

*Physics Comes to Winnipeg: The 1909
Meeting of the British Association
for the Advancement of Science*

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ABSTRACT: History of science can be used to bring scientific concepts to school science in a way that humanizes the protagonists and provides an appropriate context. The authors have researched the 1909 meeting of the British Association for the Advancement of Science (BAAS) in Winnipeg, a significant event in the city's history that has remained largely unexplored until now, despite the existence of the original documents. The Mathematics and Physical Science Division of the BAAS met in Wesley College, which is now the University of Winnipeg. The meeting took place with much fanfare and public attention, especially with the attendance of the prominent scientists Rutherford, Thomson, Hahn, and Millikan, all of whom were or would become Nobel Laureates. Prominent themes relating to this meeting will be discussed in this session.

KEYWORDS: British Association for the Advancement of Science, BAAS, 1909 meeting, Winnipeg, Nobel Laureates.

1. Background

It has been observed that there is a fundamental incompatibility between the nature of school science and scientists' science (Klassen, 2006). School science operates by the dominant methodology of *normal science education* (Van Berkel, DeVos, Verdonk, & Pilot, 2000) which is characterized by oversimplification and dependency on textbooks (Kuhn, 1963) and which tends to lack context, imagination, and engagement. Science has come to be represented both in scientists' science and in school science as a form of decontextualized and dehumanized "history" (Klassen, 2006). An effective way in which to bridge the gap between school science, and what scientists actually do is through the inclusion of an accurate history of science which has been especially crafted for science students, usually in the form of story (Stinner, McMillan, Metz, Jilek, & Klassen, 2003). History of science can be used to bring scientific concepts to school science in a

way that humanizes the protagonists and provides an appropriate context (Klassen, 2006).

An especially effective story would include situations and characters that are considered as local for the intended audience. For this reason, the authors frequently research episodes in the history of science that have a strong Winnipeg, Manitoba, or Canadian component. One such instance is the 1909 meeting of the British Association for the Advancement of Science at Wesley College, which is now the University of Winnipeg, a significant event in the University's history that has, until now remained largely unexplored, despite the existence of the original documents. Although the authors were aware of the 1909 meeting, it was not until the late Dr. Harry Duckworth provided more detailed information, in person, that the research project that is described in this paper began.

2. Introduction

In 1909 the city of Winnipeg was a bustling, rapidly-growing, prosperous city and was seen as the metropolis of the future. It is said that a young Rhodes Scholar of the day, Kingsley Fairbridge, who set sail from South Africa for Oxford via North America, boasted as he left New York: "Winnipeg, Chicago, and New York—I saw them all!" (Duckworth, 1993). Thus, it is not so surprising that the British Association for the Advancement of Science chose Winnipeg for its 79th annual meeting in 1909—only the fourth meeting to be held outside the British Isles. The event marks one of the key events in the history of Winnipeg and also of the University of Winnipeg, since the sessions of the Mathematics and Physical Science section were held at the then Wesley College, which has since become the University of Winnipeg (see Figure 1). The meeting was notable for having four Nobel Laureates in attendance—the most Nobel Laureates ever to have assembled in Winnipeg at one time. Surprisingly, very little has been written about this important episode. When we received a transcript of a speech on the matter given in 1993 by Harry Duckworth, who is a former president of the University of Winnipeg and, himself, a physicist, we set out to research the meeting, especially how it relates to the state of physics at the time.

The papers given by the Nobel Laureates identify several important themes at the time. They include the evidence for atomism, the nature of radioactive substances, the nature of the ether, objections to the light quantum hypothesis, and a discussion on

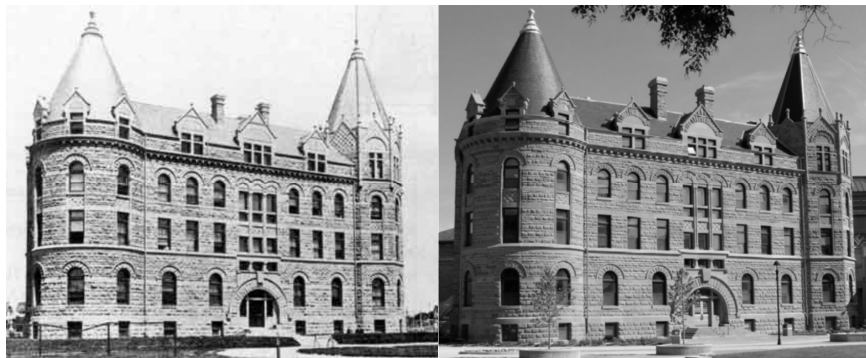


Figure 1: Wesley College (1910) and the University of Winnipeg (2008)

physics education at university. We have related this latter topic to work in physics education by other Nobel Laureates since then.

In researching the history we were able to find a number of original documents located in the library archives at both the University of Winnipeg and the University of Manitoba. The most significant of these is a large scrapbook at the University of Manitoba Archives containing a record of the public's view of the meeting through newspaper articles printed before, during, and after the meeting, as well as official documents and lists related to accommodations, transportation, and attendees. Along with the scrapbook are biographies of the prominent scientists produced for the meeting and a guide to Winnipeg for people arriving from overseas.

3. Initial Arrangements

The British Association for the Advancement of Science (BAAS) was founded in York in 1831. At its first meeting, the chairman of the Philosophical Society, William Harcourt, proposed that its purpose should be “to give a stronger impulse and more systematic direction to scientific inquiry, to obtain a greater degree of national attention to the objects of science, and a removal of those disadvantages which impede its progress, and to promote the intercourse of the cultivators of science with one another, and with foreign philosophers” (British Association for the Advancement of Science, 2008). The Winnipeg meeting was the third to take place in Canada. The two earlier such meetings in Canada had taken place in Montreal in 1884 and in Toronto in 1897.

The choice to make Winnipeg the site for the meeting was not a hasty one. In 1905, a number of Fellows of the Royal Society of Canada presented the idea to the Prime Minister, Sir Wilfred Laurier, who immediately promised \$25,000 toward the cause. This was an enormous sum of money, likely the equivalent of well over a million dollars in today's currency. It was the task of Rev. George Bryce, the first professor at Manitoba College, to convince the city of Winnipeg of the benefits of holding the meeting. Bryce's successful efforts resulted in the city council sending an informal invitation to the BAAS for the 1909 meeting, which the Association accepted unanimously at its 1906 meeting in York. Following the issuance and acceptance of the official invitation at the 1907 meeting in Leeds, the preparations for the meeting were accelerated, and Rev. Bryce was placed in charge of making the arrangements.

The arrangements needing to be made were extensive. Having insufficient space in hotels, the local committee sent out letters asking the citizens of Winnipeg to provide accommodation for the duration of the meeting. While the response was gratifying, not everyone felt comfortable with the idea of allowing strangers into their homes. The *Saturday Post* in its April 24th, 1909 edition claimed that the request for private accommodation would "deprive the hotels and boarding houses of a considerable volume of prospective business" and that the visiting scientists were simply "deadheads foisted upon private homes" (*Saturday Post*, 1909).

Along with accommodations, Bryce made arrangements and raised funds for overseas visitors to take part in a trip to the West coast of Canada. The 13-day trip was to be made by train, taking a select group of 200 conference participants to Regina, Moose Jaw, Calgary, Edmonton, Vancouver, and Victoria. In addition to this trip, which took place after the meeting, the organizing committee also arranged many excursions in Manitoba to various sights.

Travelers from Great Britain were advised to leave at least ten days prior to the start of the meeting on August 25th. The main routes between Great Britain and Canada were from Liverpool or Glasgow to Quebec and Montreal, and from Liverpool, Glasgow, Southampton, or London to New York or Boston. Four or five of those days were spent on the ocean voyage, while three or four additional days were spent traversing the Gulf of St. Lawrence to Montreal. From Montreal, passengers could travel via the Canadian Pacific Railway to Winnipeg.



Figure 2: *The University of Manitoba, c. 1909*

4. The State of University Science Education in Manitoba at the Time

The academic environment in Winnipeg at the time that the 1909 meeting was held consisted of the University of Manitoba with its seven associated colleges. Wesley College, where the Mathematics and Physical Science section meetings were held, was one of the seven colleges.

The University of Manitoba had been founded in 1877 but did not get its own building until 1901 (see Figure 2), having initially been established strictly as an examining body for its colleges. In 1904, the University hired its first six professors in the sciences. In their first annual report, in 1905, the professors reported that no practical (laboratory) work had yet been possible due to the lack of equipment and the absence of a scientific library. Despite these serious shortcomings, the University managed to celebrate its first seven graduates in the natural sciences in 1907. It was against this background that the 1909 BAAS meeting was planned. A report in the journal *Nature* in July of that year described the university as “a small and by no means beautiful structure. It resembles, in fact, in size and general style the public elementary schools of the city” (*Nature* 1909, p. 75). The BAAS was coming to Winnipeg on the basis of the city’s reputation and on the basis of the enthusiasm and organizational ability of George Bryce, but not on the basis of any development in the sciences and education. The meeting, however, did generate considerable public interest in science. The Science Club of Winnipeg grew from having 10 to 12 members in 1905 to having a waiting list and increasing its size to 45 members in 1912.

4.1 The State of Physics

At the turn of the twentieth century, the University of Manitoba was still fairly small. In 1905, Frank Allen, a member of the first group of six professors to be hired, began teaching the physics courses. In that year there were 40 students, and Allen was the only instructor. Over the next several years, the number of physics students grew, climbing from 94 to 147 students between 1908 and 1909. The university calendars during that period of growth reveal a change in the way that teaching physics was approached. The calendar for 1905 – 1906 reveals a somewhat restricted approach, specifying that “[t]he Study of Physics will, as far as possible, be treated experimentally and in such a manner that no higher mathematical knowledge than the elements of plane trigonometry will be required” (University of Manitoba, 1905). However, the 1908 – 1909 calendar, in its description of the Department of Physics, reveals that the Department had already acquired equipment and was improving the instruction:

The Department of Physics occupies the eastern end of the first floor of the University Building plus two rooms in the basement. A large part of this space is taken up by the lecture theatre which is capable of seating 120 students. Instruction in Physics is given by means of lectures and laboratory practice. In the former the general laws of mechanics, heat, magnetism, electricity, sound and light are presented with experimental demonstrations. Some apparatus for this purpose has already been obtained and additions are being made from time to time. Laboratory work is at first confined to experimental verification of physical formulae and to practice in the use of instruments of precision. Special attention is given to the employment of graphical methods. (University of Manitoba, 1908)

During those years of growth, Professor Allen remained the sole instructor until 1909, when the university hired R.K. McClung, a friend and co-researcher of Ernest Rutherford, who had, unfortunately, arrived in Winnipeg too late to participate in the British Association meeting. During the year of the meeting, the University acquired more equipment and space, purchasing a seismograph and adding a new building to the North side of the existing structure.

5. The Success of the Winnipeg Meeting

In 1908, J. J. Thomson had been announced as the new president of the British Association (see Figure 3). It was not until January of



Figure 3: Sketch of Sir J. J. Thomson from a 1907 Edinburgh Newspaper Clipping

1909 that the presidents of the eleven sections of the association were named, with E. Rutherford leading the mathematics and physical science section (Connor, 2004). The meeting had 1468 people in attendance, which included 455 overseas visitors. Some of the prominent physicists in attendance were J.J. Thomson, Ernest Rutherford, Otto Hahn, Robert Millikan, Arthur Eddington, and J.H. Poynting.

Thomson gave his presidential opening address on the evening of August 25th in the newly-completed Walker Theatre, which had a seating capacity of 2000. The extravagantly-built theatre was a showpiece for the prosperous city and was used for the opening, closing, and two popular public lectures. Rutherford gave his presidential address to the mathematics and physical science section the next morning in Convocation Hall at Wesley College (now the University of Winnipeg). The organization and attention to detail of the meeting was unparalleled, driven by an almost unheard of sum of about \$50,000 in government grants, the organizational genius of Bryce, and the enthusiastic and energetic involvement of the citizens of Winnipeg. The hospitality abounded with numerous social occasions, including garden parties, luncheons, formal evening functions, and polo matches to engage the city's visitors. Volunteers

drove conference participants wherever they wished to go. That year, the Bulletin of the American Geographical Society reported about the Winnipeg meeting that

[t]he social events were numerous and of such a character as to introduce the members and guests most happily into the life of the growing metropolis and to give them vividly the background of its history. (Brigham, 1909, p. 757)

Not surprisingly, the meeting was considered by all to be an unqualified success. The degree of appreciation of Winnipeg by its guests is captured in a newspaper summary of J.J. Thomson's closing remarks in the Walker theatre:

Sir Joseph Thomson bade farewell to the Winnipeg people. He said he wished to seize that opportunity, finally, to thank the citizens of Winnipeg for their generosity and hospitality, which had known no bounds. He wished, also, to pay a tribute to the admirable organization of the meeting. It was no exaggeration to say that the Winnipeg meeting had been prepared more thoroughly and carefully than any previous meeting held by the Association. (*Winnipeg Free Press*, Sept 2, 1909)

One would assume that the meeting would have affected the state of science (and physics) education in Winnipeg. There is certainly evidence of increased interest in science at the time; however, the development of the university, itself, was hampered by indecision and inertia on the part of the government of the day (Duckworth and Goldsborough, 2004).

6. Papers Given at the Conference

6.1 Rutherford and Atomic Theory

Rutherford, who was the president of the mathematics and physical science section of the meeting, concentrated his talk on defending the validity and reality of atomism. Having just won the Nobel Prize in chemistry the previous year for his investigations into the disintegration of the elements and the chemistry of radioactive substances, his opinions carried considerable weight. After giving a brief introduction to the history of atomism, beginning with the work of Dalton around 1805 and continuing to his own research on the subject, Rutherford set out to make the case for the atomic theory. The first piece of evidence presented was the work by Perrin on Brownian motion and the corresponding theoretical explanations by Smoluchowski and Einstein. Second, he put forward his recent work on alpha rays, including the various methods of single-particle counting and the famous "mouse-trap" experiment. He concluded this

part of his talk by stating that “the experiments, taken as a whole, appear ... to give an almost direct and convincing proof of the atomic hypothesis of matter” (Rutherford, 1909, p. 294).

Rutherford then went on to discuss a related topic, namely, various methods for determining Avogadro’s number, N , and the charge on an electron, e . Incidentally, it is interesting to note that Rutherford used the term “electron” quite comfortably, but that Thomson, in his address the evening before, did not use the term at all, rather preferring to use the term “corpuscle”. After mentioning various early estimates for N , Rutherford described Rayleigh’s estimate of N from light scattering in the atmosphere (the cause of the blue sky), Perrin’s determination from Brownian motion, and the determination from the rate of transformation of radium. The discussion of the various methods of determining N was followed by a discussion of methods of determining e , beginning with Townsend’s method in 1897, and then mentioning determinations by C.T.R. Wilson, J.J. Thomson, Millikan and Begeman, Moreau, Ehrenhaft, Rutherford and Geiger, and Planck. Rutherford observed that

[w]hen we consider the great diversity of the theories and methods which have been utilized to determine the values of the atomic constants e and N , and the probable experimental errors, the agreement among the numbers is remarkably close. (Rutherford 1909, p. 298)

This agreement among the diverse determinations of N and e , was, in itself, evidence for the atomic theory.

It is interesting to realize that the atomic theory was experiencing strong enough challenges that Rutherford would see it necessary to devote most of his keynote talk to defending it and emphasizing it in his conclusion:

In the light of these and similar direct deductions, based on a minimum amount of assumption, the physicists have, ... some justification for their faith that they are building on the solid rock of fact, and not, as we are often so solemnly warned by some of our scientific brethren, on the shifting sands of imaginative hypothesis. (Rutherford, 1909, p. 302)

One should realize that while Rutherford’s conclusion was based on his interpretation of experimental data, it was also guided by his philosophical stance as an experimental realist, as noted earlier in his presentation:

For the great majority of scientists it is not sufficient to group together a number of facts on general abstract principles. What is wanted is a concrete idea, however crude it may be, of the mechanism of our phenomena. ... [T]he facts of nature are

ultimately explicable on general dynamical principles, and ...
 there must consequently be some type of mechanism capable of
 accounting for the observed facts (Rutherford, 1909, p. 291)

Had it been two years later, Rutherford might not have found it necessary to defend atomic theory in the way he did, as he, Geiger, and Marsden would identify the massive central atomic nucleus, which would prove to be the final justification for the atomic theory and the last key element to enable the theorists to construct a viable atomic model.

6.2 Otto Hahn and Radiochemistry

Another future Nobel Laureate attending the 1909 meeting was Otto Hahn. Since Hahn had been working with Rutherford in Montreal, one can imagine that the Winnipeg meeting was something of a reunion for them. Only months before the meeting, Hahn had succeeded in applying radioactive recoil, which had already been observed by Harriet Brooks and Rutherford. His Winnipeg paper was entitled "Separation of New Radioactive Disintegration Products." At that time, Hahn and Meitner were struggling to devise a model that would describe their many and complex observations. As the neutron had not yet been discovered, their efforts to construct a model for radioactive decay appear as somewhat awkward first attempts.

Of particular interest in the paper was Hahn's characterization of his partnership with Meitner at the very initial stages. Having collaborated with Hahn for thirty years, her exclusion from the 1944 Nobel Prize that Hahn was awarded has been called "a rare instance in which personal negative opinions apparently led to the exclusion of a deserving scientist" (*Physics Today*, 1997, p. 32). His Winnipeg paper describes a joint project:

In collaboration with Dr. Lise Meitner, the author began, two years ago, an investigation of all the various Beta-ray products, with the view of comparing all the separate and single products under identical conditions. (Hahn, 1909, p. 394)

While her contributions were later downplayed, it is clear from Hahn's paper in Winnipeg that her work was fundamental from the very beginning.

6.3 J.J. Thomson, Physics Education, the Ether, and the Light Quantum

One would think, based on Thomson's prominence and public experience, that he came across as a dynamic and forceful public persona. However, an Edinburgh newspaper article of the day hints at a different picture:

Professor Thomson is a man of somewhat retiring disposition, and his name is not perhaps so well known to the general public as are the names of some of the other distinguished members of the Association, but in scientific circles he is regarded by many as perhaps the leading man of science in this country now that death has removed Lord Kelvin. (*The Scotsman*, March 12, 1908)

Knowing the huge reputation that Kelvin had in Great Britain, being labeled as Kelvin's successor must have been a somewhat daunting role for Thomson. Evidently, he was characterized by modesty.

Thomson's presidential address provides us with a window into mainstream thinking in physics in 1909. Although the speech was delivered to the entire body representing all the branches of science and mathematics, it was customary for the president to speak only about his own specialization. Thomson's address was not primarily intended to be a scholarly exposition, but a less formal discussion of the president's perspective on "the state of physics". Interestingly, Thomson addressed not only key issues in the theories of physics, but he began his talk by sharing his perspective on physics education in the university.

It seems likely, from the passion that exudes from this part of the speech, that Thomson was a very committed and, likely, also a very good, teacher. Three aspects are covered in his speech—the motivation-deadening effect of premature specialization, the importance of mathematics to the study of physics, and the importance of undergraduate research. Thomson explains that in the British system, students compete for university scholarships and spend their high-school years preparing for the entrance examination in the one area they wish to enter. When they enter university, they continue to specialize before they even obtain their first degree. In Thomson's experience, the effect of all this narrowing of effort is to "dull" the student's "enthusiasm" (the term Thomson uses for motivation). Thomson notes that

[t]he premature specialization fostered by the preparation for these scholarships injures the student by depriving him of adequate literary culture ... [and] ... it retards the progress of science by tending to isolate one science from another. The boundaries between the sciences are arbitrary and tend to disappear as science progresses. (Thomson, 1909, p. 259)

Thomson explains that an important reason for a student to sustain strong motivation throughout the studies is the tremendously difficult nature of research, which, presumably, the student will someday perform:

Now there is hardly any quality more essential to success in research than enthusiasm. Research is difficult, laborious, often disheartening. The carefully redesigned apparatus refuses to work, it develops defects which may appear inconsistent with each other and with every known law of Nature, sleepless nights and laborious days may seem only to make the confusion more confounded, and there is nothing for the student to do but to take for his motto 'It's dogged as does it,' and plod on, comforting himself with the assurance that when success does come, the difficulties he has overcome will increase the pleasure—one of the most exquisite men can enjoy—of getting some conception which will make all that was tangled, confused, and contradictory clear and consistent. (Thomson, 1909, p. 259)

It is readily apparent that Thomson is a strong advocate for a liberal education and that he tends to hold a rather progressive view of the role of physics in relation to the other sciences. Interestingly, his views on the new theories in physics are not as progressive as they appear, as we shall see later.

Thomson then turns to another of his causes, namely, his appeal to include a greater study of mathematics in physics. He sees mathematics as not only the language of physics, but a “way of detecting ambiguities and discrepancies in ... ideas” (Thomson, 1909, p. 260). Sitting in the audience was Frank Allen, the first physics professor in Winnipeg. One can imagine that Thomson’s words struck right to the heart of the Manitoba resolution not to use any mathematics higher than plane geometry!

The last issue in physics education is Thomson’s strong advocacy of undergraduate involvement in research. He cites two primary reasons for his view. First, he sees “book” learning as rather limited; in his words, “[i]t is possible to read books, to pass examinations without the higher qualities of the mind being called into play” (Thomson, 1909, p. 262). Being involved in genuine research, according to Thomson, improves the judgment, independence of thought, and maturity of the student, and

[r]esearch develops qualities which are apt to atrophy when the student is preparing for examinations, and, quite apart from the addition of new knowledge to our store, is of the greatest importance as a means of education. (Thomson, 1909, p. 262)

Thomson’s views and recommendations on education are refreshingly candid and wise. We cannot help but think of other Nobel Laureates in physics who have also become very involved in education. A discussion of these physicists is included in the next section.

After having dealt with physics education, Thomson turns to another topic important to him, that of the ether. He goes into a long discussion of the nature and importance of the ether, and, curiously, does not give even a hint that the concept of the ether might have been challenged. One rather astounding fact that he brings out is that the ether is supposed to have a density of about 2,000 million times that of lead!

Last, Thomson launches into a subtle attack on Einstein's light quantum, damming it with faint praise. He never mentions Einstein by name. As with the electron, Thomson does not use any of the latest scientific terminology. He never uses the term "electron", but, instead, "corpuscle". He never uses the term "quantum" but, instead, "light particles" (Thomson, 1909, p. 272) or "unit structure of light energy" (Thomson, 1909, p. 273). He begins by admitting "that the energy has a structure of this kind has lately received a good deal of support" (Thomson, 1909, p. 272). However, he outlines his "grave objection" to treating radiant energy as a gas, based on a contradiction he sees with the second law of thermodynamics. Based on classical theory, he goes on to show how light would be expected to consist of "parcels", all of the same energy, when emitted. He departs even more strongly from Einstein's view by insisting, "I do not think there is any reason for supposing that in any casual specimen of light of this wave-length, which may subsequent to its emission have been many times refracted or reflected, the bundles possess any definite amount of energy" (Thomson, 1909, p. 274).

7. Other Physics Nobel Laureates' Thoughts on Science Teaching

It is interesting to observe the prominent place that Thomson gave to physics education in his presidential address. Robert Millikan, present at the meeting and to become a Nobel Laureate in 1923, spent much of his early career in writing and publishing physics textbooks. Other Nobel Laureates besides Thomson and Millikan, have pursued an interest in physics (and science) education. Because of the influential role that such advocates in science education play, we wish to highlight two contemporary examples, namely, Carl Wieman and Leon Cooper.

7.1 Carl Wieman

Since winning the Nobel Prize in Physics, along with Cornell and Ketterle, in 2001 for the achievement of Bose-Einstein condensation in dilute gases of alkali atoms and for early fundamental studies of

the properties of the condensates, Carl Wieman has become intensely involved with improving science education. His initiative is based at the University of British Columbia in Canada. For his efforts, he has been awarded the Oersted Medal, which recognizes contributions to the teaching of physics, and he serves as Chair of the Board on Science Education of the National Academy of Sciences.

Wieman separates science students and science-teaching into two categories—novice and expert. He believes that most undergraduate students, when they enter university, can be classified under the novice heading. Their way of problem solving consists of pattern matching to memorized recipes, and they see the information they are taught as isolated pieces of information to be memorized. The taught information may be seen by the student as something just handed down by an authority, in this case their professor, and unrelated to the world. The students' tendency to defer to authority presents a problem: while it may allow the student to pass a course, it does not encourage scientific thought. Ideally, Wieman would like to see science educators mold these novices into experts. An expert's way of problem solving is widely applicable in that it uses systematic concept-based strategies, enabling the information being learned to be viewed as a coherent structure of concepts. These concepts are not simply things to be memorized, told to them by their professor, but are genuine ways of describing nature that are established by experiment.

Like Thomson, Wieman believes that some of the most valuable time for an undergraduate student is the time spent in a research laboratory. While doing research, students are forced to create their own understanding, which encourages expert-like thinking. This is where he believes that a typical science course fails. To illustrate the current shortfalls of science education, Wieman cites three sets of data on the lack of effectiveness of traditional science teaching, namely, retention of information from lecture, conceptual understanding, and beliefs about physics and problem solving.

According to his research, a typical student retains very little from a lecture. He believes that in order to engage students, an educator needs to address their beliefs. Some of these beliefs include why it is worth learning, how it connects to the real world, and how it connects to the things the student knows. Wieman also suggests the use of technology to engage students. By incorporating technology, such as a personal response system (informally known as "clickers") and interactive simulations, students have a chance to become

actively invested in their learning, and educators are able to get useful feedback on how much the students understand.

7.2 Leon Cooper

Another Nobel Laureate dedicated to the advancement of science education is Leon Cooper. Cooper, along with Bardeen and Schrieffer, won the Nobel Prize in physics in 1972 for his work on developing the theory of superconductivity. Since that time, alongside his research, he has written physics textbooks. Cooper's approach to the textbook is unique in that he includes an authentic historical account of the origins of the concepts about which he writes. In another study undertaken by one of the authors (Klassen), Leon Cooper was interviewed on his views about the teaching of science and the nature of science (Niaz, Klassen, Metz, and McMillan, 2008), and he addressed the importance of context:

What led me to the belief that physics and science should be taught in historic context is that some questions make sense only in the context of their time. Further, almost any issue is illuminated by putting it in context. Inspection of textbooks that are actually used in courses ... shows that very few, if any, follow the approach of putting ideas in their context the way I do (Cooper, 2007, personal communication).

It is clear from the interview that Cooper believes in putting information into a historical perspective, meaning that it is important to address the "why" and "how" of science instead of simply teaching the newest and fastest way of obtaining a result (Niaz, et. al., 2008). Teaching in this way emphasizes the need for aspiring scientists to "take things apart" as it was done in the past.

8. Concluding Remarks

The records of the 1909 meeting of the BAAS in Winnipeg afford the keen observer a snapshot of the world of physics in the early 20th century. Furthermore, it puts the state of Winnipeg university physics (and science) education into a realistic perspective. Our research has revealed that Winnipeg university science education of the time was driven more by enthusiasm than by substance. A greater driving force was the dynamic economic and social climate in Winnipeg.

The presentations of Nobel Laureates Thomson, Rutherford, and Hahn provide a unique picture of what was taking place in physics at the time. In particular, the presidential address of Thomson reveals the thinking in establishment physics. Although Thomson's views on physics show an understandable pre-modern physics bias, his views

on education, having sprung forth from first-hand experience and passionate commitment, are valuable to take into consideration even today.

To most students, the names of the physics “greats”, like Thomson, Rutherford, Millikan, and Hahn, are only that—names. However, it is possible, through stories like those unearthed in this paper, to provide greater insight into the personalities of the scientists, their interests, and the difficulties that surrounded the birth of new scientific concepts and paradigms.

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