfied, and hence it is quite clear that such molecules would manifest feebler tendencies to enter into new combinations, than if the atoms existed singly with their combining tendencies unengaged. In the nascent state, the atoms evolved from a combination exist singly for an instant, and enter, if no atoms of another element are present with which they can unite, into combination with each other.

This view of the molecular constitution of elements is further supported by the fact, that elements are capable of existing in allotropic modifications in which the *same* elementary body possesses entirely different properties Thus Oxygen in one modification is without odour and comparatively inactive, in the other, as Ozone, it possesses a strong penetrating odour and is intensely active, and yet both are Oxygen and only that. We cannot possibly account for this difference in the properties of the same element, unless we assume that the allotropic modification of an element depends upon a special grouping of its atoms. This assumption gains confirmation from the fact, that when Oxygen is converted into Ozone condensation takes place, so that 3 vols. of Oxygen condense to 2 vols. of Ozone.

At the moment when one modification passes into the other, as when Ozone is converted into Oxygen, heat is evolved. This is what we should expect if the allotropic modifications depended upon special groupings of atoms, for in the act of rearrangement a clashing of atoms and hence internal commotion, must result. If we conceive 6 atoms of Oxygen arranged in 3 molecules of 2 atoms each to constitute common Oxygen 2 molecules of 3 atoms each may represent Ozone. In the act of conversion of Ozone into Oxygen one atom of each of its molecules is expelled, the 2 expelled atoms unite in a molecule, furnishing 3 molecules of 2 atoms each of common Oxygen. The clashing of the 2 expelled atoms in the act of union represents the heat given out in the conversion.

From these 2 lines of argument we conclude, that atoms never exist single or isolated except in the nascent state, but that in each element the atoms are combined to form molecules, which are indivisible by mechanical means. The constitution, then, of all bodies, whether elementary or compound, is molecular. Returning now to our atoms it will be remembered, that chemical considerations have led to the conclusion that for each element the atoms are absolutely alike in specific weight and other properties, but that for different elements they differ in these respects. The farther question now arises, how may I account for the difference in properties between the atoms of the different elements. What, for instance, constitutes the difference in properties between an Oxygen and Chlorine atom? Why is it, that the Hydrogen atom has a spec. grav. 16 times less than that of an Oxygen atom? If we accept the old notion of atoms, that they are exceedingly minute hard particles, filling the space each occupies continuously with its matter, we might assume with Dalton that an Oxygen atom is 16 times larger than a Hydrogen atom, and thus explain by difference in size of the atoms of the different elements, the difference in their ascertained spec. grav. The fact, however, that all gases expand equally for equal increments of heat, pressure being the same, and diminish in volume equally for equal increments of pressure, temperature being the same, led Avogadro as early as 1811 to the great generalization, that equal volumes of gases at equal temperatures and pressures contain the same number of molecules. This generalization is now universally accepted and lies at the foundation of our modern chemistry. Assuming the molecular structure of gaseous elements to be the same, we may state the law of Avogadro in the following modified form: For the same temperature and pressure, elements in the gaseous state contain the same number of atoms. In accordance with this law it follows, that to account for the difference in spec. grav. between Oxygen and Hydrogen, for example, by the size of their atoms, we should farther have to assume, that in a pint of Oxygen gas the atoms are packed 16 times closer together than the atoms of Hydrogen in the same volume measured at the same temperature and pressure. In accordance with this view we may make the general statement, that for different elementary gases measured at the same temperature and pressure the distance between their molecules depends upon the size of their atoms. This would undoubtedly explain the difference in the atomic weights of the elements, and without speculating any farther we might rest satisfied with the statement of Dalton, that any other distinguishing properties between the elements are due to inherent differences in the nature of their atoms. Most of the continental chemists did

not rest with this conclusion of Dalton's, and many bent their energies to discover methods for determining experimentally the relative size of the atoms of the different elements, but it is to the extensive labours of Schroeder and Kopp especially that we owe any advances made in this direction. Assuming the solid condition of each element at equal temperature and pressure to be of the same molecular structure, these eminent chemists have succeeded in showing, that many of the elementary bodies may be arranged in groups, each group consisting of members in which the solid atomic volume is identical. Thus chromium, cobalt, copper, iron, nickel, and manganese have the same atomic volume, which differs only from that of another group. This has naturally created a very strong probability in favor of the equality in the size of the atoms of these elements against Dalton's assumption to the contrary. Selecting Osmium and zinc out of another group for which Kopp has proven an equality of solid atomic volume, it will be very probable, that an atom of Osmium is of the same size as an atom of Zinc; yet I may ask the question, how am I then to account for the difference between the atomic weight of these elements? The only reason I can assign for the difference between the spec. grav. of bodies is, that for equal volumes they contain unequal quantities of matter. But if an Osmium atom occupies as much space as a zinc atom, and the space occupied by each is continuously filled with its matter, I cannot see how equal spaces may contain in the one case 3 times as much continuous matter as in the other. This difficulty may be overcome if we abandon the old conception of the continuity of the atom altogether and conceive of an atom as itself a compound. Such an assumption is farther justified by the fact, that elementary bodies in their properties do not so fundamentally differ from bodies which are known to be compound as to exclude the belief of a certain complexity in the nature of these atoms. The element Oxygen does not differ more fundamentally in its properties from the element Chlorine, than this last differs from Cyanogen or Carbon Dioxide, which are known to be compounds. We may then assume an atom to be a compound of particles of the same size, weight and form, united in numbers corresponding for each element to its combining weight, and held together in stable systems by dynamic bonds, which have resisted all efforts of decomposition. These particles of which elementary atoms are conceived as composed, have been variously termed atomettes, elements, and physical atoms. These terms have already significations attached to them other than to the one here needed, and to avoid confusion we shall call these last particles of which all atoms are composed *ultimates*. Matter from this point of view is all of the same kind, consisting of ultimates, which are pertectly identical. These combined in definite numbers corresponding to the different atomic weights constitute the atoms of the various elements. Whatever number of ultimates we conceive of as united to form our atom of Hydrogen our atom of Oxygen will contain 16 times that number, Nitrogen 14 times that number, and so on. We can now explain without any difficulty how atoms of the different elements having the same size may contain different quantites of matter, for we may readily conceive, that, in the Osmium atom, which contains 3 times the quantity of matter that is contained in a zinc atom, the ultimates are packed 3 times closer than in the zinc

atom. We have here a consistent explanation for the difference in the atomic weights of the elements, any other differences in the properties of the various elements, we may with this view of matter conceive as depending not, as so vaguely expressed by Dalton, upon the inherent differences in the nature of atoms, but more consistently with the generalization that phenomena are interpretable by motion, depending upon the nature of the motions set up in the atoms.

This theory has been developed in explanation of chemical phenomena in a remarkable work entitled "Elements of the Economy of Nature" by Dr. Macvicar. In this work figurative representations of the atoms of the various elements are even attempted, and from their inspection the author has been led to predict the possibility of the resolution of some of the elements into simpler bodies. We know, as yet, too little of atoms to have much confidence in these figurative representations. Future investigations may indeed reveal their nature and permit of their dynamic formulation, but at present we shall have to rest with the conclusion that atoms are compounds, without attempting to form a definite idea of their special configuration.

These ultimates, however minute, must be conceived of as extended, and consequently must have size and form; for, if matter i its ultimate analysis is resolved, as Bayma in his molecular physics maintains, into material points, having location but not extension, it will be difficult to see how, by the aggregation of any number of such unextended points, extended bodies result. Extension, as our first experiences tell us, is a primary property of matter, that property in virtue of which it occupies space. To deny it this property, is to do away with matter altogether, and it is perfectly absurd to talk about *material* points, having location but nct extension. Boscovich in his famous mechanical theory more consistently denies the existence of matter altogether, and assumes, instead of material points, centers of force which by their interaction give rise to the various phenomena we witness. "But no arrangement of centers of force, however complicated," as Clerk Maxwell very pertinently remarks, "can account for the fact, that a body requires a certain force to produce in it a certain change of motion, which fact we express by saying, that the body has a certain measurable mass. No part of their mass can be due to the existence of the supposed centers of force." Berthelot, the eminent French philosopher, maintained, that the atoms of the elements are composed of the same matter, distinguished only by the nature of the motions set up in them; and Henry St. Claire Deville after him, declared "that when bodies deemed to be simple combine with one another, they vanish, they are individually annihilated. For instance he maintains, that in "Sulphate of Copper", there is neither Sulphur nor Oxygen, nor Copper. Sulphur, Oxygen, and Copper are composed each of them by a distinct system of vibrations of one energy and one single substance. The compound Sulphate of Copper answers to a different system, in which the motions are confounded that would produce the respective individualities of its elements, Sulphur, Oxygen and Copper." But what conception can we form of such vibrating oscillating atomic weights? How can vibration account for the constant weight ratio in which the atoms of the differ nt elements enter into combina-

tion? If but one kind of matter is assumed, then to account for the difference in the combining weights of the elements, these must contain in the construction of their atoms different quantities of it. Besides, we cannot point to a single case of constant unimpeded motion; yet this theory necessitates the conclusion that the atoms have each from the commencement of their existence vibrated with a definite velocity of which none has been dissipated. These objections do not apply to our conception of an atom as a compound of extended particles, which we have termed ultimates. These we must imagine as firmly united by dynamic bonds in numbers corresponding to the combining weights of the atoms into stable systems, which resist our best efforts to produce decomposition Yet we must think of them as so united, that even in the densest atom they do not touch each other but leave ample room for rapid vibrations and oscillations across their respective positions of equilibrium. These ultimates, then, are the building material, from which by establishment of immutable configurations elements resulted Through the constant flux of these to ever more and more stable combinations, this sublime universe is hastening to its destined end. To conceive of the minuteness of these ultimates is as futile a task as the endeavour to grasp the meaning of the number which might be written to express in miles the distance of the faintest nebulae on the outskirts of our siderial system. Truly "Deus magnus in magnis, maximus in minimis," we may exclaim with a profounder meaning than the author of these much quoted words could ever have realized If now in imagination we magnify one of our little diatoms melosira distans, which we used in our first experiment as an illustration of the divisibility of matter, we should see it break up into myriads of groupes of molecules harmoniously disposed about centers of attraction each molecule formed of a triplet of atoms. One atom of Silicon consisting of 28 or some multiple of 28 ultimates joined to 2 atoms of Oxygen, each composed of 16 or some multiple of 16 ultimates. We should see each ultimate vibrating within each atom, each atom vibrating in each molecule, each molecule moving in each group, and each group animated with its own motion. We need only imagine each ultimate a shining, twinkling point, to realize the analogy between this structure and the star spangled expanse of a night sky above us. We should, if we carry out the fancy of Dumas, see worlds, circulating about worlds, and these again about other worlds, blending to a harmonious law-regulated whole A microcosm expanded to a macrocosm! The sublime study of astronomy reversed.

The compound structure of the atom has so far been deduced from chemical facts; we shall see, however, that certain physical phenomena also require for their explanation the assumption of the compound nature of atoms. Dr. Draper was the first to show, that when a solid is gradually heated from redness to whiteness, and the light it emits is passed through a prism, and its spectrum examined, that the colours made their appearance successively as the temperature rose, first the red, than the orange was added, then the yellow, the blue, the indigo, and finally the violet, so that when the body attained white heat it

emitted light waves corresponding to all the colours of the spectrum. Reversely, when the body cooled from white heat, the colours from the violet to the red would be successively blotted out from the spectrum. Now the light and heat given out by the white hot body, are due to the intense internal commotion of the solid—its atoms and molecules are in incessant and rapid vibration, which, communicated to the universal elastic ether, throw it into corresponding vibrations, which received upon our retina produce the sensation of light and colour. But it has always been found exceedingly difficult to imagine a motion of a solid atom, which shall be capable of throwing the universal elastic ether into a series of waves graduating completely, and without a break from red, and below it to violet and above it. The phenomena of sound are usually cited as an analogy in point. It is, namely, a fact of acoustics, that a vibrating string sounds not alone its fundamental tone but gives a variety of other less intense tones, termed over tones. To illustrate optically the compound motion of a sounding body, which renders it capable of producing overtones, it is only necessary to fasten a common knitting needle with a silvered bead attached to one end with sealing wax into a common vice upright, so that the glass bead may swing with the knitting needle if this is set into vibration. Concentrating the light of a lamp upon the bead in an otherwise dark room, and striking the needle gently, yet quickly, the bead will be seen to move in beautiful undulating lines of light intertwining in the most marvellous patterns. We are told to imagine the oscillation of an atom something like this motion of the bead, in explanation of the variety of ether waves capable of generation by such motion The analogy, however beautiful, does not hold good, for no sounding body can be made to vibrate in such a manner as to give rise to all the possible sounds at the same time. Our white hot body does, however emit *all* the waves of light from the red to the violet at the same time. In explanation of this, it may of course be said, that in a solid, made up by the aggregation of complex molecular groups of atoms, held together by the force of attraction, yet prevented from touching by an assumed action of a repulsive force, that in such an aggregation some in each group would be so disposed in relation to the others, as to require from the attractive tension exerted upon them a greater force to set them oscillating than the others The former would vibrate more rapidly and give rise to shorter wave lengths than the latter. This argument may be extended to all the other atoms composing one group, so that a difference of position of an atom in a group accounts for the different attractive tension to which it is subjected, and consequently for the different rate of vibration it maintains. In accordance with this explanation a single atom of a group is not assumed as competent to furnish all the wave lengths of the spectrum, but only its definite and specific quota, which includes its fundamental vibration and its specific overtones—this latter term signifying, for want of a better, the additional superposed vibrations. Each atom of a group then furnishes its specific set of vibrations, different from that of another atom of the same group in consequence of the disturbing effect of the attractive force of the atoms of a neighboring group. The whole

effect owing to *aggregation* would be the sum of all these vibrations, resulting in a continuous spectrum. If now we cancel the force of attraction, which held these atom groups together in the solid, by rendering the solid a vapour, then each molecule of the substance will no longer be influenced by any attraction exerted upon it by any other molecule, and we shall now only obtain if we render the vapour incandescent, the fundamental vibrations, and its specific overtones, and these only These fundamental vibrations and overtones would now of each atom be exactly the same, and not, as in the case of the solid, different merging into a continuous spectrum. These definite vibrations should furnish a discontinuous spectrum consisting of a number of bright lines. This is found to be the case. If, for instance, we vaporize iron between the carbon poles of a voltaic arc and send the light, which this incandescent iron vapour emits, through a prism, the spectrum which it furnishes will be found to consist of a surprising number of bright lines from the red to the violet. The spectrum is discontinuous. If we consider the vibrations such an iron atom must perform to produce this effect, and think of the atom as the gleaming silver bead of the knitting needle we should, by reducing its vibrations in rapidity, see it weaving luminous paterns of wonderful complexity and marvellous beauty. By substituting air, for the universal elastic ether, and bringing the vibrations within the range of the auditory nerve, we should hear the incandescent vapour sing its fundamental tone and overtone,—it would be musical. The incandescent solid considered in the same manner would produce a painful and intolerable noise, as when *all* the keys of a piano are struck at the same time. It must, however, be observed that the motion of the glass bead of the knitting needle in that manner, which renders it capable of giving out overtones, is a consequence of the solid structure of the knitting needle—a result of the aggregation of myriads of groups of atoms composing the knitting needle; and in order, that this analogy shall hold good for our iron atom, we must also regard it as an aggregation of still smaller particles—our ultimates; for the more we think of it, the more impossible will it seem, that a solid continuous particle can vibrate in the supposed manner. Were the atom a compound, we could understand it, and the bead of the knitting needle would then be an analogy in point. For we would then see how in a compound of a number of ultimates, bound at definiet distances from each other to a permanent system, the iron atom could maintain a palpitating motion necessary for the explanation of the phenomena of light The position of each ultimate with respect to the whole system constituting the atom, would assign to it its vibrating period in conformity with the definite force of attraction exerted upon it by other ultimates of the same system. The force of attraction would vary in intensity according to the position of the atom within the system; this force of attraction would determine its vibrating period, which might be different for the different ultimates of the same atom. We could then also see, that the greater complexity of aggregation would be capable of emitting light waves verging more and

more toward a continuous spectrum, which is reached when the solid state is attained; and, further, we can see why each elementary substance in the form of incandescent vapor has a definite, different spectrum, since the spectrum may now be supposed as depending on the grouping and number of the ultimates constituting an atom.

The perfect coincidence of the vibrations of incandescent hydrogen upon the earth, no matter how obtained, with that observed in any celestial body which is known to contain it, the perfect definiteness and invariability of its combining weight, no matter from what source the Hydrogen be extracted, be it from meteoic iron, or from some kind of coals deposited ages ago in the carboniferous age, show it to be constructed upon one pattern, one type—its configuration is permanent, and this holds equally true with all the rest of the well established elements. We cannot avoid the conclusion of Sir John Herschel, that this uniformity and invariability are marks of a manufactured article—it was created, and it must be admitted with Clerk Maxwell, the illustrious physicist, "that in the case of molecules, each individual is permanent, there is no generation and no variation, or rather no difference between the individuals of each species. Hence the kind of speculation with which we have become so familiar under the name of theories of evolution is quite inapplicable to the case of molecules." If then we accept the nebular hypothesis, we must at least start with these manufactured molecules. The time may not be far distant when the spectroscope will furnish material aid to research in the domain of molecular physics, when we shall be enabled to make out connections between the wave lengths of the bright lines of the metals and their atomic weights. We may even hope that molecular physics will be reduced to an exact science, so that from its data we shall be able by mathematical deduction to arrive at the properties of matter.

The case of heat is so similar to that of light, that whatever in the structure of atoms is capable of explaining the emission of light waves will also explain the emission of heat waves.

But we may yet derive a further argument for the compound constitution of our atoms from the late development in molecular science arrived at by the joint labours of Kroenig, Clausius, and Clerk Maxwell. The dynamic theory of gases maintains, that the molecules of a gas are in a state of rectilineal motion, flying in all directions at a calculated velocity of 17 miles per minute, through the space the gas occupies, having their directions continuously altered by collisions with each other, and producing pressure by striking against the sides of the containing vessel. It might indeed at first sight appear strange to you, that we should be able to sustain unharmed a bombardment of the molecules of this air moving at the rate of 17 miles per minute. We can do so, remarks Clerk Maxwell "only because the molecules happen to be flying in different directions, so that those which strike against our back enable us to support the storm which is beating against our faces. Indeed, if this molecular bombardment were to cease, even for an instant, our

veins would swell, our breath would leave us, and we should literally expire." It is, however, to a statement of Clausius in connection with this theory, that I call your special attention. In an article entitled "Motion, which we call heat," he states in description of the resulting collisions of the molecules, (the term molecule in molecular physics may be substituted for our term compound atom,) that when 2 molecules in their motion collide, they fly apart with in general the same velocity, which they had before impact. Now from this it follows that the molecules must be elastic, and perfectly so, if no motion is to be lost in the collision. But we cannot think of elasticity as a property of continuous bodies. When 2 glass balls in motion meet we explain the fact of their flying apart by appealing to their molecular structure. The 2 balls in meeting approach with their centres of gravity, the balls flattening at the point of contact, the molecules, which are there situated, have been pressed inwards in regaining their original position the balls are propelled in directions opposite to the original direction of motion. We need exactly the same explanation for the collision of any 2 molecules, say of Oxygen gas, and we shall have to seek the explanation of the elasticity of molecules in the construction of their atoms.—their compound nature, for only then will they be capable of exhibiting a resilience so necessary for the application of the kinetic theory to gases.

Thus from both chemical and physical considerations, we have been led to assume a compound nature for the atoms. Matter conceived of as molecular aggregations of groups of such atoms is, on account of the marvellous complexity of structure it permits, admirably adapted for an almost unlimited variety of motions. In the variety of the motions of these ultimates and their groups lies the explanation of the variety of the phenomena of this beauteous universe. The diamond sparkling on the bride's finger owes its splendour to its molecular structure. Each maple leaf, ere it is chilled by the winter's frost, changes the rate of vibration of its chlorophyll, which wraps it in a winding sheet of gorgeous red. The deep blue sky above the golden tinted clouds on a western horizon, owe their beauty but to the vibrating periods of molecules; and even were we able by mathematical analysis to follow all these motions, and accurately formulate them, rudely as this might tear away the glory and beauty which like a veil cover this creation, we would, I doubt not, find behind it that which would anew inspire us with awe, aye with reverence, as we gaze out upon the boundless fields of beauty and knowledge beyond! Our soul is thirsty for this knowledge, and the intellects of our best men are strained to their utmost in unravelling this wondrous complexity of structure and motion. Those who have seen deepest into it, and have gone farthest in their investigations, have worked their way through Materialism, and attained with President Wurtz to the conclusion that things have not in themselves their own *raison d'etre*, their support and origin, but are subject to a First Cause—unique, universal, God.