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Article abstract

Reaction to Darwin's theory of evolution within the natural history community of nineteenth-century Nova Scotia focused on his use of hypothesis to account for a diversity of facts about the origin of species. Critics here, as elsewhere, faulted Darwin's reasoning for straying from proper Baconian inductive method. Those locally engaged in natural history were inclined to stick closely to a descriptive inventory of the colony's (after 1867, the province's) natural resources. More fundamentally, Darwin's approach challenged the mission of natural theology to support a providential reading of the natural world and humanity's place within it. A review of publications in the *Proceedings and Transactions of the Nova Scotian Institute for Natural Science* and a private-diary account of a discussion emerging from a Mechanics Institute lecture during the 1860s and '70s reveals how members reacted critically to Darwin's science while insisting on the compatibility of science and religion.

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Abstract: *Reaction to Darwin's theory of evolution within the natural history community of nineteenth-century Nova Scotia focused on his use of hypothesis to account for a diversity of facts about the origin of species. Critics here, as elsewhere, faulted Darwin's reasoning for straying from proper Baconian inductive method. Those locally engaged in natural history were inclined to stick closely to a descriptive inventory of the colony's (after 1867, the province's) natural resources. More fundamentally, Darwin's approach challenged the mission of natural theology to support a providential reading of the natural world and humanity's place within it. A review of publications in the Proceedings and Transactions of the Nova Scotian Institute for Natural Science and a private-diary account of a discussion emerging from a Mechanics Institute lecture during the 1860s and '70s reveals how members reacted critically to Darwin's science while insisting on the compatibility of science and religion.*

Résumé : *Parmi les cercles de naturalistes néo-écossais du XIXe siècle, les réactions vis-à-vis de la théorie de l'évolution de Darwin se concentraient surtout sur son utilisation d'hypothèses pour expliquer une diversité de faits liés à l'origine des espèces. Ici comme ailleurs, les critiques ont souvent reproché à Darwin le fait que son raisonnement s'écartait de la méthode inductive proprement baconienne. Dans la région, ceux qui s'intéressaient à l'histoire naturelle étaient plutôt enclins à s'en tenir à un inventaire descriptif des ressources naturelles de la colonie (devenue province en 1867). Plus fondamentalement, l'approche de Darwin remettait en question l'orientation de la théologie naturelle, qui soutenait une lecture providentielle du monde naturel et de la place de l'humanité en son sein. Un examen des textes tirés des Proceedings and Transactions of the Nova Scotian Institute for Natural Science et d'un compte rendu trouvé dans un journal personnel faisant mention d'une discussion soulevée à la suite d'une conférence de l'Institut de mécanique dans les années 1860-1870, révèle comment les membres ont généralement critiqué la science de Darwin tout en insistant sur la compatibilité de la science et de la religion.*

Keywords: Darwinism, Nova Scotia, ways of knowing, natural history, natural theology

“About thirty years ago there was much talk that geologists ought only to observe and not theorise; and I well remember some one saying that at this rate a man might as well go into a gravel-pit and count the pebbles and describe the colours.” Charles Darwin to Henry Fawcett, 18 Sept. 1861

DARWIN'S REMARK BELIES A FRUSTRATION with a simplistic kind of Baconian inductivism, according to which the scientist must take care to observe nature free of the biasing influence of prior hypotheses or other 'idols of the mind.' Hypotheses (or general ideas) were supposed to reveal themselves to the scientist's mind only after the accumulation of facts obtained by means of

objective observation. Darwin's remark also alludes to what John Pickstone described as the 'natural historical' way of knowing.¹ Description, sorting, classifying: these are activities central to the tradition of Natural History. What was once called Natural Philosophy, on the other hand, involves the attempt to discover the laws and causes of phenomena, and relies on the 'analytical' way of knowing whereby things are broken down conceptually and perhaps physically into more fundamental elements. The process of explaining why things occur the way they do or why objects possess the outwardly observable properties they have, often relies on positing elements or forces that are either invisible or only indirectly detectable with the naked senses. Explanation and the identification of general laws frequently require the proposal and testing of hypotheses; and so Darwin [Fig. 1], in his very next line, remarked: "How odd it is that anyone should not see that all observation must be for or against some view if it is to be of any service!"² Darwin's fame rests, of course, on his willingness to put forth bold hypotheses in order to explain a diversity of natural historical phenomena with resort to key concepts such as the community of descent, natural selection, pangenesis, and the formation of coral atolls through the gradual subsidence of sea-bed geology, to name a few.³ So, while Darwin was an exceptionally capable natural historian, the pains he took to make careful observations on a wealth of subjects were motivated by a desire to identify and to test explanatory hypotheses using the analytical way of knowing and its closer association with theory and experiment.

In addition to the *natural historical*, the *analytical*, and the *experimental* ways of knowing, Pickstone also identifies a fourth more ancient and widespread activity which he calls *world reading*. This he describes as a hermeneutical approach to interpreting the world and one's experiences in it as a kind of text full of meaning and significance. It includes what one typically thinks of as a philosophical or religious approach to reflection upon the natural world. In the nineteenth century this took the form of 'Natural Theology', the attempt to understand God the creator through the study of his creations as illustrated by works such as Bishop Paley's *Natural Theology or Evidences of the Existence and Attributes of the Deity* (1802) and the *Bridgewater Treatises* (1833-1840).

Natural history as practised in Britain and British North America in the first half of the nineteenth century was strongly influenced by natural theology. While utilitarian commercial interests provided a significant stimulus for engaging in what Suzanne Zeller has called the 'inventory sciences' in early Canada (geology, terrestrial magnetism, meteorology, botany), natural theology provided the activities of describing and classifying the flora, fauna, and natural resources of a colony like Nova Scotia with a more lofty and edifying purpose.⁴ Darwin's theory of evolution evoked criticism and controversy for challenging natural theology's mission to provide empirical corroboration for the truths of Christianity as revealed in scripture and to be accepted on the basis of devout faith. Darwin's theory that humans share a common ancestry with all other extant species of animals and plants, a process driven not by intelligent



Figure 1. Water-colour portrait of Charles Darwin, after his return from the voyage of the Beagle, by George Richmond, 1830s.

providence but by blind material events and forces like natural selection was a competing ‘world reading’ with broad and alarming implications. In reaction, many impugned the method by which Darwin reached his conclusions as unscientific. As Henry Fawcett, the economist and Liberal politician, wrote to Darwin shortly after the publication of *The Origin of Species*: “It is easy for an antagonistic reviewer when he finds it difficult to answer your arguments to attempt to dispose of the whole matter by uttering some such commonplace, as “This is not a Baconian induction.””⁵

Baconian inductivism was frequently employed as a rhetorical device by which to criticize the scientific status of Darwin’s theory of evolution. No other subject in science has cut so deeply to the core of traditional religious and philosophical beliefs about the nature of humanity and its ultimate place in the universe. The nineteenth century witnessed a shift in attitudes toward science, its value, purpose, and its standing with respect to other ‘ways of knowing.’ Those who promoted the theory of evolution insisted that science was no longer to be handmaid to theology. Naturalists of a younger generation, like T.H. Huxley (1825-1895) and John Tyndall (1820-1893), were comfortable with science’s mission being the disinterested pursuit of knowledge and truth for their own sakes, no matter where its conclusions might lead; while representatives of the previous generation and those of a more conservative religious faith vigorously resisted. These debates played out across the globe, in scientific journals and newspapers, but also in the parlors of private residences and in more public spaces like lecture halls or wherever groups of the civic-minded and intellectually curious met to debate the important issues of the day.⁶

Here we discuss the reception of Darwinism in nineteenth-century Nova Scotia as evidenced in the printed records of the local scientific society of note, the *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* [Fig. 2]: what they reveal about attitudes toward the different ways of knowing and how these attitudes tended to vary between those engaged in natural history and those trained in the experimental techniques of the physical sciences. Suzanne Zeller has previously noted that the *Proceedings of the Nova Scotian Institute of Science* (its current title) provide very useful glimpses into the scientific topics discussed by the membership and how various theories have been received, and she concludes that “enticements continue to lurk in those 150 years of published papers, begging for historical and scientific follow-up.”⁷ We follow this lead and discuss a selection of some of the most pertinent articles and speeches from the published *Proceedings* between the years 1863-1879, the period during which there was frequent discussion of Darwin or ideas relevant to the theory of evolution and the origin of species.⁸ These tended to be written by some of the earliest members of the Nova Scotian Institute of Natural Science who were supportive of the missions of natural theology and inventory science, many of whom could best be described as gentleman and amateur natural historians. In the years following (from the 1880s on) the published items reflect the

increasing activity of individuals trained in the experimental techniques and theories of the current physical sciences, men who were employed as professors to teach these developments in the province's several universities, but who were also engaged in theoretical and experimental research and concerned with publishing their results to the scientific community outside of the province. James Gordon MacGregor (1852-1913), an experimental physicist trained in Edinburgh, Leipzig, and London and professor of physics at Dalhousie College from 1879 to 1901, signaled this change; as did the renaming of the organization to the Nova Scotian Institute of Science under MacGregor's presidency in 1890, a change resisted by several of the older members.⁹ While there is evidence of an increasing acceptance of the use of hypothesis in scientific practice among the institution's members, there was also a distinct decline in the discussion of Darwinism and its implications for religion and 'man's place in nature.' Why this occurred is unclear. Perhaps these topics came to be considered too philosophical or theological—too much concerned with what Pickstone called 'world-reading'—and so insufficiently professional, technical, or properly 'scientific' by the standards of a new class of university-based specialists working in a different kind of reward system in which publication acquired a new significance. These individuals were eager to shed the organization's reputation as an amateur natural history society so that publication in its official organ would be regarded with greater credibility within a non-local community of professional scientific researchers.¹⁰ Or perhaps due to the call of duties or opportunities elsewhere, those few individuals most interested in discussing these more general topics were lured away from the province, making further contribution to the *Transactions* for them unviable. Alternatively, it may be that by the end of the century many people had found a way to reconcile the idea of evolution with their religious faith, so that the topic was no longer worthy of comment.¹¹ Of course, some combination of all three may have been at work.

Papers in the Proceedings and Transactions of the Nova Scotian Institute of Natural Science

The Nova Scotian Institute of Natural Science (NSINS) was founded in 1862.¹² Its original membership consisted of 51 regular, 4 associate, and 2 corresponding members. Most were amateur enthusiasts, with a handful of mining engineers, military men, physicians, and two professional 'scientists': Henry How, Professor of Chemistry and Natural History at King's College (then in Windsor, Nova Scotia), and George Lawson, Professor of Chemistry and Mineralogy at Dalhousie College in Halifax.¹³ The colony's most famous home-grown scientist, the geologist and paleontologist, Sir John William Dawson (1820-1899), had left Nova Scotia for Montreal in 1855, prior to the founding of the NSINS, to become principal of McGill College, and was never a member.¹⁴ Dawson's influence over the organization, nevertheless, could be felt from afar, as we discuss below.

While the NSINS held regular meetings and, starting in 1867, published regular proceedings and transactions, it struggled to grow its membership

significantly or to expand its list of contributing lecturers and authors beyond a relatively small subset of regulars.¹⁵ Its focus throughout its early period from 1863 to 1880 was the main topics of natural history, geology (especially as related to coal, gold, and other commercially important minerals), botany, zoology (of fish and other marine organisms especially), meteorology, in addition to the occasional piece dealing with the ethnography of the local indigenous Mi'kmaq people, and curiosities of animal behaviour and anatomy.¹⁶

In the period from 1863-1879 there were also a number of items notable for their discussion of the theory of evolution, the age of the earth and of humanity, the implications for traditional religious accounts of human origins, and of the legitimacy of Darwin's and his compatriots' reliance upon hypothesis in arriving at their conclusions. After 1879, however, discussions of such broad philosophical nature are absent, replaced by technical reports dealing with specialized topics in experimental physics and chemistry by the likes of MacGregor and other professional scientists who had found wider employment within the province's universities.¹⁷

We now discuss several of these articles and Presidential Addresses published in the *Proceedings and Transactions of the NSINS* in the period from 1863-1879 that illustrate reactions to Darwin's ideas as well as the authors' opinions about proper scientific method or 'ways of knowing.'

P.C. Hill's "Inaugural Address" (delivered 1863; published 1867)¹⁸

In 1863 the lawyer and politician Philip Carteret Hill (1821-1894) gave his Inaugural Speech as the first president of the NSINS, in which he made clear that, at least in his estimation, the Institute's purpose was to conduct natural history in the service of natural theology.¹⁹

Hill opened by noting that the progress of science requires communication, "every laborer in the field casting his contribution into a common receptacle whence all can freely draw"²⁰, thus evoking Bacon's trope of the ant as symbolic of science as a mere aggregative stock-piling of facts (whereas the bee, in contrast, collects and processes its raw material to produce a sweeter and more valuable product). Hill stressed the importance of "facts verified *in situ*"²¹, since all and any facts secured by the workers in Natural History cannot help but be relevant for the pressing question whether species have been separately and distinctly "created" in local centres or originally in one centre in Central Asia from whence they have emanated after the "deluge". In that regard "our own country presents in many aspects a new and untrodden field for research."²²

Of greater interest are his remarks on the proper attitude and reward for engaging in the study of natural history. "The love of knowledge itself..." he said "must be the great motive animating all our efforts. And rightly viewed, what higher incentive could be presented to any intelligent mind? The works of nature are but the manifestations and exponents of the Creator's skill."²³ Touching again on the question of species he reminded his audience that:

To have lifted the veil from some portions of this wonderful order and design; to have learned something of the true system in which the Creator has arranged His works, from the glories of modern science. Classification, which simply, in one word, embodies this idea, is now the great object of attention; thus, the orders into which the animal kingdom is divided are based on the essential and immutable diversities which modern research has revealed, and the transfers which sometimes take place of species, or even a genus, from one place to another, in the general system, are merely the result of a further insight obtained by pains-taking laborers into this universal plan of creation.²⁴

And “he who, in earnest sincerity of purpose, devotes his attention to any one branch, however special and circumscribed it may appear, cannot fail to see new and hitherto unknown evidences of the skill and wisdom of the Great Architect, the contemplation of which will not only confer on himself the most exalted pleasure, but will add to the general stock of human knowledge.” Hill concluded his talk by holding up Dawson, Darwin’s staunch critic, as a model: “The object of this Institution,” he said, “is to stimulate the effort to follow so bright an example.”²⁵

Thomas Belt “Recent movements of earth’s surface” (delivered 1863)

Belt (1832-1878) was a geologist born in Newcastle upon Tyne, who moved to Nova Scotia sometime around 1862-63 as superintendent of the Nova Scotian Gold Company’s mines. He stayed for a couple of years before moving on to Nicaragua.²⁶ One of the founding members of the Institute, he read a paper on February 1, 1863 titled “Recent movements of the earth’s surface.”

In his talk Belt mentioned “the celebrated naturalist, Darwin” on the formation of coral reefs and atolls, and also Lyell on the uniformitarian theory in geology and the implications for the great age of the earth, which would need to be measured in “millions of years” rather than the thousands favoured by more traditional catastrophist and biblical accounts. Noting that some were concerned the new science would “tend to sap the foundations of religion,”²⁷ Belt concluded with a parable of an island whose inhabitants erected wooden bulwarks to buttress its shores against the erosive actions of the waves and winds, only to discover that, after a particularly severe storm swept all the artificial constructs away, the island was revealed to rest on a bed of solid granite. “And is it not so with religion?” Belt asked, “have we not reared bulwarks and buttresses, which we, puny mortals, think are necessary for its support? The sea of knowledge ever spreading, sweeps them away, but exposes the eternal rock of truth on which religion is built.”²⁸ But while Belt believed science and religion could be reconciled, not all members of the Institute believed this was possible on the question of the earth’s age, as we will see presently.

George Lawson “On the flora of Canada” (delivered March 7, 1864) and “Notice of the occurrence of Heather (*Calluna vulgaris*) at St. Ann’s Bay, Cape Breton Island” (delivered Dec. 5, 1864)

Lawson (1827-1895) was a Scottish botanist educated at the University of Edinburgh and the University of Giessen, Germany where he attained a D.

Phil. He was Professor of chemistry and natural history at Queens College in Kingston, Upper Canada from 1858 until 1863, when he moved to Halifax where he spent the rest of his life teaching at Dalhousie College. Lawson was sympathetic to Joseph Dalton Hooker's theory of plant species distribution and variation by gradual spread under naturally occurring climatic changes, a uniformitarian view in the fashion of Lyell and Darwin. The article attributed to Lawson on the distribution of Canadian Flora (i.e. upper and lower Canada) would appear to be a report written by someone in attendance of a talk Lawson gave in 1864.²⁹ Lawson is said to have discussed the views of Hooker, Lyell, Dawson, and Darwin in application to the question of the distribution of plant species in North America, and most notably, that he had found Darwin's theory of the origin of species "insufficient to meet the wants of the case."³⁰ Later that same year Lawson gave another talk concerning the discovery of a patch of heather on Cape Breton Island. This was "a matter of great interest in a strictly scientific point of view," he explained, "for it has important bearings on the questions of distribution, age and origin of species."³¹ Lawson chose to believe that this and other disjointed patches of heather were remnants of more robust populations that had slowly worked their way from the far north down the east coast of North America in advance of periods of glaciation, in opposition to those who suggested the plant had been introduced into the new world by Scottish immigrants.³²

William Gossip "Enquiry into the antiquity of man" (1865)

William Gossip (born 1809 in Plymouth, England, died 1889 in Halifax), moved to Nova Scotia with his parents in the early 1820s and became a prominent publisher, bookseller and journalist in Halifax. A member of the NSINS since 1863, Gossip was the first editor of its *Proceedings and Transactions* and its president from 1878-1880. An Anglican and a conservative with an interest in anthropology and geology, he contributed several papers including two anniversary addresses (1876, 1879), about which more below. On March 6, 1865 he delivered what was essentially a critical response to Sir Charles Lyell's 1863 book *Geological Evidences of the Antiquity of Man* in which Lyell came out in support of a much greater age for the human species, the existence of recurrent ice ages, and, albeit less enthusiastically, Darwin's theory of descent by means of natural selection. Gossip set out to salvage the Biblical account of creation and the chronology of human history from such attempts to push back the antiquity of man far into pre-historical time. Lyell's book, he objected, was skewed by "bias" and "speculation" calculated to invoke scepticism about the "truth of the sacred record."³³ We quote at length one key passage:

One great cause of scepticism is the readiness with which mankind yield their belief to theories put forth with show of reason, by those whom they regard as superior intelligences, and in whom they repose implicit confidence. Let a man do some great thing which will bear the test of enquiry in every possible shape, and become famous thereby, and he may afterwards commit a thousand vagaries, and find multitudes to

uphold him. A Lyell, a Darwin, or a Huxley, may go a long way in the path of human knowledge, make important discoveries, and satisfy the world that all they do is right and just and proper—and that therefore their theories, equally with their facts, may be received with faith equal to that which should follow plain demonstration. But there is no reason why we should respect their speculations as we do their truths, seeing that, although in their own hands, they lead to nothing, and are nothing. Such an impotent conclusion has met Lyell... Such also has met Darwin, who has let go his belief in creation, and adopts variation of species instead; and such also meets Huxley, who traces back organized being to molecules... We must, therefore, be careful while giving due credit for the truths that such men teach, not to be led away by speculation which is not truth, and to which the test of truth cannot be applied in any satisfactory results.³⁴

Gossip concluded with a reminder to his audience to keep their priorities in proper perspective, stating that “the exploration of the earth for the past history of man is of little consequence as it concerns his present happiness, to say nothing of the future, while it only tends to perplex his ideas and unsettle his reason.”³⁵

In 1873 Gossip also published in the *Transactions* a lecture on “The affinity of races.”³⁶ In what was most likely a response to Louis Agassiz’s polygenist division of the various races of humankind into separate species, Gossip appealed to evidence of ethnological and linguistic similarities between the Caribs of the West Indies and the peoples of the biblical lands to argue for the unity of all humans. Gossip also offered the speculative hypothesis that the lost continent of Atlantis—situated midway in the Atlantic Ocean between the Western and Eastern hemispheres—might have been the location of the original garden of Eden, and from whence all the diverse races of humankind spread out to conquer the globe.

Thomas Frederic Knight “Natural History and its place in the sciences” (1869)

Knight (1828-1902) is listed in the *Proceedings* as having joined the NSINS on January 7, 1867, with “Receiver General’s House, Halifax” given as his address. He wrote several important reports on the fish and fisheries of Atlantic Canada.³⁷

Knight’s paper on the historical development of Natural History into a proper science is the most methodological of the papers discussed here, and it treats most closely the subject of different “ways of knowing” (though without using those terms). At the center of his discussion is the antagonism between the Artificial and Natural methods of classification and the role of ‘the inductive philosophy’ in the creation of a truly scientific arrangement of organic and inorganic bodies.³⁸ The ancients, according to Knight, failed to apply the ‘process of induction or experiment’ in their attempts to provide adequate terminology and to systematize nature. Linnaeus, “the greatest naturalist...of any age,”³⁹ he credits with inventing the Artificial method in classification, as Cuvier expounded the Natural method. “The Artificial method is allowed to be Natural as to the narrowest members of the system, viz. – species and genera; but it is called artificial as respects the wider groups.”⁴⁰ A natural method he

explains, “is an attempt to provide positive and distinct characters for the *wider* as well for the natural groups” whereas an artificial system is “intended for ready identification of allied genera, but obscures close relations or affinities beyond genera.”⁴¹ Cuvier’s natural system (consisting of the four great divisions: vertebrata, mollusca, articulata, radiata) was based on internal characters rather than external ones alone, and Knight claims as “a signal proof of the excellence of natural arrangement that being founded on internal structure it must be permanent.”⁴²

In consideration of the rationale of classification, Knight takes “a thoroughly philosophical standpoint,”⁴³ which leads him to identify three grand instruments or *organa* by which the human mind arranges sensory observations or phenomena in its pursuit of knowledge and truth. These are: Language (for the acquisition and communication of ideas), Mathematics (for the determination of number and quantity), and Experiment or induction (composed of the dual operations of analysis and synthesis).⁴⁴ While Analysis consists of the observation, comparison, and separation of ideas, Synthesis involves their combination and re-organization. Through the processes of induction general laws are established and true classification begins. Following the lead of Whewell and Herschel, he writes that Natural History achieves the level of a science when it moves beyond the mere cataloguing of facts and begins to discover general laws.⁴⁵ The explorer and naturalist Alexander von Humboldt he identifies as the first to employ “wonderful powers of generalization in comprehending the vastness and oneness of nature.”⁴⁶ Speaking of the positive benefits secured by the study of natural science, Knight noted that it “suggests to the human mind the idea of a great first cause or intelligent artificer of nature; and under this head might be discussed the doctrine of *final causes*.” It moreover “enlarges and strengthens the intellect”, in addition to the economic utility it provides in the pursuit of art and industry.⁴⁷

Knight concluded by saying that “if we fully comprehend the sphere of natural science, we shall not restrict ourselves to contemplation only of the earth beneath our feet with its wealth of life and wonder and beauty; but *we shall assert the dignity of our origin*, and lift our gaze to the atmosphere that envelopes us, and even penetrate with the aid of its cunning implements the mysterious depths of the illimitable space” [italics added].⁴⁸ In this way, without ever explicitly mentioning Darwin and his ground-shaking ideas, Knight counseled his audience of the congruity of the progress of natural science and its particular ways of knowing with what Pickstone called the more ancient hermeneutic activity of “world-reading” and the framework of Natural Theology with which it was so strongly associated.

Angus Ross “Evolution” (1874)

George Angus Ross (1854-1889) was a lawyer and a Liberal member of the provincial parliament from Lunenburg, Nova Scotia who campaigned for the repeal of Nova Scotia’s membership in Confederation in 1886. It is striking

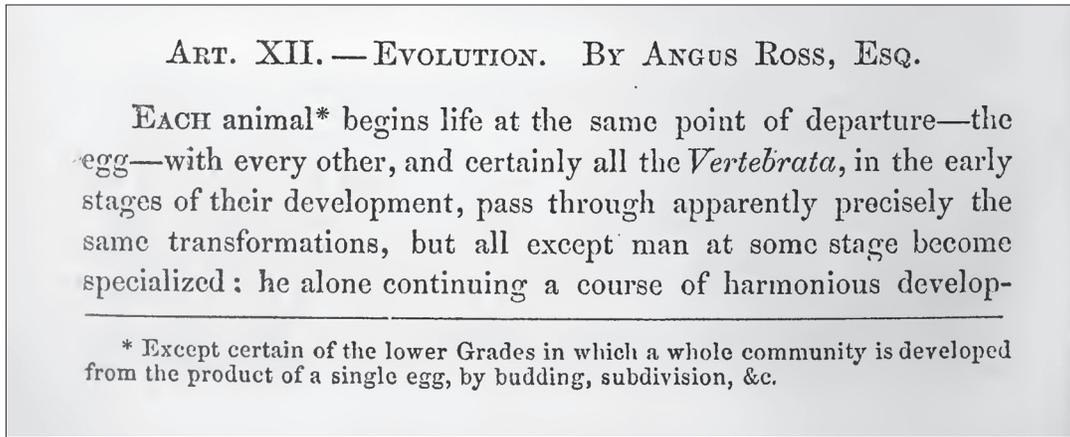


Figure 3. Angus Ross, “Evolution,” *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 3, 4 (1874): 410-435.

that in an essay specifically titled “Evolution” [Fig. 3] Ross could write 25 pages of detailed discussion about the evidence for the evolution of species without once mentioning Darwin.⁴⁹ Perhaps by 1874 to have done so would have been unnecessary, so closely associated had the two become. Or perhaps, though he found Darwin’s hypothesis of the community of descent of species compelling, he was less convinced of Darwin’s explanatory hypothesis of natural selection as its mechanism.⁵⁰ Ross summarizes the multiple lines of evidence from within the Animal Kingdom, noting in particular: comparative vertebrate anatomy, embryological homologies, vestigial structures, the fossil record (which he mentions, following Darwin’s lead, one would expect to be imperfect and full of gaps), biogeographic distribution patterns of closely related species, the inherent difficulty of drawing firm and clear species boundaries between many real populations of organisms, and evidence for the creation of new species from cross-species hybrids. His discussion of the relationship between single-celled protozoa and the tissue-forming metazoa and the doctrine of recapitulation (i.e. that ontogeny recapitulates phylogeny), strongly suggests that Ross had also been reading the popular accounts of Darwin’s German colleague, the militant evolutionist and materialist Ernst Haeckel who wrote extensively on these topics.⁵¹ Yet in contrast to Haeckel’s materialism Ross advocates for a version of theistic evolution whereby God has no need to specially create each species but rather allows them to unfold “by the operation of His Laws from a single protoplasmic primordial Type”.⁵²

One of the most interesting aspects of Ross’s article is his critical response to the Harvard biologist Louis Agassiz’s opposition to the theory of evolution and his defense of polygenism, the thesis that the various human races are of independent origin and equivalent to separate species. Agassiz, who had studied with Cuvier in Paris and had made his reputation as an authority on fossil fishes and the theory of past ice ages, became an influential source of scientific racism after moving from Europe to the United States in the 1840s. Originally

a Biblical monogenist, soon after meeting black people for the first time in the States Agassiz adopted the opinion that the differences between human races were as great as the differences between different species of monkeys or even as great as the differences between the monkeys and humans.⁵³ What he called “The appalling feature of the subject [of Darwin’s theory of the community of descent]” was this: that if one accepts that all races of human have a common origin, then one must accept also that all species of monkey likewise have a common origin and so too humans and monkeys.⁵⁴ Since we cannot accept that monkeys and humans have a common origin, Agassiz reasoned, we cannot accept that the different races of humankind have a common origin. To this Ross responded:

Now, I need not say that a disbelief of the original unity of Man is irreconcilable with Christianity, so that if as Agassiz affirms, a common origin for the races of Mankind necessarily implies a common origin for the various species of each Genera of Monkeys, and for each of these Genera and Man, then, from a theological point of view, we would be driven to accept the view which assigns a common origin to Man and Monkeys, and if to these then to all Vertebrates, and ultimately to all organic Types.⁵⁵

A clearer example of the adage that one person’s *modus tollens* is another’s *modus ponens* could not be wished for. It is worth noting how Ross here appeals to the “way of knowing” Pickstone called “world reading” to challenge Agassiz’s own bit of hermeneutics. But like Thomas Knight (see above) Ross insisted on the compatibility of natural science and Christianity and concluded with the words: “I have thus endeavoured, in intervals snatched from professional study and daily avocations, to sketch in outline this great subject, in undoubting faith that fidelity to truth is the only true fidelity to Religion and to God.”⁵⁶ But as our next writer illustrates, not all contributors to the *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* were so insistent on reconciling faith and science.

Andrew Dewar “Spontaneous generation, or predestinated generation” (1875)

Andrew Dewar (1846-1932) was a Scottish-born architect who came to Halifax in 1869 and spent just over 12 years in the Atlantic provinces before returning to Edinburgh in 1881 and finally settling in 1903 in Johannesburg, South Africa. Dewar was evidently less of a natural historian following a cautious Baconian empirical method than an enthusiastic amateur philosopher intent on drawing the most wide-ranging universal principles with which to create a cosmic system. In short, Dewar advocated for a deistic version of ancient Greek atomism updated with modern ideas of evolution and his own speculations about magnetism as the ultimate physical force driving the entire cosmos. In this respect his was just one of many such projects popular in the nineteenth century, one of the best known perhaps being Herbert Spencer’s ‘Synthetic Philosophy.’⁵⁷ But where Spencer proposed that the entire universe was being driven ever onward to more progressive and complicated evolution as a result of the law of the conservation of energy, Dewar believed that the motive force

could be traced to his hypothesis that each atom is a magnet with a dipole force of attraction and repulsion. Dewar referred to this as his ‘ato-magnetic theory of life’.

Dewar’s first publication in the *Transactions* of the NSINS was based on a talk he gave on April 12, 1875 on the topic of spontaneous generation of life. Dewar began with a concession to his audience that the topic was a “dangerous” one, but “knowing well that we are addressing a Scientific Society who look at and discuss the subjects brought before them from no other than a scientific point of view” he begged their indulgence for a short time.⁵⁸ Dewar also admitted that he had no new experimental evidence to offer on the question whether living organisms are always produced from the seeds or eggs of previously existing organisms or whether life can spring forth from inorganic matter; but, in any case, he remarked “no one would put faith in experiments performed in such a benighted country as Nova Scotia.”⁵⁹

Dewar announced his belief in the evolution theory, i.e. that new species of life have emerged from previous organic forms, but faulted Darwin and his colleagues (he mentions Tyndall and Huxley) for providing no account of the very first form of life. His own solution, which he preferred to call “predestinated generation” over “spontaneous generation”, proposed that life was created not just once but continually as the pre-ordained result of a law “implanted in matter in the beginning.”⁶⁰ To motivate acceptance of the spontaneous generation of life from inorganic matter Dewar offered that what we typically regard as dead or inert matter is not really entirely lifeless, if we recognize that all matter is constantly in motion as a result of physical laws such as magnetism. If we are willing to regard magnetism as a ‘lower’ form of life, he suggested, then we can begin to recognize analogies between supposedly inorganic matter and living organisms. For instance, every magnet possesses attractive and repulsive polarity, just as plants and animals typically display anterior-posterior polarity (branches-roots; head-tail). Plants and animals also grow outward from a central point in the seed or egg in analogy with a magnet. Cutting a zoophyte into pieces, as the Swiss naturalist Abraham Trembley (1710-1784) did with fresh water polyps (hydra), produces two smaller organisms each with two poles, in further analogy with the division of a magnet resulting in two smaller magnets each with its own positive and negative poles.

Dewar reasoned further—using the hypothetical method—that if each magnet divided results in a smaller magnet, then by extension each atom is itself a magnet with attractive and repulsive poles. “If we can prove,” Dewar said, “that the life which forms crystals and rocks and moves the compass needle, is the same as that which grows trees and moves our bodies, then we may consider our premises proved, for as all organic beings are composed of so-called inorganic matter, and if the same life pervades both, what should prevent the life force from gathering several inorganic atoms, and growing them into an organic animal?”⁶¹ This was a big ‘if’ indeed, but Dewar’s proposal was essentially that of earlier philosophers and naturalists who had been struck by

the analogy between the ‘growth’ of crystals and the development of organic beings.⁶² As for the properties of mind, a feature exclusively enjoyed by ‘man’, Dewar conceded that only the “special interposition” of the Deity could be responsible for such an extraordinary faculty. But aside from this one act of special creation Dewar insisted that the hypothesis of predestinated generation was preferable to the supposition of many such acts, for “A God which endowed matter from the beginning with new properties which enabled it when in a certain condition to form new life, is certainly greater than one who had to interpose in every new creation.”⁶³

Despite this attempt to reassure his audience of the moral rectitude of his proposal, a report on the minutes of the Institute recorded that, “This paper elicited considerable discussion, and a majority of those presented expressed themselves as opposed to the theory advanced; but the Publishing Committee, not wishing to constitute themselves rigid judges, have decided upon giving it a place in the *Transactions*, leaving it open to the public for scientific criticism.”⁶⁴ It is also mentioned in William Gossip’s Anniversary Address of 1876 that Dewar’s paper received critical attention in an unnamed Halifax “periodical”.⁶⁵

Regardless, the Institute displayed its open-minded and ‘scientific’ attitude by continuing to permit Dewar to present several more talks over the next few years. According to the *Proceedings of the NSINS*, at an ordinary meeting on February 14, 1876, Dewar read a paper “On the Atomic philosophy—its past and present,” and at an ordinary meeting on December 11, 1876, a paper entitled “A New Theory of the Descent of Man,” after which a discussion is said to have taken place in which the President J. B. Gilpin, Dr. Reid, Dr. Sommers, the Honourable L.G. Power, and Dr. J.G. McGregor, took part.⁶⁶ Neither of these talks were published in the *Proceedings*; however, they likely included ideas Dewar published two years earlier in a book with his co-author, Thomas Roderick Fraser, M.D. titled *The Origin of Creation, or The Science of Matter and Force. A New System of Natural Philosophy*.⁶⁷ Dewar did publish in the *Proceedings* a second account of his atom-magnetism speculations in “Magnetism, the life of the world”⁶⁸ but it included little new worth mentioning here.

Surprisingly, given the scathing criticism Dewar’s speculations received from the scientific community elsewhere, the NSINS proved more sympathetic. For instance, none other than William Gossip in his presidential Anniversary Address of 1879 made favourable remarks about Fraser and Dewar’s “atom-magnetic theory”, referring to their “plausible theory of the magnetic polarity of atoms.”⁶⁹ Their ideas about atoms he thought had been given some validity by Norman Lockyer’s experiments in stellar and solar spectroscopy to arrive at the conclusion that hydrogen is the fundamental element. Gossip spoke approvingly of Lockyer’s employment of what is now called the hypothetico-deductive method, wherein “[Lockyer] has started an hypothesis, and justified it by experiment.”⁷⁰ Gossip also mentioned Sir George John Allman’s 1879 British Association for the Advancement of Science (BAAS) lecture on protoplasm as the material basis of life; but here he *was* critical of the protoplasmic theory

of spontaneous origins of life,⁷¹ citing the failure of scientists to create a living cell or protoplasm in the lab, “a reason for which I think is satisfactorily given in the Book of Genesis, chap.3, v. 22 to 24.”⁷² Gossip was here referring to the story of the expulsion from Eden, which he believed foretold of safeguarding “the Tree of Life” (the purported source of life or souls) and the immortality of the soul. Gossip believed that while science has required many changes in empirical beliefs it has placed revealed religion “upon a surer basis,”⁷³ and that “Science and religion ought to dwell in perfect harmony. True science can do no more than accommodate each to each by the operation of the laws of eternal truth.”⁷⁴

Gossip concluded his address on a frustrated note, however, lamenting that the Institute had failed to inspire much interest in science among the broader public: “we must, I suppose, rest content with being the pioneers of science in Nova Scotia, and leave it to future generations to enter into and profit by our gratuitous and disinterested labors.”⁷⁵

John Somers “Experimental microscopy” (1879)

Just slightly earlier that year, on May 12 (Gossip’s Anniversary Address occurred in October), the physician John Somers (examiner in physiology and histology in the Dalhousie College of Medicine and twice NSINS president 1880-1883 and 1885-1888) gave a talk before the NSINS on the significance of microscopy for several topics of debate in the life sciences [Fig. 4]. Somers mentioned how the microscope had opened up the world of the ‘infusoriae’, the unicellular microbes that proved so difficult to assign to either the animal or vegetable kingdoms. “Here,” he wrote, “we find the battle ground where Vitalist, Evolutionist and Panspermatist can wage intellectual warfare.”⁷⁶ The microscope, he explained had been vital to “exploding false ideas and crude theories” such as the spontaneous generation of living organisms from non-living matter. When Somers writes of Athanasius Kircher (1601-1680) that, “If one of the ablest men of his time, which Kercher [sic] undoubtedly was, will to us appear at a disadvantage, because he too readily accepted a false theory, how careful we should be lest our successors a century or so hence may be in a position to subject our theories and experiments to the criticism of ridicule”, one can only wonder whether he is making an oblique reference to the theory of evolution.⁷⁷

These 1879 contributions by Somers and Gossip appear to be the last time topics of such a broad nature were discussed in the *Transactions* in that century. Why then this cessation of discussion about Darwin and evolution? One possibility is that the institute’s leadership made a decision to focus publication on more strictly scientific topics and to leave discussion of more religious and philosophical topics for other venues.⁷⁸ Alternatively, as Jerry Pittman has documented, by the late 1870s and early 1880s newspapers produced by religious groups in the province “began to inform readers that evolution could be reconciled favorably with Christianity,”⁷⁹ which could help explain why

ART. XII.—EXPERIMENTAL MICROSCOPY.—BY J. SOMERS, M. D.,
*Professor Physiology, Microscopy, &c., Halifax
 Medical College.*

(Read May 12th, 1879.)

THIS short essay owes its existence to a wish expressed by members of the Council of the Institute.

It contains nothing original, or what any person familiar with the use of the Microscope, does not already understand. It was prepared to accompany a series of experiments presented to the members, and it does not pretend even to explain the nature of these, nor of the specimens exhibited.

The writer feels complimented in that he has been requested to fill at the final meeting of this season, a vacancy which has occurred for the first time for many years. One who never failed to present the results of his observations at the final meeting of the session, has closed his earthly labors. Endeared as he was to us all, not only for his zeal and arduous toil in the cause

Figure 4. John Somers, “*Experimental microscopy*,” *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 5, 1 (1879): 81-87.

discussion of Darwinism and evolution in the *Transactions* of the NSINS ceased. Yet another possibility arises from noting that the *Transactions* had always drawn on a small pool of contributors to begin with, and the number showing an interest in these particular topics was fewer still. Of those we have discussed, Thomas Belt moved away sometime in the mid 1860s as did Andrew Dewar in 1881. Hill, Knight, and Ross each contributed no more than one, two, and three articles respectively. That leaves Somers (who contributed 14, almost all dealing with mosses or other botanical topics), Lawson (with 18), and Gossip (10 in total). But why none of these men said anything more on the topic of evolution or Darwinism in this venue remains unclear.

The Mechanics Institutes

Another site of interest for gauging how these kinds of debates played out is the local Mechanics Institutes, which were created with the mission of educating the public (working class) about developments in science, culture, history, and philosophy.⁸⁰ Due to considerations of space we conclude here with only a brief discussion of one such example.

Second only to the founding of a Mechanics Institute in Halifax in 1831, the port town of Sydney, Nova Scotia, situated on the north-eastern coast of Cape Breton Island, established a Mechanics Institute in 1847.⁸¹ In his diary, the Clerk and High Sheriff of Sydney, John L. Hill recorded the events of a lecture

of the Mechanics Institute held on February 26, 1872. Hill wrote in his diary:

Mr. R. Martin lectured on The Mind. Self opened the discussion. Rev. Mr. Chipman spoke. Murray Dodd. Mr. Pipes [later Premier of Nova Scotia] (with much truth and sound argument. Mr. Wiley and Mr. Grant. Dodd thought Bible & Geology differed and seemed disposed in favour of Geology. Pipes thought Geology & Bible will agree. Better that the apparent differences would end by & by—instanced Galileo & Copernicus. Self denied progress in development. Monkey Ape Gibbon or Gorilla never could become man—human species sixteen teeth upper and lower jaw. Wolf can never be a dog. Horse never become an ass. Dodd instanced Chrysalis becoming Butterfly. Tadpole becoming frog as instances of Progressive development—poor examples—an egg producing a hen would be as good, unless it were a Goose's.⁸²

Hill evokes what were at the time common objections to the evolution hypothesis, but it is notable that his reasons for skepticism are not theological but empirically grounded, citing a lack of evidence for the emergence of a new species from one previously existing. Dodd, on the other hand appeals to analogies of development in butterflies and tadpoles, as Darwin and many other defenders of the 'development hypothesis' did. In doing so they displayed greater willingness to employ a hypothetical mode of reasoning beyond directly observable phenomena, so long as the hypothesis in question provided a reasonable explanation of the phenomena and helped to provide what Whewell had called a 'consilience of inductions.'

Conclusion

As Darwin recognized in the mid-19th century, progress in science requires a willingness to move beyond cautious observation and cataloguing of facts as promoted by the adherents of a strict Baconian inductivist methodology. Natural history was supplemented by the experimental and hypothetical methods of the modern physical and life sciences, which were largely taken up by the later generation of research scientists who were employed in academic institutions like Dalhousie University. This change in attitude and procedure is reflected in the later issues of the *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* from the 1880s on.⁸³ Professional scientists trained in the most recent experimental ways of knowing and theories increasingly came to replace amateur naturalists as the primary authorities on topics about the natural world, if not about their ultimate significance and meaning for humanity's place in the universe.

Those who were devoted to the study of natural history in Nova Scotia and other colonies of British North America (from 1867 on the Dominion of Canada) worked under the perceived mission of inventorying its natural resources and recording useful facts about the local flora, fauna, geology, and meteorology. By and large those who published in the *Proceedings and Transactions* initially displayed a humble and even self-denigrating attitude. Its earliest members for the most part understood their mission to be restricted to carefully cataloguing and describing the local facts of natural history *in situ*,

and that the tasks of systematic classification and interpretation were to be left to the leaders of science in the metropole (London and Edinburgh). But this division of intellectual labour did not mean that the scientific upper class was beyond criticism if they were perceived to stray from what was considered proper Baconian inductive method, and their hypotheses and speculations threatened to unsettle the bedrock of natural theology on which the traditional Christian readings of the world-order were affixed. Only the boldest and least reliant on local opinion for their livelihood it seems—like the itinerant architect and amateur philosopher Andrew Dewar—dared to openly endorse the anti-establishment religious views of radical figures like T.H. Huxley, John Tyndall, or Ernst Haeckel, and then only after moving elsewhere. As support for the newer methods of science was created in the province's universities, and professionals trained in the techniques of experimental and theoretical science were hired to teach in them, the contents of the *Proceedings and Transactions of the Nova Scotian Institute of Science* came to reflect this new class of members and their efforts to align the society with their own standards of research and publication. This seems also to have contributed to a decline in the sort of philosophical discussion about the implications of Darwinism and evolution that had once been common in its pages. Whether this was the result of a conscious editorial decision, diminished interest, or concern with the topics is unclear.

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Endnotes

- 1 John V. Pickstone, *Ways of Knowing: A New History of Science, Technology and Medicine*. (Chicago: University of Chicago Press, 2001) and Pickstone, "A Brief Introduction to Ways of Knowing and Ways of Working," *History of Science* xlix (2011): 235-245.
- 2 Darwin to Henry Fawcett, 18 Sept. 1861. "Letter no. 3257," Darwin Correspondence Project, accessed on 9 April 2018, <http://www.darwinproject.ac.uk/DCP-LETT-3257>.
- 3 For Darwin as proponent of the hypothetico-deductive method see Michael T. Ghiselin, *The Triumph of the Darwinian Method* (Berkeley: University of California Press, 1969) and Michael Ruse, *The Darwinian Revolution: Science Red in Tooth and Claw*, 2nd. edition (Chicago: University of Chicago Press, 1999).
- 4 Suzanne Zeller, *Inventing Canada: Early Victorian Science and the Idea of a Transcontinental Nation* 2nd. edition (Montreal-Kingston: McGill-Queens University Press, 2009); Zeller, *Land of Promise, Promised Land: The Culture of Victorian Science in Canada* (Ottawa, Canadian Historical Association Historical Booklet No. 56., 1996).
- 5 Fawcett to Darwin, 16 July 1861. "Letter no. 2868," Darwin Correspondence Project, accessed on 9 April 2018, <http://www.darwinproject.ac.uk/DCP-LETT-2868>.
- 6 Ronald L. Numbers and John Stenhouse eds., *Disseminating Darwinism: The Role of Place, Race, Religion, and Gender* (Cambridge: Cambridge University Press, 1999).
- 7 Suzanne Zeller, "Reflections on Time and Place: The Nova Scotian Institute of Science in its First 150 Years," *Proceedings of the Nova Scotian Institute of Science* 48, 1 (2015), 49.
- 8 Zeller has briefly discussed two of the authors covered here (Angus Ross and Andrew Dewar), in Suzanne Zeller, "Environment, Culture, and the Reception of Darwin in Canada, 1859-1909," in *Disseminating Darwinism: The Role of Place, Race, Religion, and Gender*, eds. Ronald L. Numbers and John Stenhouse (Cambridge: Cambridge University Press, 1999), 91-122, as well as the botanist George Lawson in Zeller, "George Lawson: Victorian Botany, the Origin of Species and the Case of Nova Scotian Heather" in Paul Bogaard ed., *Profiles of Science and Society in the Maritimes prior to 1914* (Sackville, NB: Acadiensis Press, 1990), 51-62.
- 9 See Harry Piers, "A Brief Historical Account of the Nova Scotian Institute of Science, and the events leading up to its Formation; with Biographical Sketches of its Deceased Presidents and other Prominent Members," *Proceedings and Transactions of the Nova Scotian Institute of Science* 13, 3 (1913): liii-cxii, lxxii. In Zeller's words: "MacGregor showed himself a force of nature who reconfigured the NSIS in his own image of Analytical science as the path to progress in the modern world", Zeller, "Reflections on Time and Place," 12.
- 10 See Zeller, "Reflections on Time and Place," 13.
- 11 See Jerry N. Pittman, "Darwinism and Evolution: Three Nova Scotia Religious Newspapers Respond, 1860-1900," *Acadiensis* 22, 2 (1993): 40-60.
- 12 Zeller, "Reflections on Time and Place," 9.
- 13 By 'professional scientist' we intend those with scientific training and engaged in scientific activity as their primary means of employment, in contrast to so-called 'amateurs', who may have acquired significant expertise in a scientific topic, but did not rely upon this activity for their profession. On the nuanced nature of the concept of 'professional scientist' during this time see Paul Lucier, "The Professional and the Scientist in Nineteenth-Century America," *Isis* 100, 4 (2009): 699-732.
- 14 Born in Pictou, Dawson studied at the University of Edinburgh in 1840-1841 and 1847, taught natural history and practical mineralogy at the Pictou Academy (1848) and at Dalhousie College (1850). Dawson escorted Sir Charles Lyell during his visits to Nova Scotia in 1841 and 1852 to the Joggins fossil cliffs. He was elected a fellow of the Geological Society of London in 1854 and the Royal Society of London in 1862 (with sponsorship from Darwin and Lyell), published *Acadian Geology* (1855) and many other books, and was knighted in 1884. Like his fellow paleontologist at Harvard College Louis Agassiz (1807-1873), Dawson was a vocal opponent of Darwinism in North America, and authored one of the first, and very critical, reviews of the *Origin of Species* in North

- America. See John William Dawson, "Review of Darwin on the Origin of Species by means of Natural Selection," *The Canadian Naturalist and Geologist* V, 2 (April 1860): 100-120. For Dawson's early years in Nova Scotia see Susan Sheets-Pyenson "Sir William Dawson: the Nova Scotia Roots of a Geologist's Worldview" in Bogaard ed., *Profiles of Science*, 83-99.
- 15 Zeller, "Reflections on Time and Place", 32.
 - 16 The by-laws dictated that the Institute was to "undertake the publication of lists of the various natural productions of the province, with such observations as their respective authors may deem necessary," Piers, "A Brief Historical Account of the Nova Scotian Institute of Science," lxiv.
 - 17 Reports on local geology and natural resources (principally coal but other valuable minerals as well) also continued to be common features in the published *Proceedings and Transactions*.
 - 18 The *Proceedings and Transactions* for the years 1863-1866 were first published together in 1867.
 - 19 Hill was mayor of Halifax at the time and it seems attended just this one meeting of the Institute. See Piers, "A Brief Historical Account," lxvi. He was premier of Nova Scotia from 1875-1878. The following assessment of Hill is relevant: "By the late 1850s he had clearly demonstrated the tenets of a conservative creed in an address to the Young Men's Christian Association of Halifax following an extended visit to the United States. Dismissing the uninhibited expectations of young Americans, he told rank-and-file Nova Scotians to imitate the Englishman who, cast in a subordinate role, performed his duties conscientiously and uncomplainingly." J. Murray Beck, "HILL, PHILIP CARTERET," in *Dictionary of Canadian Biography*, vol. 12, (Toronto and Laval: University of Toronto/Université Laval, 2003), accessed April 23 2018, http://www.biographia.ca/en/bio/hill_philip_carteret12E.html.
 - 20 Philip Carteret Hill, "Inaugural Address," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1, 1 (1867), 1. The first volume of the Proceedings and Transactions (covering the first four years of activity) was published in 1867, as explained in Piers, "A Brief Historical Account," lxviii.
 - 21 Hill, "Inaugural Address," 2.
 - 22 Ibid.
 - 23 Ibid., 2-3.
 - 24 Ibid., 3.
 - 25 Ibid.
 - 26 Belt corresponded with Darwin on the dispersal of seeds by animals, geology, the theory of ice-ages, and climate (see 12 Jan. 1867, "Letter no. 5359," Darwin Correspondence Project). His memoir *The Naturalist in Nicaragua: A narrative of residence at the gold mines of Chontales; journeys in the savannahs and forests; with observations on animals and plants in reference to the theory of evolution of living forms* (London: John Murray, 1874) was praised by Darwin as "the best Nat. Hist. book of travels ever published." See letter to Fritz Müller 1 Jan. 1874, "Letter no. 9223," and to J.D. Hooker 25 March 1874, "Letter no. 9372," Darwin Correspondence Project.
 - 27 Thomas Belt, "Some recent movements of the earth's surface," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1, 1 (1867), 29.
 - 28 Ibid., 30.
 - 29 Perhaps the proceeding's editor William Gossip (see below).
 - 30 George Lawson, "On the flora of Canada," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1, 2 (1867), 75.
 - 31 George Lawson, "Notice of the occurrence of Heather (*Calluna vulgaris*) at St. Ann's Bay, Cape Breton Island," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1, 3 (1867): 31.
 - 32 For a fuller discussion see Zeller, "George Lawson: Victorian Botany."

- 33 William Gossip, "Enquiry into the antiquity of Man," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 1, 3 (1867): 81.
- 34 Ibid., 100-101.
- 35 Ibid., 101.
- 36 William Gossip, "The affinity of races," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 3, 3 (1873): 288-315.
- 37 We have been unable to learn much more about his education or occupation.
- 38 Thomas Frederic Knight, "Natural history, and its place in the sciences," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 2, 3 (1869), 88.
- 39 Ibid., 91.
- 40 Ibid.
- 41 Ibid., 92.
- 42 Ibid.
- 43 Ibid.
- 44 Ibid., 93.
- 45 Ibid., 97.
- 46 Ibid., 98.
- 47 Ibid., 99.
- 48 Ibid., 100.
- 49 Angus Ross, "Evolution," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 3, 4 (1874): 410-435.
- 50 What is distinctly odd is that there appears to be no mention in the *Proceedings and Transactions* of Darwin's explicit application of evolutionary theory to human origins in his 1871 book *The Descent of Man, and Selection in Relation to Sex* (London: John Murray). A North American edition was published by Appleton in New York the same year.
- 51 By 1874, Haeckel's popular university lectures on evolution (*Natürliche Schöpfungsgeschichte* Berlin: Georg Reimer) were in their third edition and would be translated into English two years later.
- 52 Ross, "Evolution," 432.
- 53 Louis Menand, *The Metaphysical Club: A Story of Ideas in America* (New York: Farrar, Straus and Giroux, 2001), 103-106.
- 54 Ross quotes from an unnamed source which appears to be Agassiz's lecture to the Cooper Institute in New York, February 26, 1867 on "The Monkeys and Native Inhabitants of South America". See *The Round Table* V, (April 6 1867): 213. https://books.google.ca/books?id=8uBQAQAAMAAJ&pg=PA213&lpg=PA213&dq=%22the+monkeys+and+native+inhabitants+of+south+america%22&source=bl&ots=p_xVDqW0_p&sig=Z8iBWIX24yVo9uVg8bN-WA2xMbo&hl=en&sa=X&ved=0ahUKEwiEicPIoKTcAhVSON8KHUZJAR0Q6AEIKTAB#v=onepage&q=%22the%20monkeys%20and%20native%20inhabitants%20of%20south%20america%22&f=false.
- 55 Ross "Evolution," 434.
- 56 Ibid.
- 57 Herbert Spencer, *First Principles* (London: Williams and Norgate, 1862).
- 58 Andrew Dewar, "Spontaneous generation, or predestinated generation," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 4, 1 (1875): 35.
- 59 Ibid. One wonders how that assessment was received by his audience.
- 60 Ibid.

- 61 Ibid., 38.
- 62 James E. Strick, *Sparks of Life: Darwinism and the Victorian Debates Over Spontaneous Generation* (Cambridge, MA: Harvard University Press, 2000), 42; Donna Haraway, *Crystals, Fabrics and Fields: Metaphors that Shape Embryos* (Berkeley, CA: North Atlantic Books, 2004).
- 63 Ibid., 37.
- 64 *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 5, 1 (1875): 444. It may be relevant to note that 1874 saw one of the lowest submission rates, see Piers, “A Brief Historical Account,” lxxi-lxxii.
- 65 William Gossip, “Anniversary Address,” *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 4, 2 (1876): 229.
- 66 *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 4, 3 (1876): 234.
- 67 The authors self-published a North American edition in Halifax in 1876 with Longmans, Green, Reader, and Dyer of London. To quote the review in *The Chemical News*, Jan. 22 1875 [sic]: “What we have to protest against in this book is not merely the abundance of gross errors, but the total absence of scientific method and of the scientific spirit. Almost every page bears evidence of vague habits of thought, of inaccurate observation, and of hasty generalisation. Of what is required to establish a theory, the authors seem to have but a very dim conception. That such a book should be produced in Britain, and in the latter part of the nineteenth century, is truly humiliating” (39). https://books.google.ca/books?id=v2sfCwFk28AC&pg=PA38&lpg=PA38&dq=tr+fraser+%22the+origin+of+creation%22&source=bl&ots=IVbaFeXXkP&sig=mqgnea_srIz2YOI_gvSC-np-08A&hl=en&sa=X&ved=0ahUKEwjVjK-605YXcAhXEtIMKHwVedao4ChDoAQgxMAA#v=onepage&q=tr%20fraser%20%22the%20origin%20of%20creation%22&f=false. *The Popular Science Review* was no kinder: “It is the most extravagant piece of composition we have almost ever seen written on a scientific subject...by men whose knowledge even of the rudiments of science is absurdly small, or we might better say absolutely *nil*” Vol. 14, p. 80. <https://books.google.ca/books?id=h8AWAQAIAAJ&pg=PA80&lpg=PA80&dq=tr+fraser+%22the+origin+of+creation%22&source=bl&ots=WbYcD9j7K-&sig=duTRvFjiPfyB9wx6MpskwAJutw8&hl=en&sa=X&ved=0ahUKEwipyK715IXcAhVCt1MKHcT8BeUQ6AEIXDAP#v=onepage&q=tr%20fraser%20%22the%20origin%20of%20creation%22&f=false>. Given these scathing criticisms of the book in scientific periodicals it must be noted that Dewar’s co-author, Thomas Roderick Fraser, is not the celebrated experimental pharmacologist Dr. Thomas *Frederic* Fraser, FRS and professor of medicine at the University of Edinburgh.
- 68 Andrew Dewar, “Magnetism, the life of the world,” *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 5, 1 (1879): 58-64.
- 69 William Gossip, “Anniversary Address,” *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 5, 1(1879): 101.
- 70 Ibid., 100.
- 71 Ibid., 105-106.
- 72 Ibid., 105.
- 73 Ibid.
- 74 Ibid., 106. Dewar continued to publish his ideas on ato-magnetism after leaving Canada for South Africa. In 1898 he published, under the name Andrew Redcote Dewar, the book *From Matter to Man, a new theory of the universe* (London: Chapman & Hall, 1898). By this time he had moved beyond deism to a full-blown atheism, espousing what he called ‘the New Materialism.’ All nature, living and inanimate, he maintained, followed the blind laws of magnetism and electricity that animate the eternal atoms, the entire cosmos (itself eternal and so without need of a first cause) evolving without plan or providence to greater complexity. Ideas from thinkers such as Haeckel, Huxley, Spencer, and E. Ray Lankester are notable throughout. The book was reviewed in *Nature* by the British chemist and entomologist Raphael Meldola (1849-1915) who concluded: “We do not recommend this work to the serious attention of our readers, but as a study in word-stringing it is not devoid of interest.” See Raphael Medola “Review of *From Matter to Man, a new theory of the universe*” *Nature* 62 (1900): 493-494.

- 75 Gossip, "Anniversary Address," 111.
- 76 John Somers, "Experimental microscopy," *Proceedings and Transactions of the Nova Scotian Institute of Natural Science* 5, 1 (1879): 83.
- 77 Somers was a 'traditionalist' on medical issues of disease etiology and treatment. He rejected the germ theory of disease as resting on insufficient evidence. See Colin Howell and Michael Smith, "Orthodox Medicine and the Health Reform Movement in the Maritimes, 1850-1885," *Acadiensis* 18, 2 (1989): 55-72. Somers was also opposed to the name change of the NSINS pushed by MacGregor, see Zeller, "Reflections" 15, n. 10.
- 78 Verification or refutation of this hypothesis would require inspection of relevant archives of the NSINS or correspondence of MacGregor and others in positions of editorial influence. We unfortunately have not had time to follow this up.
- 79 Pittman, "Darwinism and Evolution: Three Nova Scotia Religious Newspapers Respond, 1860-1900," 51.
- 80 C.B. Ferguson, "The Nova Scotian Institute of Science, Early Organization," *Proceedings of the Nova Scotian Institute of Science* 25, 4, (1964): 222-223; Martin Hewitt, "Science, Popular Culture, and the Producer Alliance in Saint John, N.B.," in Bogaard, *Profiles of Science*, 244.
- 81 Robert Morgan, "Glimpses into the intellectual life of early Cape Bretoners," (Talk, Nova Scotia Librarians meeting in Sydney, NS, Beaton Institute of Cape Breton University, Oct. 5, 1978).
- 82 John L. Hill Diary, MG 2.2, Beaton Institute, Cape Breton University. Bob Morgan, the historian long associated with Cape Breton University, hinted at the existence of this document when one of us (AR) gave an earlier version of this paper in a talk to a joint meeting of the Cape Breton Naturalists Society and the Old Sydney Society during the Darwin bicentennial and Origin sesquicentennial year in 2009. CM eventually tracked down the document in the Beaton Institute Archives at CBU in the summer of 2017. We are very pleased to express our gratitude to Bob, who passed away in 2011, but whose positive impact continues to be felt on his colleagues and students to come. Bob also mentioned this diary passage in Morgan "Glimpses into the intellectual life". We thank Anna MacNeil for assistance in reading Hill's cursive writing.
- 83 Zeller, "Environment, Culture, and the Reception of Darwin," and Zeller, "Reflections on Time and Place."