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William Dawson and Scientific Education

The history of the role of Sir William Dawson in Canadian science is twofold: it is concerned with his strong opposition to evolutionary geology and with his brilliant activity as Principal at McGill University. Such traditional points reduce the thought and action of William Dawson to some scientific misunderstandings and to his academic career at the expense of his total humanity. It neglects that he was a true scientific intellectual, responsible for giving 19th Century Canadian science its distinctive stamp. Until ten years ago no serious study of Dawson's life and work had been produced. Charles F. O'Brien has recently helped to remedy this deficiency by writing a very interesting book, *Sir William Dawson, A Life in Science and Religion* (Philadelphia, 1971), which offers a much clearer picture of the way in which Dawson worked and interpreted the intercourse between science and religion. There are, however, some aspects of Dawson's scientific views which would seem to deserve closer examination, namely, his belief that the natural sciences were essential to a proper education.

Long before his Principalship at McGill, Dawson extended his scientific influence far beyond academic teaching and became involved in a project of "university extension" sponsored by Dalhousie College. His autobiography was a serious effort to survey the principal scientific developments in nineteenth-century Canada. In it Dawson reported this unusual early teaching experience as one of the most interesting of his early activities:

> About the year 1849, an effort was made to infuse new life into Dalhousie College, an institution which has received a small provincial endowment, and possessed a building in the city of Halifax. Dr. McCulloch had been transferred some years before, from his position in Pictou, to be its principal, but on his death it threatened to lapse into a decaying state. In these circumstances it was suggested that, for one

> year, a series of extra-academical lectures on scientific and other subjects should be delivered, to which the public might be admitted—a sort of anticipation of the 'University extension' movement of our time. An invitation was given to me to take one of these courses,—on natural history subjects.'[1]

Documents[2] in the possession of Dalhousie University Archives can provide readers with an intelligible account of Dawson's contribution to Canadian education along these lines. On December 29 of 1849 the Chairman wrote Dawson:

> The Governor of Dalhousie College had a meeting two days ago and empowered me to engage your services if convenient to yourself for a course of 24 lectures on Geology Mineralogy Botany and Zoology to occupy 10 or 12 weeks during the session of the Legislature. The lectures to be delivered at night say at 8 o'clock in the College. The teachers and pupils to have the privilege of attending two or three hours a week or more to be devoted to familiar illustration of the subject matter of each lecture to such of the pupils as may discover a taste for such enquiries. The remuneration out of the College funds to be Forty pounds and all the fees of whoever you can attract as an audience to be yours—the amount to be moderate. This and the hours of attendance and the details to be arranged here in all of which no difficulty needs to be anticipated. I could not give you an earlier notice. I will be well pleased if you can come.
>
> M.J.W. Dawson Believe me yours truly[3]

Dawson was glad to accept this offer and accordingly moved with his wife from Pictou to Halifax. Writing his autobiography, he still remembered such teaching experience as a momentous and useful one:

> I lectured to a large class, partly composed of citizens and partly of pupils of the higher schools, as well as students of Dalhousie. Finding that some interest was aroused, I organized a practical class for special subjects, particularly mineralogy and the study of fossils, and made excursions with the members of this special class to collect objects of interest. The course was thus, on the whole, useful from an educational point of view . . . . At the same time, I obtained some confidence in my power to interest students.[4]

The lectures given at Dalhousie College are not to be regarded as a major event in Dawson's life, but rather as a first chance to express his scientific attitude. Another and more rewarding opportunity was given to Dawson by Joseph Howe, who appointed him Superintendent

of Education in Nova Scotia. Dawson writes that his first impulse was to decline, but he eventually took up the office, reluctantly postponing his attractive geological pursuits. The main duty of the Superintendent was to interest himself in all questions relating to the recent introduction of agriculture in scholastic curricula. For three years, from 1850 to 1853, Dawson travelled from county to county, meeting teachers, lecturing on education, explaining the means of introducing agriculture into the schools and, above all, providing new apparatus and writing text-books, including *Handbook of the Geography and Natural History of Nova Scotia* (Pictou and Edinburgh, 1852) and *Scientific Contribution towards the Improvement of Agriculture in Nova Scotia* (Pictou, 1853).[5] Additional work was done by Dawson in publishing an educational journal and writing reports and statistics to explain to members of the Legislature his new educational projects: free schools provided by a compulsory local tax supplemented by an equal contribution from public funds, the appointment of inspectors, and the establishment of a normal school.[6] Dawson resigned from the office in 1853, partly because of a severe illness due to continual travelling and strenuous work, but the results counterbalanced such tiring activity:

> intelligible statistics as the schools had for the first time been collected; some unity had been introduced into the work of local commissioners of schools; improvements had been made in books, apparatus, buildings, and methods of teaching and a large proportion of the people had become convinced of the necessity of systematic means for training teachers.[7]

Accordingly, in 1855, a normal school was established in Truro by Sir Charles Tupper, despite the fact that he was the leader of the political party opposed to that which had appointed Dawson. In the same year, however, William Dawson left Nova Scotia to become Principal at McGill, where his educational aims were to find wider field of application.

Both in teaching and writing William Dawson proved himself as a disseminator of scientific information, as well as an enthusiastic propagandist for science and for the great good it could confer on his country. It would hardly be possible to conduct here a satisfactory discussion of the philosophy of Dawson, who took all science for his province and did much to encompass it, but a perusal of one of his most exhaustive essays, *The Present Rights and Duties of Science* (1878) may be of some help.[8]

Science, according to Dawson, has two fundamental rights: the right of investigation and a right to a large share in the education of the young. As far as the first right is concerned, Dawson stressed the utilitarian aspect of science by underlining the striking disproportion between the advantages which science provides for mankind and the precarious financial support which is granted to scientific institutions. As for the second right of science, the teaching of science and science educators, ever since the beginning of his cultural activity in Canada, Dawson had recognized the desirability of a reformation in education. In his opinion, humanistic studies ought to yield to such practical and useful subjects as geology, geography, chemistry, agriculture, and the like. Knowledge in these fields supplied the needs of traders and manufacturers. He did not hesitate to point out the deficiencies of Canadian universities, with their lack of competent teachers and inability to attract learned men. Among the remedies he proposed, here and in other writings, were that professorships should be increased in number and fellowships should be given to competent men, namely to teachers who are willing to explain phenomena by means of investigation and not by books or idle speculation. (Thus, his attitude toward evolutionary theory can be regarded as a corollary of this emphasis upon the importance of sense-observation and his corresponding distrust of all learning that does not stem from the physical world. Darwin's theory, to which Dawson maintained an abiding aversion, was to him the unlawful operation of reason upon an unsufficient physical foundation.)

According to Dawson all young people begin life with certain natural sciences of their own and it should be the duty of the educator to systematize and give scientific meaning to those stores of fact that pupils already possess. Unfortunately such competent teachers are very difficult to find and the existing educators rather force pupils to attend to dry abstractions:

> Nearby all our educators are still wedded to the abstract scholastic methods of education still in use. Even our science text-books are generally tainted with the same bad leaven.[9]

At this point the scholar of Dawson cannot help but recall some remarks he made in his autobiography concerning his schooldays at Pictou Academy. In the following lines we can easily recognize Dawson's precocious search for concrete scientific knowledge:

> I was delighted to find that mathematics could become of some interest when applied to the problems of physics and astronomy . . . . I learned

> that the mysteries of solid geometry and trigonometry had been materialized in the crystals of quartz, calcite and zeolite, which I had collected from ballast piles on the wharves, or from the quarries and coast cliffs.[10]

For Dawson, the right of science in the education of the young was twofold. The first is related to the training of scientific workers, the second concerned that elementary and popular teaching such as Dawson himself practised at Dalhousie College:

> The second represents the diffusion of the benefits of science among the mass of the people; and this also is essential, both to give the public support and countenance which the scientific worker requires, and to leaven society itself with the influence of scientific training.[11]

It appears clearly from the above comments that Dawson was extremely broadminded and truly modern as far as mass education is concerned, which is a rare occurrence indeed even among scientists of our times. So too, were his ideas regarding the so-called neutrality of scientists who should care for many facets of human life and feel responsible for the social improvements of their times:

> I fear I may seem too sanguine in this matter, but I have a very deep conviction that few even of our most advanced thinkers have any just conception of the educational value of science, with reference not merely to learning, but to all our political, social, and even religious interests.[12]

The word "political", used here, is seldom found in Dawson's works written before Confederation. During British Rule such a term was open to embarrassing misunderstandings which the Principal of McGill could not risk. Nonetheless, he was deeply concerned about political problems. So, for instance, he shared the attitude of many Canadian intellectuals who, for more than one reason, were not in favour of making Canada a free Confederation. Such feelings, of course, were not going to increase the popularity of the intellectuals among the young, often too eager for changes and more freedom, but Dawson was not afraid, four years before Confederation, to address his students with the following courageous remarks:

> We must, at least in our present condition, either remain a dependency of the mother country, or fall into the hands of the United States. Yet this situation, while it affords no present hope of great political eminence or military success, is not without counterbalancing ad-

> vantages. It gives us a position of humble and pacific usefulness, respectable, if not great, and tending to induce us to cultivate the arts and sciences of peace, rather than those ambitious projects which agitate greater states.[13]

Yet science has also certain duties and increasing responsibilities which its cultivators owe both to themselves and to their calling. Such duties may be grouped as follows: the duty of co-operation among scientists, the duty to cultivate specialties without neglecting general views, the duty to confine research within human bounds and the duty of practical application. Co-operation among scientists was but a dream in Dawson's days, as he pointed out in the opening address delivered before the Royal Society of Canada, the organization of which[14] was mainly due to his strenuous work and energy:

> I would place here first, the establishment of a bond of union between the scattered workers, now widely separated in different parts of the Dominion. Our men of science are so few, and our country so extensive, that it is difficult to find in any one place, or within reasonable distances of each other, half-a-dozen active workers in science. There is thus great lack of sympathy and stimulus and of the discussion and interchange of ideas, which tend so much to correct, as well as encourage.[15]

The isolation of scientists, however, results in many and varied shortcomings which hamper science itself. Each individual pursues a path of his own, without concert with his fellows. The result is a narrowing of scientists' minds, a tendency to extreme views, a danger of losing sight of the amplitude of science.

Nevertheless, as we have already seen, science has a duty not to neglect general views. In the nineteenth century scientists tried to restore that unity of science which the Industrial Revolution had diverted into so many streams. According to Dawson, the extraordinary development of modern science might cause its undoing. Specialism, which he admitted was a necessity, was however going to fragment the specialties themselves in a way that made the outlook hazardous. The workers risked losing all sense of proportion in a maze of minutiae. The pure specialist or the pedant cannot occupy a useful place in Canada where, as Dawson points out, the perpetual ebb and flow of social life and the frequent changes of position "demand a variety of information and a versatility of powers, greater than that which could be necessary in the more advanced communities of the old world."[16]

The duty of every Canadian was then to aim at excellence in his special calling without neglecting to cultivate his mental powers more intensively and to aspire to versatility. Nonetheless, William Dawson was deeply concerned with the growing necessity of professional training, provided that such training was not confined to mere serving of an apprenticeship. In these restricted circumstances, all students would fall below the level of their masters and, in time, the general standard of the profession would be lowered:

> A mere imitator can never attain to excellence . . . . He who, in a country like this, sets before himself only the standard of a previous generation, will be a dwarf in the generation to come.[17]

Professional education was a catch-phrase in Dawson's days, in a country faced by a multitude of practical problems requiring for their solution a multitude of skilled professional people. The need for such professional education was generally recognized, but the steps actually being undertaken to meet the situation were tentative, hesitant and ill-financed. Money was one problem. A scarcity of well-trained professors to organize and to teach professional subjects was a second. A third, in many respects the most difficult to solve, was the long arm of tradition. Dawson never ceased to urge this subject on the attention of the "friends of education" in Canada with the aim of erecting new schools of science and of introducing science into the curriculum of other institutions.

To improve the teaching of science in Canada, Dawson believed it extremely useful to collect information as to the state of similar institutions abroad. In 1870 he went to Great Britain with his wife for scientific and personal reasons, the most important of which was to see his eldest son who had entered the Royal School of Mines. This visit, however, marked the most important moment in the development of his ideas on education as can be discovered from a perusal of his *Science Education Abroad*, which is still an important paper on the comparative evaluation of science education in 19th Century Europe. In his accurate description of some British Institutions, such as London University, Royal Institution, Owen's College of Manchester and of some other similar schools in Cambridge, Oxford and Edinburgh, and remarks about science education in U.S.A., Germany and Switzerland, two kinds of comment strike the present-day reader. The first of these calls to mind Dawson's first teaching experience at Dalhousie College and points out very clearly his concepts of science as lifelong education. At Owen's College evening classes

were provided for "partial students" to accommodate those whose business prevented them from attending lectures in the day-time. Dawson's comment sounds more than enthusiastic:

> The number of students last year was no less than 400. This is a remarkable indication of the avidity for learning on the part of the young business men of Manchester, who enter on this somewhat severe course of study as an employment for their evenings, and after the toils of the day.[19]

Another and most interesting remark in Dawson's review of science education is his warm approval of the Swiss Polytechnicion of Zurich and, above all, of the Prussian scholastic system, of which he had collected information in Great Britain:

> From such institutions in Germany and Switzerland annually proceed numbers of educated young men who are prepared to advance every branch of art by the application of science, who are distancing England in so many manufactures, and who are now contributing so largely to the wonderful success of the German armies.[20]

It is rather surprising to read such a sentence, which shows striking differences from that ideal of "sciences of peace" of which Dawson had always spoken in favour. Let us, however, remember that the above paper was written in 1870, after his return home from Europe where the Franco-Prussian War was in progress. In his autobiography, Dawson tells us of a visit he paid at that time to the Superintendent of Education in Quebec City, Dr. Chauveau:

> [Dr. Chauveau] was full of the news, and quite sure that in a few weeks we should hear of the triumphant entry of the Emperor Napoleon into Berlin . . . . This was the universal opinion of French Canadians of the time, and until the final catastrophe of the Empire came, even the more educated could scarcely believe that there was any truth in the cabled dispatches of German victories. In the following year, I found that many of the common people on the lower St. Lawrence . . . still believed that the Emperor had annihilated the Prussians.[21]

Is there a taint of harsh feelings towards French-speaking Canadians in Dawson's remarks? In the same autobiography he stresses that "the French Canadian element . . . had given little attention to Natural and Physical Science."[22]

Recent criticism makes Dawson's observation rather doubtful, but his was the general attitude of the English-speaking Canadians

toward the French community in Lower Canada. Dawson is here mainly concerned with scholastic systems, and by 1870 there was in Lower Canada little to distinguish technical colleges from classical ones since the former tended to adopt the same program as that of the latter, partly because this would entitle them to receive the larger government grant.[23] While convinced of the low level of French-Canadian scientific training, he could not express this openly in Montreal for self-evident reasons, so he transferred his criticism to Europe, to that French culture he could not attack in Canada, to that scientific weakness which, in his opinion, had brought the French Emperor to a deserved defeat.

Therefore it might be inferred that Dawson saw Canada owing her independence and peace to her good scientific institutions and professional training, but let us not go so far. We shall here confine ourselves to stressing the role of William Dawson in the development of Canadian science. Although other people may have said similar things, it was Dawson's general statements about the aims and methods of science education that influenced Canadian Universities. He gave considerable importance both to the liberal educational value of the natural sciences (physical, earth and medical sciences) and to the professional character of the applied or engineering sciences. While realizing the first part of such a program at McGill University, he did not cease to stress the relevance of the second part, which was to become a reality after his death. According to him, basic scientific education would represent for a vast majority of the only opportunity they had not only to acquire knowledge which was not normally provided by traditional culture, but also to learn to conceptualize, and to develop powers of observation, analysis and logical reasoning. Not teaching science, but learning scientifically was the general rule he stated for educational purposes in his country:

> I have been surprised to find that classes of young men will rather commit to memory a dry text-book or imperfect lecture notes, than open their eyes to see for themselves and exercise their minds in perception and comparison, so thoroughly has the natural habit of observation been crushed by previous vicious training. This is one of the first evils the educator has to counteract, the next is to eradicate the habit of receiving statements on authority, and to stimulate the mind to the contrary habit of 'proving all things', a scientific as well as religious duty.[24]

Certain other details are still worth noting regarding Dawson's visit to Britain in 1870. As he recalls in his autobiography, it was on that oc-

casion that he collected material and information about higher education for women:

> In Edinburgh we made the acquaintance of Miss Louisa Stevenson, the Honorary Secretary of the Ladies' Educational Association, and at her house met several ladies interested in the higher education of women, from whom we learned much that was likely to be of value on the work of this kind, which we contemplated establishing in Montreal.[25]

As a result of such educational stimulus, Dawson made strenuous efforts to increase University funds until, in 1884, the first session for women was commenced in the Faculty of Arts at McGill. However, as far as scientific education was concerned, Dawson was rather reluctant to provide professional training for young ladies. Although some Canadian women had already shown interest in scientific subjects, as we can infer, for instance, from the by-laws of the Canadian Botanical Society of Kingston[26], which provided full-membership both for men and women and from a paper published by Lady Dalhousie[27], Principal Dawson was not in favour of extending regular courses of higher education to women. According to him, professional scientific education was to be considered superfluous for young ladies living in a country where "few women remain unmarried": women should be liberally educated rather than introduced into the professions. Trained Canadian students had a duty to repay their young country and to improve her welfare through professional activities, and such repayment was hardly to be expected from Canadian women living in a prosperous country which allowed them to avoid harsh professional competition and to devote their strength to the perpetuation of mental qualities through the generations:

> It is a noteworthy fact that eminent qualities in men may often be traced to similar qualities in their mothers. Knowledge, it is true, is not hereditary, but high mental qualities are so, and experience and observation seem to prove that the transmission is chiefly through the mother's side.[28]

Such tenets gave rise to wide criticism, and today, ought to be rejected, but let it be stressed that without these deep utilitarian views of Dawson, scientific training in Canada would have been retarded to quite considerable extent.[29]

In Dawson's case one cannot help feeling that he would have found a more satisfying niche for his science and scholarship had he taken up the post offered him at Princeton University in 1878. He rejected it

for a more active role as Principal when there was a review of most educational problems with the emergence of Canada as a "new country." His work provided a synthesis which answered particular urgent questions of his day. A combination of temperament and training placed him firmly in the tradition of nineteenth-century Canadian education.

NOTES

1. William J. Dawson, *Fifty Years of Work in Canada, Scientific and Educational, Being Autobiographical Notes by Sir William Dawson,* edited by Rankine Dawson, (London and Edinburgh, 1901), p. 68.
2. The first document, dated October 1849, is a record of a Board meeting held at Dalhousie College concerning the invitation given to William Dawson. Board minutes of December 27 of the same year show that it met again on the same subject.
3. Dalhousie University Archives.
4. Dawson, *Fifty years*, p.69.
5. The *Contributions* are in the Peter Redpath Library, in Montreal. In a second edition Dawson added a treatise on livestock, so the *Contributions* formed the basis of a text-book for the use of the McGill Normal School, *Contributions towards the Improvement of Agriculture in Nova Scotia; with Practical hints on the Management and Improvement of Live Stock, (Halifax, 1854).*
6. *Report of Schools of Nova Scotia for the Year 1850, by the Superintendent of Education,* (Halifax, 1851); *Report on the Schools of Nova Scotia for the Year 1851, by the Superintendent of Education,* (Halifax, 1852); *Report on the Schools of Nova Scotia for 1853, by the Superintendent of Education,* (Halifax, 1853).
7. Dawson, *Fifty Years,* p. 74.
8. "The Present Rights and Duties of Science", *Princeton Review* (1878), pp. 674-696.
9. *Ibid,* p. 678.
10. Dawson, *Fifty Years,* pp. 29-30.
11. Dawson, *The Present Rights,* p. 679.
12. *Ibid,* p. 678.
13. Dawson, *The Duties of the Educated Young Men in British America, Being the Annual University Lecture of McGill University,* (Montreal, 1863), p. 6.
14. Dawson, *Fifty Years,* pp. 198-201.
15. *Ibid,* p. 190.
16. Dawson, *The Present Rights,* p. 15.
17. *Ibid,* p. 12.
18. Dawson, *Science Education Abroad, Being the Annual University Lecture of the Session 1870-71,* (Montreal, 1870).
19. *Ibid,* p. 7.
20. *Ibid,* p. 11.
21. Dawson, *Fifty Years,* p. 161.
22. *Ibid,* p. 179.
23. Robin S. Harris, *A History of Higher Education in Canada 1663-1960,* (Toronto, 1976), p. 22.
24. Dawson, *The Present Rights,* pp. 689-690.
25. Dawson, *Fifty Years,* p. 158.
26. *Annals of the Botanical Society of Canada,* I (1860-62).
27. Countess of Dalhousie, *Catalogue of Canadian Plants,* "Transactions of the Literary and Historical Society of Quebec", I, (1829), pp. 255-263. The name of Lady Dalhousie, is missing in D.P. Penhallow, "Review of Canadian Botany from 1800 to 1895", *Transactions of the Royal Society of Canada,* (1897), pp. 3-56.

28. Dawson, *Fifty Years*, p. 252.
29. While restricted to liberal subjects, Dawson's efforts to secure higher education for women were considered very advanced by Canadian cultivated circles, as we can infer from the *Queen's College Journal*, 23 October 1875, pp. 5-6. ("Principal Dawson on University Culture"): "From what we have said about Principal Dawson's Lecture it will be seen that he is thoroughly *progressive* in his views as to female education . . . . The young ladies of Kingston are less favoured than their sisters in Montreal."