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# The 'Bureau of Scientific and Industrial Research and School of Specific Industries': The Royal Canadian Institute's Attempt at Organizing Industrial Research in Toronto, 1914-1918

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THE 'BUREAU OF SCIENTIFIC AND INDUSTRIAL RESEARCH  
AND SCHOOL OF SPECIFIC INDUSTRIES':  
THE ROYAL CANADIAN INSTITUTE'S ATTEMPT AT ORGANIZING  
INDUSTRIAL RESEARCH IN TORONTO, 1914 - 1918

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Towards the end of the nineteenth century, science and industry were being brought into closer touch through a wide variety of means. One of these was industrial research. The prime models for forms of this research were to be found in German and American institutions. However, the forces which had brought about this development, including the growth of scientific research, the increasing role of the state in science and in the economy and the emergence of big business, were not unique to Germany and the United States. Relatively contemporary movements calling for industrial research could be found in many other industrialized and industrializing countries.

A movement preaching the gospel of industrial research and attempting to lay its foundations arose in Canada in the early twentieth century. It was at once both a reaction to similar efforts in other countries, especially following the outbreak of World War I, and at the same time a response to developments in Canadian universities, governments and industries. Paralleling the slightly earlier and related movement for technical education, nowhere in Canada was the industrial research movement stronger than in Ontario.

The idea of industrial research found a well-prepared audience in the province of Ontario. By the early twentieth century the province's two major universities, Toronto and Queen's, had improved and expanded their scientific and engineering education, fostered graduate studies and promoted the ideal of research. Both the Dominion and Ontario governments were spending some funds on science and were concerned with industrial development. Indeed, several federal government departments had been conducting, for quite some time, studies of use to such primary industries as forestry, fisheries, mining and agriculture. It appeared to be simply a case of extending that effort to secondary industry. Economically, manufacturing and services were rapidly growing in importance in Ontario at the expense of primary industry.<sup>1</sup> There was a

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trend within Canadian industry towards concentration, specialization, and a growing dominance by large corporations, all accompanied by a search for the means to continued economic security.<sup>2</sup> Industrial research appeared to be a way of achieving that security. Furthermore, businessmen and their organizations had taken some interest in research well before World War I. The Toronto-based Canadian Manufacturers' Association had been calling for closer relations with universities from at least 1900.<sup>3</sup> It had organized in 1902 the Canadian Section of the Society of Chemical Industry. However, it was with the Great War that industrial research came to the forefront of manufacturers' interests. Following the war the Canadian Manufacturers' Association undertook an extended propaganda campaign clearly aimed at convincing manufacturers, and others, of the need for research. The emerging awareness of industrial research was accompanied by a tremendous growth in its practice. The number of industrial research laboratories went from approximately thirty-seven in 1917-18 to 998 in 1939.<sup>4</sup>

One of the earliest plans for promoting industrial research in Canada was put forward by the Royal Canadian Institute of Toronto. This article reviews the history of the Institute's Bureau of Scientific and Industrial Research and School of Specific Industries. Although the Bureau never became securely established, its story reveals the reasons for the Institute's interest in the subject and better illuminates some of the concerns and problems facing the organization of industrial research in Ontario, and in Canada, in the early twentieth century.

When the Canadian Institute was officially granted the title of 'Royal' in April 1914, it had already been in existence as a scientific society for some sixty-five years. Founded in 1849, the Institute had been devoted to the encouragement and general advance of the physical sciences and arts and manufactures, and, in particular, to promoting knowledge related to surveying, engineering and architecture.<sup>5</sup> It had attempted to fulfill these goals by establishing a journal, an extensive library of scientific periodicals and its own building. As an organization in Toronto promoting research in the second half of the nineteenth century, the Canadian Institute acted as a useful complement to the University of Toronto, at that time almost wholly devoted to educational goals. By the turn of the century, however, the Institute faced identity and membership problems.<sup>6</sup> Among other factors, the emergence of various specialized scientific societies and the growth of research within the University of Toronto competed for the allegiance of its members. In efforts to develop new directions, popular lectures on science were struck to 'make the Institute known and recognized throughout Canada as a National Institute, and to procure its recognition abroad.'<sup>7</sup> It was as part of this revival movement that the Canadian Institute became the Royal Canadian Institute.

The way in which the Institute planned to extend its usefulness was by promoting and becoming directly involved in industrial research. Precisely why this route was chosen is

unknown. However, the question of linking science and industry, very much in the air at that time in both North America and Europe, was attractive to a scientific society seeking a new purpose. The Institute's president, Frank Arnoldi, appears to have played an important role in determining the path the society would follow. A well-known lawyer, he had been on the Institute's Council since 1909, becoming president in 1913. Arnoldi was actively concerned with the Institute's welfare. He was behind its obtaining of the title 'Royal,' a new membership drive and the plans to enlarge its work. As part of this activity he had been gathering information on the Smithsonian Institution, the Carnegie Institution and the Mellon Institute.<sup>8</sup> By June of 1914, under his leadership, the members of the Council were considering a bureau of research.<sup>9</sup> Seven months after its change in title, the Royal Canadian Institute had decided to organize, under its care, a 'Bureau of Scientific and Industrial Research and School of Specific Industries.' It inaugurated a campaign in the fall of 1914 to establish that Bureau by sponsoring a series of addresses on the necessity of industrial research and by publishing a pamphlet entitled *Co-operation between Science and Industry in Canada. The Royal Canadian Institute as an Intermediary for its Promotion.*

The Institute's intention in founding a Bureau was to help bring science and industry in Canada closer together, for it seemed clear that the two had to be intimately related in order to ensure healthy and vigorous industrial progress. The inaugural pamphlet declared 'this is a scientific age' and noted that all 'thoughtful men' were concerned with the relation of the sciences to industrial progress.<sup>10</sup> Unfortunately, Canadian science and industry had few links. Science graduates, the pamphlet stated, were 'sent into the world with no established medium to guide them to usefulness.'<sup>11</sup> And hardly any Canadian industries performed research despite the increasing examples of successful German and American firms. The Institute's Bureau would aim at convincing industries of the benefits of research and would assist in putting science to work on their needs and problems. In this way the Bureau would foster the dissemination of foreign technical knowledge in Canada as well as the discovery of new processes and products, hence promoting industrial efficiency and the development of Canadian resources. In short, the Bureau would do for manufacturers what agricultural colleges and experimental farms in Canada had for some time been doing for farmers.<sup>12</sup>

It was fitting that the first speaker in the campaign to establish the Bureau was R.F. Bacon, the acting head of the Mellon Institute of Industrial Research and School of Specific Industries, in Pittsburgh.<sup>13</sup> The Mellon Institute had special significance for Canadians aside from its well-publicized success in industrial research. Its founder was Robert Kennedy Duncan, a Canadian and a graduate of the University of Toronto's chemistry department. Duncan was a very influential promoter of industrial research in the United States. His idea, inspired by German practice, was to bring university scientific research and its need for personnel and money into closer touch with the needs of industry and its funds.<sup>14</sup> As a

result, Duncan instituted a system of industrial fellowships first at Kansas in 1907 and then at Pittsburgh in 1911, his latter organization being endowed by the Mellon brothers in 1913. Duncan served as a particularly suitable example of what Canadians could do in industrial research and, it was argued, of the adverse effects on Canadian industry of the scientific brain drain.

Bacon's speech was also significant because the Institute's Bureau was to be closely modelled on the Mellon Institute, as was indicated by the near identity in the full titles of both organizations. The Mellon Institute illustrated how industrial research could be carried out for industries unable to afford their own research facilities, a situation which appeared to characterize most Canadian firms. Like its American counterpart, the Bureau was envisioned as primarily operating on a scheme of industrial fellowships.<sup>15</sup> A firm would give a sum of money to the Bureau to establish a fellowship to deal with a problem it had. The Bureau's director would find an individual qualified to do the needed research and would supervise the fellow's work. The Bureau would find laboratory facilities perhaps using its own proposed laboratories -- hence the 'School of Specific Industries' in its name -- or those of the University of Toronto or of other universities. Any of the fellow's discoveries became the property of the company and a firm could take the fellow into its regular employment if it wished. Aside from acting as an agency for research, the Bureau would also act as a clearing house for scientific and technical information. It planned to undertake translating and bibliographic searches, and also to build up the Institute's already significant scientific-technical library.<sup>16</sup>

The Bureau may have been modelled on the Mellon Institute but this alone could not ensure its success. The Royal Canadian Institute, itself penurious, looked to the groups that would be affected by its Bureau -- manufacturers, universities and governments -- for co-operation and financial aid. The timing of its appeal, coinciding with the beginning of the Great War (and despite the fact that the war emphasized and appeared to prove the value of scientific research) was not very opportune. Early in 1915 Arnoldi tried, without success, to enlist a number of prominent businessmen, such as R.W. Leonard, J. Woods and F. Nicholls, to serve on a Committee of Management for the Bureau; they were all too busy.<sup>17</sup> The Institute's Council became the Bureau's Board of Governors. Arnoldi's approach to the University of Toronto in May met with some initial success. The University offered the use of its laboratories and apparatus and also printing privileges at its press. But the Institute's plans soon led to a reaction within the University of Toronto that saw their rejection there in early 1916 and the adoption of a scheme by the University that gave birth the following year to its School of Engineering Research.<sup>18</sup> Finally, government, and especially the Dominion government, was also looked to by the Institute for support. It proved to be the most important factor in the Bureau's fortunes.

At the start of the campaign to establish the Bureau, Arnoldi had sent a copy of the pamphlet specially published for that purpose to Sir George Foster, Minister of Trade and Commerce in Ottawa. Foster replied by thanking the Institute for its 'excellent' pamphlet and wrote 'there are some points in it which I propose to attempt to carry out in a practical way.'<sup>19</sup> Interest in industrial research was not limited to the Royal Canadian Institute. Foster was convinced of the benefits science could offer industry. In April of 1915 he was planning an informal meeting with the heads of McGill, Queen's and Toronto to discuss support of research work. Arnoldi heard of the plans and, arguing that the Institute was directly concerned with the topic, that it had set out with the object of co-operating with the universities, and that it was a Dominion corporation while the universities were provincial institutions, managed to invite himself to the May 25th meeting in Ottawa.<sup>20</sup> There, a government memorandum was distributed which proposed a Commission on Industrial Research. The Commission would supervise three different areas: 1) it would arrange with and finance various universities to undertake research in subjects of importance to the whole country; 2) it would handle research for individual manufacturers under a scheme like that of the Mellon Institute; and 3) it would establish a fund to which professors could apply for equipment grants to work on problems which might not be so closely associated with industry.<sup>21</sup> The Commission would also correlate its work with that of the Government departments performing research. Arnoldi argued at the meeting that American experience had shown that commissions did not work very well. Something more than university or government participation was required. That something more was the Bureau. It was an established body, Arnoldi said, within the duties set out in the Royal Canadian Institute's charter. A short time after the meeting Arnoldi expressed his feelings when he wrote asking for substantial assistance from the government for the Bureau, stating that it would be a 'monstrous proposition at this date to ignore the Royal Canadian Institute and the objects of its Institution and to set aside its proposed Bureau for carrying to practical life the result of its sixty-five years of work.'<sup>22</sup> Foster's plan was to unfold very slowly over the next year and it was to be one and a half years before the outcome, the Honorary Advisory Council for Scientific and Industrial Research (the early National Research Council) first met. Yet anticipation among manufacturers, scientists and the Ontario government that the Dominion government was going to do something to organize industrial research hung like a black cloud over the Bureau's efforts to establish itself.

Arnoldi soon gave up hope of obtaining funds from the Dominion government and concluded that the Bureau would have to 'proceed independently.'<sup>23</sup> His view was shared by Francis Mills Turner, the Bureau's acting unsalaried secretary and later secretary-treasurer. Turner was a recent graduate in chemistry at the University of Toronto and had been appointed in May to his position in the Bureau on Arnoldi's suggestion.<sup>24</sup> He was an enthusiast for industrial research and also had some knowledge of the Mellon Institute, having known Duncan and

some other individuals there.<sup>25</sup> Turner believed that what was needed at that time was concrete progress, not another government commission. He wrote to Arnoldi in June of 1915:

The work we have to do is an extensively practical one and its main appeal must be to practical men and unless our methods in constructing our business seem at least as business-like and efficient as those they employ in their own businesses, it is not likely they will give much heed to anything we may have to say to them.<sup>26</sup>

Both Turner and Arnoldi felt that the Institute's Bureau, ready to do something concrete and tangible, would be in a position of leadership and would prove acceptable to both manufacturers and scientists.

With an energetic, entrepreneurial approach, Turner set out to build up the Bureau by having it do things. He began several negotiations for fellowships. For example, he unsuccessfully approached Thomas B. Allen about establishing a carborundum fellowship.<sup>27</sup> He did some research for an Ottawa firm and also carried out a few literature searches.<sup>28</sup> He reserved space for a Canadian exhibit to be managed by the Bureau at the National Exposition of Chemical Industry scheduled for September of 1915 in New York City, but was unable to obtain exhibits from either Canadian manufacturers or from Dominion and provincial governments.<sup>29</sup> Turner also began talks with George Locke, the Chief Librarian of the Toronto Public Library, aimed at establishing a technical library in Toronto.<sup>30</sup> These plans too were ultimately not to amount to much. He then directed his efforts to preparing a campaign for the fall of 1915. It was to include addresses by individuals prominent in industrial research and was aimed at interesting industrialists in the Bureau and at obtaining \$10,000 to set the Bureau's work in motion. Letters describing the Bureau and asking for support were sent to the membership of the Canadian Manufacturers' Association, members of scientific societies, officers of banks, presidents of local Canadian clubs and some others. However, very few of the 300 communications sent to manufacturers were even acknowledged. Obtaining funds to get the Bureau working seemed to be impossible; by 14 December only \$450 had been subscribed.<sup>31</sup> Turner concluded, in an understatement, that lack of comprehension by manufacturers of the nature of industrial research and of its importance was even greater than supposed.<sup>32</sup>

A byproduct of the 1915 fall campaign was attraction of the interest of a Dominion commission. As propaganda for the Bureau, Turner had prepared articles on industrial research, one of which, 'Our Great National Waste,' appeared in the *Canadian Magazine*.<sup>33</sup> It was noticed by W.J. Black, secretary of the Economic and Development Commission. As a result, Turner was engaged by the Commission in 1916 to prepare a statement on the conditions affecting industrial research in Canada. It is unclear what influence Turner had on the Commission, but its 'Proposed Report' of 1916 recommended that the Commission of Conservation be converted into a Bureau of

Industrial and Scientific Research.<sup>34</sup> This recommendation, combined with the failure to secure subscriptions for the Bureau, made even Turner look to the Dominion government as 'the most hopeful outlook for the establishment of some kind of national industrial laboratory.'<sup>35</sup>

Turner resigned from the Bureau at the end of March, 1916.<sup>36</sup> Despite his numerous activities on its behalf, he had never been able to work full-time for the Bureau. He had to earn a living and his jobs required frequent absences from Toronto, mostly spent in the United States. He soon permanently resided there, employed in the scientific publishing business. Joining the Chemical Catalog Company about 1917, he rose to become a vice-president and director of the Reinhold Publishing Corporation.<sup>37</sup> Turner thus became one more example of a Canadian scientist making a career in the United States; ironically, one of the problems that would be solved, it was hoped, by the establishment of the Bureau.

Under Arnoldi and Turner the Bureau had not been able to make much progress towards becoming established. The independent route did not seem to be working. That path, however, had not been backed by all the members of the Board of Governors. In particular, John C. McLennan, professor of physics at the University of Toronto and first vice-president of the Institute, had all along preferred the approach of a Dominion Commission formulating a national plan within which the Institute's Bureau would find a niche.<sup>38</sup> McLennan expressed his opinion at the 25 May 1915 meeting with Foster in Ottawa, and again in his address, 'Industrial Research in Canada,' before the Royal Canadian Institute in November, 1916.<sup>39</sup> In this speech he outlined his idea of how industrial research would best be organized in Canada. He argued that universities were not a satisfactory mode of organization for stimulating and fostering industrial research. Instead, a Dominion commission was the best agency for the task. It would coordinate and give direction to the research activities of the various departments of the Dominion government. University facilities could be used but they would have to be supplemented by the founding of research bureaus of laboratories in the centers of industrial activity, namely, Toronto, Montreal and Winnipeg.<sup>40</sup>

McLennan's views gained weight as Arnoldi and Turner's efforts proved fruitless, as he became President of the Institute in May of 1916, and as Foster moved in June of that year to establish, on the British model, a Committee of the Privy Council on scientific and industrial research with an Advisory Council, on the latter of which McLennan was to serve. When in December of 1916 McLennan urged the Bureau's Board of Governors that 'what we wanted was to get together and see if one scheme could not be worked out that would embrace all the different interests,' few members of the Board must have disagreed.<sup>41</sup> Under McLennan the Bureau moved 'to widen its sphere of influence' by including on its Board representatives of most groups in Toronto and western Ontario interested in industrial research.<sup>42</sup> The Board of Trade of Toronto, the Associated Board of Trade of Ontario, the Toronto



branch of the Canadian Manufacturers' Association, the Society of Chemical Industry, the Toronto branch of the Canadian Mining Institute, the Canadian Society of Civil Engineers, the Joint Committee of Technical Organizations and the local branches of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers were all invited to send representatives, an offer most of the organizations took up. The Bureau also renewed its efforts to raise funds.

The Institute's strategy now, clearly, was to seek to establish its Bureau in connection with the federal Honorary Advisory Council for Scientific and Industrial Research. At the first meeting of the Advisory Council in early December of 1916, McLennan was suggesting the need for local information bureaus.<sup>43</sup> At the second meeting, a month later, he placed on the agenda a proposal to institute local scientific, technological and industrial boards in Toronto, Montreal and Winnipeg. The 'Local Libraries and Information Bureaus of Research' committee was formed to consult with interested parties.<sup>44</sup> By the time of the Advisory Council's third meeting in mid-February of 1917, the Institute's Bureau had composed and set to the Council a *Memorandum* from 'the Manufacturing, Scientific and Financial Organizations of Western Ontario.'<sup>45</sup> These groups were, of course, members of the Bureau's Board, with the exception of the Toronto banks. The *Memorandum* stressed the need for immediate and vigorous action in industrial research and asked the government, through the Advisory Council, to establish a Bureau of Industrial and Scientific Research in Toronto. This would comprise an information bureau for manufacturers, a laboratory for the solution of manufacturing problems and a technical library of trade journals and technical magazines. The Advisory Council's committee recommended that the government make provision for setting up a library and bureau of scientific and industrial information at Toronto.<sup>46</sup> The Advisory Council itself recommended half-maintenance costs for technical research bureaus set up by provincial agencies, and accordingly included \$25,000 for this purpose in their budget for the following year.<sup>47</sup>

It finally seemed as if the Bureau would become a reality. Armed with the backing of the Advisory Council the Bureau rejoined its efforts to raise a subscription among manufacturers. McLennan and Thomas Roden, a Toronto silversmith representing the Canadian Manufacturers' Association on the Bureau's Board and an individual who was to become a staunch supporter of industrial research, began to meet groups of manufacturers of allied trades. These dinner meetings were sponsored by the Executive of the Manufacturers' Association and succeeded in obtaining in a very short time promises of over \$6,000 for 5 years from such groups as food products and spices manufacturers, lithographers, bakers, chemical manufacturers, fertilizer companies, abattoirs and oil, varnish and paint manufacturers. Plans for the Bureau were progressing well.<sup>48</sup>

However, support for the Institute's Bureau proved to be very fragile. The war was one of the causes of this situation, for

the Bureau had to compete with the campaigns of the British Red Cross, the Patriotic Fund and the Victory Loan for the businessman's money and attention. In terms of publicity, it faced the conscription crisis and election of 1917. McLennan was called away to Britain in the spring of 1917 to do research for the Admiralty, remaining there for some years.<sup>49</sup> Of even greater importance than the war was the position of the Dominion government. Although manufacturers' interest in industrial research was undoubtedly growing, their attitude remained one of waiting for a lead from the Advisory Council. For its part, the Privy Council Committee had approved of the Advisory Council's estimates with the exception of the \$25,000 for Information and Technical Research Bureaus, which was held over for further consideration.<sup>50</sup> The Dominion government seemed unwilling to support local bureaus whatever function they might have. Without this support the pledges made by the allied trade groups for the Bureau were worthless because they had been made on the understanding that the Advisory Council would be involved and would match their funds.<sup>51</sup> The Advisory Council now focussed its attention on setting up its own central research institution which would also incorporate the functions of the Mellon Institute. The Royal Canadian Institute's plans for the Bureau collapsed. The Bureau did very little in 1918 aside from serving as a forum for the Advisory Council when it came to Toronto to speak to local interests on its aims and policy.<sup>52</sup> By 1919 the Bureau had faded away. A sure sign of its demise was the Institute's striking of a committee in January of 1919 to 'report on methods of enlarging the activities of the Institute with a view to interesting a larger constituency in its work,' the same want that had led the Institute some four years earlier to attempt to organize a Bureau of Scientific and Industrial Research.<sup>53</sup>

The Royal Canadian Institute's hope of gaining national prominence through organizing industrial research failed with its inability to establish its Bureau of Scientific and Industrial Research. The Institute was to remain a local organization, a society keeping science before a segment of the Toronto public, lobbying for the support of science, but not directly concerned with the advancement of science or technology. Although the Bureau had not succeeded, the efforts to promote it had helped in generating and focussing interest in Ontario on the question of industrial research. That interest proved to be more fruitful ten years after the demise of the Bureau with the formation of the Ontario Research Foundation in Toronto by manufacturers and the Ontario government than it had been at the time of the Institute's activities. Finally, the history of the Bureau's relationship with the Dominion government was an early illustration of a characteristic of scientific research and development in Canada: federally sponsored research and development is still mostly performed by its own agencies.

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## NOTES

1. R. Neill, 'The Politics and Economics of Development in Ontario,' *Ontario History* 70 (1978), 285.
2. T. Traves, *The State and Enterprise: Canadian Manufacturers and the Federal Government, 1917-1931* (Toronto, 1979).
3. 'Official Report of Manufacturers' Convention,' *Industrial Canada* 1 (1900-1901), 64, and 'Higher Education and Manufacturing,' *ibid.*, 262.
4. [A.B. Macallum], 'Research in Canada' [1918]. Public Archives of Canada [hereinafter cited as PAC], Borden Papers, vol. 188, 103588-103608; and Dominion Bureau of Statistics and National Research Council, *Survey of Scientific and Industrial Laboratories in Canada* (Ottawa, 1941), 20.
5. W.S. Wallace, 'A Sketch of the History of the Royal Canadian Institute, 1849-1949,' in his (ed.) *Royal Canadian Institute Centennial Volume* (Toronto, 1949), 131.
6. *Ibid.*, 160-1.
7. Council of the Royal Canadian Institute [hereinafter RCI], 'Minutes,' 14 March 1911. RCI Archive (held by the RCI).
8. Arnoldi correspondence, 22 Dec. 1913, 1 July, 9 July, 9 Oct., 12 Oct., 1914. Public Archives of Ontario [hereinafter cited as PAO], RCI papers, MU 2563 no. 11 env. 1. All references to this collection of papers will hereafter be given only by envelope number.
9. Council of the RCI, 'Minutes,' 12 June 1914. RCI Archive.
10. *Co-operation between Science and Industry in Canada. The Royal Canadian Institute as an Intermediary for its Promotion. Establishment of a Bureau of Scientific and Industrial Research* (Toronto, 1914), 3, 6.
11. *Ibid.*, 6.
12. *Ibid.*, 9-10.
13. His speech, 'The Value of Research to Industry,' was printed in *Science* 40 (1914), 871-81.
14. Royal Commission on Industrial Training and Technical Education, *Report of the Commissioners, Part II, chapter XI*.

15. *Op. cit.*, note 6, 10-11.
16. RCI, *Yearbook and Annual Report for the 65th session (1913-14)* (Toronto, n.d.), 2-3.
17. Arnoldi correspondence, 9-17 Feb. 1915, env. 1, PAO.
18. P.C. Enros, 'The University of Toronto and Industrial Research in the Early Twentieth Century,' in R. Jarrell and A. Roos, eds., *Critical Issues in the History of Canadian Science, Technology and Medicine* (Thornhill, 1983).
19. Foster to Arnoldi, 26 Oct. 1914. Env. 1, PAO.
20. Correspondence between Arnoldi and Foster, 11-20 May 1915. PAC, Foster papers, vol. 18, file 1929.
21. 'Precis of Conference of Representatives of Canadian Universities with Sir George E. Foster, KCMG, Ottawa, May 25th, 1915,' Falconer papers, University of Toronto Archives [hereinafter cited as UTA], Box 37, file 'Conference of Representatives ...'
22. Arnoldi to Payne, 24 June 1915. PAC, Foster papers, vol. 18, file 1929.
23. Arnoldi to Turner, 22 July 1915. Env. 4, PAO.
24. Board of Governors, 'Minutes of First Meeting,' 10 May 1915. Env. 12, PAO.
25. *Ibid.* See also Turner's 'The Value of Research to Industry,' *Trinity University Review* 27:7 (Apr. 1915), 149-51.
26. Turner to Arnoldi, 26 June 1915. Env. 3, PAO.
27. Correspondence between Turner and T.B. Allen, 4 June, 7 July 1915. Env. 2, 4, PAO.
28. See Turner's correspondence for the summer of 1915 in envelopes 2-4 and his 'Report regarding the activities of the BSIR 7 SSI from 1 May 1915.' Env. 12, PAO.
29. Turner correspondence, 11 June, 5 July, 11 Aug. 1915. Env. 3-5, PAO.
30. *Op. cit.*, note 24.
31. Board of Governors, 'Minutes,' 14 Dec. 1915. Env. 12, PAO.
32. Turner, 'Report to Board of Governors,' 28 Mar. 1916. Env. 12, PAO.
33. Vol. 46 (1915-16), 3-8, 170-176, 206-11.

34. PAC, Borden papers, vol. 109, 59893.
35. *Op. cit.*, note 28.
36. *Ibid.*
37. See Turner's entry in *American Men of Science*, 8th ed. and an obituary in *Publishers' Weekly* 161 (12 April 1952), 1641.
38. McLennan to Falconer, 3 Feb. 1916. UTA, Falconer papers, box 40a, file 'RCI.'
39. *Transactions of the Royal Canadian Institute* 11 (1915-17), 143-83.
40. *Ibid.*, 156.
41. Board of Governors, 'Minutes,' 8 Dec. 1916. Env. 12, PAO.
42. Board of Governors, 'Minutes,' 9 June 1916, 6 Feb. 1917. *Ibid.*
43. Honorary Advisory Council for Scientific and Industrial Research [hereinafter cited as HACSIR], 'Proceedings of the Organizing Meeting of the Advisory Research Council,' 4-6 Dec. 1916, Canada Institute of Scientific and Technical Information [hereinafter cited as CISTI].
44. HACSIR, 'Proceedings of the Four Sessions of the Second Meeting,' 5-6 Jan. 1917, CISTI.
45. 'Memorandum to the Honorary Advisory Council for Scientific and Industrial Research, Department of Trade and Commerce, Ottawa, from The Manufacturing, Scientific and Financial Organizations of Western Ontario,' exhibit B, HACSIR, 'Proceedings of the Eight Sessions of the Third Meeting,' 13-17 Feb. 1917. CISTI.
46. HACSIR, Committee on Local Libraries and Information Bureaus of Research, 'Interim Report,' exhibit K, 'Proceedings of the Eight Sessions of the Third Meeting,' 13-17 Feb. 1917. CISTI.
47. HACSIR, 'Proceedings of the Eight Sessions of the Third Meeting,' 13-17 Feb. 1917. CISTI.
48. Board of Governors, 'Minutes,' 25 April 1917. Env. 12, PAO.
49. H.H. Langton, *Sir John Cunningham McLennan: A Memoir* (Toronto, 1939), 45-51.
50. HACSIR, 'Proceedings of the Four Sessions of the Fourth Meeting,' 19-20 April 1917. CISTI.

51. National Research Council Clippings, Binder 1, June 1917. CISTI. J.C. Fields, 'Letter to the Editor,' *The Canadian Engineer* 40 (23 June 1921), 4. My thanks to Rod Millard for this latter reference.
52. Board of Governors, 'Minutes,' 7 June, 20 Dec. 1918. Env. 12, PAO.
53. Council of the RCI, 'Minutes,' 21 Jan. 1919. RCI Archive.