Sphagnum Moss in World War I: The Making of Surgical Dressings by Volunteers in Toronto, Canada, 1917-1918

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Abstract. In World War I, the shortage and cost of cotton and the unexpected need for an immense supply of surgical dressings made it necessary for Britain to experiment with a number of materials as a replacement. Though many previously used fibres and materials were tried, sphagnum moss, which had been judged beneficial in 1881 by G. Neuber, a German surgeon, and which had been adopted by the French War Department in 1895 as an absorbent dressing, became popular because of its availability, cheapness, and suitability. In 1918 Canada played an important part in the making and shipping of such dressings to Britain, Europe, and Siberia. Looking closely at the work done in Toronto, it was found that the availability of the moss was influenced by the Canadian climate, the making of the dressings was labor-intensive, and the cheapness of the product was dependent upon the volunteerism of women. For these reasons, in spite of the opinions of Drs. J. B. Porter and E. Archibald, both of McGill University, that sphagnum moss dressings had a future and would “take an important place in all hospitals,” the substance did not become a replacement for cotton. However, in the 1980s it has again been studied and is being used as a “new absorbent material” for surgical dressings by Johnson & Johnson, manufacturers of health care products.

Résumé. Pendant la Première Guerre Mondiale, le manque et le coût du coton et le besoin qui n’avait pas été anticipé d’une énorme quantité de pansements chirurgicaux obligèrent la Grande-Bretagne à expérimenter un certain nombre de matériaux de remplacement. Plusieurs fibres et matériaux qui avaient été utilisés auparavant furent essayés, mais la mousse sphagnum, qui avait été jugée bénéfique en 1881 par le Dr. G. Neuber, un chirurgien allemand, et qui avait été adoptée par le Département français de la Guerre en 1895 en tant que pansement absorbant, devint très populaire en raison du fait qu’elle était facilement disponible, qu’elle était économique, et qu’elle était très adaptée. Des recherches menées par l’auteur dans les archives montrent que le

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Canada a joué en 1918 un rôle important dans la fabrication de ce type de pansements et dans leur expédition en Grande-Bretagne, en Europe et en Sibérie. En examinant avec attention le travail fait à Toronto, le chercheur a trouvé que la facilité à se procurer la mousse était fonction du climat canadien, que la fabrication des pansements demandait un travail intense et que ce qui rendait le produit économique était le volontariat de femmes. Pour ces raisons, et en dépit des opinions des Drs. J. B. Porter et E. Archibald, tous deux de l'Université McGill, selon laquelle la mousse sphagnum avait un avenir et qu'elle prendrait une place importante dans les hôpitaux, cette substance ne remplaça pas le coton. Toutefois, elle a refait surface dans les années 1980 et elle est utilisée comme « nouveau matériau absorbant » pour les pansements chirurgicaux par Johnson & Johnson, fabricants de produits sanitaires.

In the 1980s we have come to expect that the manufacturing of a medical product is something newly developed for our generation, and when this advancement makes use of a natural material like moss we are even more pleased that the beneficence of nature has been discovered for mankind. Thus, the reader of the New Scientist on 31 January 1985 would find of interest, the announcement that the University of London's Institute of Orthopaedics and the Royal National Orthopaedic Hospital at Stanmore were in the process of "patenting a surgical dressing based on sphagnum moss." Almost one and a half years later, in Canada, on 26 August 1987, a similar statement was published. At that time Johnson & Johnson, manufacturers of health care products, announced that after twelve years of research they would, in partnership with St. Raymond Paper Co., make "a new absorbent material out of sphagnum moss."

But the use of sphagnum moss as a wound dressing has a much longer history; during the Great War it played an important part as a substitute for cotton gauze dressings. At the height of the war, on 30 January 1917, the Canadian Red Cross Society commissioned Jean I. Gunn (Superintendent of Nurses, Toronto General Hospital), John Bonsall Porter (Professor of Mining Engineering, McGill University) and Robert Boyd Thomson (Professor of Plant Morphology, University of Toronto) to determine the feasibility of making sphagnum moss surgical dressings on a large scale in Canada, for the British and Canadian military medical services.

This initiative was to draw together a wide variety of volunteers and organizations across Canada endeavoring to fill a vital need in the Allied war effort by an unorthodox, but not completely original, means. It was to be a task slow in realization, frequently frustrating, and ultimately of only limited success, exemplifying many of the difficulties that characterized the mobilization of volunteer effort in Canada during the First World War.
WHAT IS SPHAGNUM MOSS?

In the 1985 British application No. 2-134-792, the researchers claim that the moss "is known to help wounds heal, because its leaf and stalk cells can absorb up to 25 times their own weight of liquid." Furthermore, it is better than cotton because it "absorbs liquids about three times more quickly," "retains liquids much better," distributes the liquids more uniformly, is "cooler, softer and less irritating," and can be "produced more rapidly and cheaper."

This moss, sometimes called peat moss, grows around the world in bogs, along seacoasts, on moors, and in inland regions close to water. It owes its efficiency as an absorbent not only to the close overlapping of its leaves and the sponge-like matting of the pendent branches around the stem but also to the microscopic structure of these leaves. Unlike some mosses, the green, living cells of sphagnum are small, much elongated, and form an open network which runs throughout the leaf. In the meshes of this network occur the second kind of cells: colorless, dead, and empty. It is these that provide the capacity for absorption. The cell walls are punctured toward the outside by several minute pores which allow the liquid to be sucked in until the cells are filled. Every leaf contains hundreds of such absorbing cells, each one acting independently of the other. A second structure of the absorbing cells prevents them from collapsing, thus keeping the cell cavities open, whether the plant is alive or dead.

Of the forty species known to be native to North America only a few have been of surgical value. In the United States, during World War I, George Nichols, the Botanical Adviser on Sphagnum at Yale University, mentions four species, S. papillosum, S. palustre, S. imbricatum, and S. magellanicum as being satisfactory. Of these four, both the USA and England found Sphagnum papillosum to be the best for absorbency, softness, and strength. In 1985, the trials at Stanmore in England included both S. papillosum and S. palustre.

In Canada, the species of sphagnum found to be of greatest value during World War I were S. papillosum and S. plumosum var. flavicomas. Eventually, through trial and error the best Canadian material was secured from the central ponds of sphagnum swamps in coastal provinces such as British Columbia and Nova Scotia.

STANDARD WORLD WAR I WOUND DRESSING MATERIALS

By the beginning of the Great War the most popular dressing materials in the western world were absorbent and non-absorbent cotton and gauze. Prepared gauze had become commercially available as early as 1885 when Robert Wood Johnson, an American, hearing Joseph Lister...
speak in 1876 on airborne germs, developed with his brothers a method of making safer surgical dressings of "soft, absorbent cotton-and-gauze." 

Soon after war began, it became apparent to surgeons that the need for surgical dressings would be immense. This was pointed out to the Medical Society of London on 16 November 1914 by Sir W. Watson Cheyne, President of the Royal College of Surgeons of England, when he spoke of the "great prevalence of sepsis" being observed in the treatment of the wounded. Two years later, in 1916, Alex. Ogston estimated that the average minimum number of dressings per man which would be required would be at the very least, thirty. He reckoned that 45,000,000 to 100,000,000 dressings would have to be provided within a six-month period.

This need for millions of dressings would require a great number of workers. In Britain, Sir Edward Ward, the Director-General of Voluntary Organizations, was charged with fusing volunteer agencies such as the British Red Cross into "a complete and gigantic supplementary National Organization for Aid to the Sick and Wounded." In Canada this responsibility fell to the Canadian Red Cross Society.

THE MAKING OF STANDARD DRESSINGS IN WORLD WAR I

There is scant information about the people who made surgical dressings before the development of modern nursing at the turn of the century. But the nursing texts and journal articles of the 1910s make clear that the task was then the job of the student nurse, either as a probationer or in her first year of training. It was seen as a benefit for the student and the hospital; for the student it was a means to learn "exactitude," "economy," and the "requirements for surgical work"; for the hospital it provided a "larger saving" than if the maids or laundry people were paid to make them.

It is obvious that the student nurses could not make a sufficient number of surgical dressings for both their own hospitals and the Canadian military services. A Canadian Red Cross Society subcommittee, at first formed of military men because, presumably, they would know the quantities and details of the supplies needed, was soon headed by a woman, Adelaide Plumptre. Plumptre was a member of the Women's Patriotic League, an association of leading Toronto women created on 18 August 1914 "to prepare for any service that women could do." Both the League and Plumptre had pressured the Red Cross to involve women in the making and supervision of supplies for overseas. With her appointment on 23 September 1914 as Superintendent of Supplies for the Canadian Red Cross Society, Plumptre became, for the duration of the war, the coordinator for all surgical supplies made for and by that organization.
The Toronto organization of women that finally became involved in the making of sphagnum dressings, the University Women's Club, first volunteered in February, 1915, to help the Red Cross with the making of cotton-gauze surgical dressings.\textsuperscript{27} But later, with the formation of the No. 4 General Hospital (University of Toronto), the University Women's Club turned its efforts towards the supplying of items for and working closely with the University Hospital Supply Association,\textsuperscript{28} a group of women associated with the University of Toronto and under the aegis of Lady Falconer (the wife of R. A. Falconer, President of the University).\textsuperscript{29}

During 1915 and 1916, the women volunteers, in Toronto and Ontario, supplied many surgical dressings to the military establishment; the annual report of the Canadian Red Cross Society for 1916 shows that Ontario provided 1,042,332 dressings, 1,953,982 compresses, 962,206 pads, 1,901,023 wipes, and 699,635 sponges.\textsuperscript{30} Meanwhile the University Women's Club had begun to develop an interest in the making of sphagnum dressings. In 1918, these women would be joined by Lady Falconer's group of women in this enterprise.\textsuperscript{31}

THE MAKING OF SPHAGNUM DRESSINGS IN TORONTO

Sphagnum moss became an important replacement for dressing material as the amount and cost of cotton escalated and it became increasingly difficult to obtain. The \textit{Lancet}, on 11 December 1915, notes that the large number of war wounds requiring dressing at the present time threatened to exhaust the available supply of the usual materials.\textsuperscript{32} Bryan Williams suggests in a recent article that the shortage was also because cellulose, the raw material for conventional dressings, was needed for the manufacture of munitions.\textsuperscript{33}

Sphagnum moss as a surgical dressing material had been known for many years by warriors in Scotland and Ireland and by "country folk" as treatment for boils and suppurating wounds. J. W. Hotson, of the University of Washington, pointed out in 1918 that Dr. Walton Haydon, of Marshfield, Oregon, had used sphagnum as a dressing while in service with the Hudson Bay Company at Moose Factory during the years 1878-1884.\textsuperscript{34} But its use in scientific surgery is credited to Dr. G. Neuber, a privatdocent in surgery at Kiel.\textsuperscript{35} In an 1881 article he describes his experience with a turf worker who had fractured his forearm eight to ten days before being seen by Neuber. The patient's workmate had, at the time of the accident, dressed the injury with moss and when Neuber removed the material from the arm he found that it had healed well.\textsuperscript{36} Neuber's experience was endorsed by Dr. Hagedorn of Magdeburg who recommended that the moss be used "as a cheap, very absorbent, elastic and conveniently applied dressing for wounds."\textsuperscript{37} French surgeons were also interested, and in
1885 Josèph Anselme made sphagnum surgical dressings the focus of his thesis for the degree of Doctor of Medicine at Montpellier. He concluded that the substance as used at St.-Eloi Hospital “a rendu de reeis services.”38 Four years later, the French War Department had “adopted peat-moss as the best cheap absorbent dressing.”39

At least two patents incorporating sphagnum into surgical dressings were obtained before World War I. In 1899, V. Francken and J. Pirnay of Liege, Belgium, procured Patent No. 401,547 from the United States. They argued for a patent that would make the use of peat as a dressing more convenient.40 The other patent, taken out in Germany in 1907 by Richter & Co., of Brux, Bohemia, used the moss as a replacement for the traditional cotton.41

Despite these patents and the experiences of surgeons, sphagnum moss never became a standard material for surgical dressings until 1915 when it reappeared as a possible replacement; both German and British surgeons looked to it as a substitute for cotton.42 That Germany used the moss during the Great War is suggested by Lacey Amy, Special Correspondent to The Toronto Daily Star, in her article of 9 September 1918, when she reported that the German hospitals at Arras had dressings of “the fibre that has taken the place of cotton and linen in sandbags.”43

The development of sphagnum dressings in Britain began under the aegis of Charles Cathcart, surgeon at the Royal Infirmary in Edinburgh, and quickly spread to Ireland and England. There the demand for such dressings on the women’s division of the Irish Royal College of Science, a detachment of the St. John Ambulance Brigade, made it necessary to look elsewhere for assistance. Within a seven-month period from November 1915 to May 1916, these women had made 58,957 simple dressings and 325 dysentery pads for eighty different hospitals in England, Ireland, France, Belgium, Egypt, and Greece.44 In February 1916 the Director-General of the British Medical Service placed sphagnum moss on the list of materials approved by the War Office as official surgical dressings.45

Canada’s involvement began informally when Professor John Porter, studying peat for the Canadian government as a fuel resource, learned from friends in Britain of the work being done on sphagnum dressings. He was able to obtain specimens of “surgical” moss and began to search out different Canadian bogs. With the assistance of the Guysborough Red Cross in Nova Scotia he had a large number of dressings made to War Office specifications and sent them over for testing in actual service. This work he did as a private citizen, interested in contributing to the war effort, but upon his return to Montreal from his summer home in Nova Scotia, he turned the matter over to the Quebec Provincial Red Cross.46 On 13 February 1917 Plumptre reported to the Canadian Red Cross Society executive that
Surgeon General Carleton Jones of the Canadian Army Medical Corps had asked Porter to supply the Corps with one ton per month of sphagnum moss dressings which, according to Porter's calculation, meant 27,000 dressings.47

Throughout the period when Canada was involved in sphagnum dressings only four centres actually made them: Montreal, Toronto, Halifax, and St. John.48 The McGill Women's Union, of which Porter's wife was President, was one of the first to organize. Its members had heard Porter speak on 24 October 1916 and at that meeting resolved to take up the work of preparing sphagnum dressings for the Red Cross.49 The following month, the University Women's Club in Toronto heard Dr. Maude Abbott from McGill talk about Porter's work.50 They too became interested and asked Thomson about the availability of such moss in Canada, and he offered to explore the Toronto Region and, later, further afield for suitable material. Gunn, who had assisted the University women's group in making regular cotton-gauze dressings, offered to test any sample dressings at the Toronto General Hospital.51

Meanwhile, W. R. Miller of the Quebec Red Cross continued to raise the question of sphagnum dressings at the national Red Cross meetings and finally, on 30 January 1917, the Red Cross formed a sub-committee of Porter, Gunn, and Thomson to look at the feasibility of moss dressings as a Red Cross undertaking.52 With the request of the Canadian Army Medical Corps for dressings, the sub-committee recommended a special committee be appointed to deal with the matter.53 This committee, according to a 1918 letterhead, included Miller as Chairman, Porter as Technical Adviser, Gunn, Thomson, Plumptre, Major Edward Archibald, a surgeon at McGill University, and S. M. Bainbridge of Montreal, as Honorary Secretary. Because Porter had established communications with the British authorities, the Executive decided that the committee headquarters would be in Montreal.54

To survey for the moss and experiment with making it into surgical dressings took another year and a half. Delays were encountered because of the Canadian climate and the lack of shipping and persons to collect the moss and make the dressings. Moss collecting, at first for testing and later for supplies, could only be done in the spring, summer, and autumn. As Thomson wrote in his letter to C. F. Newcombe of British Columbia, Ontario could "get none or but very little here till the spring opens".55 later in March 1918 the supply from Prince Rupert, British Columbia, was delayed because it was "impossible to obtain [a] carload... on account [of] winter conditions."56 It was only with great difficulty that the Red Cross Society was able to procure some room for shipping "first-grade material"57 on boats whose space primarily was needed for munitions and food supplies.58
The search for high quality, easily accessible moss continued throughout 1917 and 1918 under the supervision of Thomson. By 5 February 1918 he had heard from science masters, teachers, professors, students, government employees, and experts, and numerous civilians of all ages, both male and female. For example, a 12-year-old from Algonquin Park, Ontario, was instructed to send

a sack of moss... by October 15—as much as a coal or sugar bag will hold. Perhaps, if the marsh is not far from your home you could make several trips and after each trip pick over the moss when it is damp to clean it of tree needles, etc.; it will not break so easily when damp as if handled dry. Spread out to dry, then put aside the good moss and discard the “leggy” variety (too much stem).

In all cases the Red Cross undertook to pay for the freighting of supplies; in turn this service was actually provided to the Red Cross without cost by the Canadian railroad and express companies.

During this time the testing of sphagnum dressings, made by the members of the University Women’s Club, was being done in the surgical service and Emergency Department of the Toronto General Hospital under the supervision of Gunn. Helen Locke, Gunn’s assistant, reported on 7 July 1917 the results of one experiment. Three samples had been tested “on one of the heaviest surgical services.” Of these, Sample A (the fine-leaved moss from British Columbia) absorbed “water readily but not as much as the absorbent cotton”; Sample B (an Ontario moss minus the stems) did “practically the same as ‘A’”; and Sample C (also moss from Ontario) did “not absorb well.” None absorbed pus, for when the dressing was removed the pus was “lying on top of the wound.” Eventually, by 11 June 1917, the committee had selected the best species of sphagnum wanted for surgical dressings, *Sphagnum papillosum*.

In Canada the moss that was being used in dressings as a replacement for absorbent cotton was not put up in bags as in the manner of the British makers of moss dressings. Exact specifications for the folding of dressings and the amount of sphagnum to be used had been developed by Porter and Gunn by 13 June 1918. Three sizes of dressings were to be made, 6 inches square, 8×10 inches, and 10×12 inches. To ensure accuracy in the making of dressings, workers were given specific measurements and directions as to their manufacture. Sphagnum wooden forms, zorbic tissue sheets (a filter paper which had been used in gas masks and was supplied by the American government in exchange for Canadian moss), and gauze were prepared to a specific size. The finished dressings were then made into packages of ten, tied, and stored until ready “to bale” into compressed packages for shipping.
Though the University Women’s Club had participated from the start in the making of test dressings it was not until 21 May 1918 that Elsie Keith, convenor of the Hospital Supplies Committee, could report that they had been invited to go ahead with the making of sphagnum dressings. Gertrude Wright of the Botany Department had notified her that a large supply of moss was on hand and that work had to begin immediately. The Ontario sub-committee was also awaiting the imminent arrival of a carload of moss from Prince Rupert, British Columbia. Because of the demand for sphagnum, twenty tons by the United States and two tons by Canada, the sub-committee had sent a request to J. P. Roenig in Prince Rupert on 27 February 1918 for the moss that he had offered on 14 March 1917. The carload finally arrived in Toronto the week of 18 August 1918. The history of its collection had been one of frustration. On 17 July 1918 Judge F. McB. Young, President of the Prince Rupert Red Cross had wired:

We made a good start at Port Simpson but our pickers... were apparently unequal to the task.... For these reasons principally we had to abandon our efforts at that place. We then explored the country in and around Prince Rupert and we located moss which we think is just as good if not better.... In picking this moss here we had to rely on the voluntary efforts of the citizens.... Unfortunately we have been delayed here by inclement weather.... However, I am pleased to report that yesterday we finished the work of collecting the moss in sufficient quantities to make a carload.

The moss “arrived in splendid condition,” still “slightly moist but sweet smelling and not the slightest sign of mould.” Gunn inspected the moss on 27 August and approved it for use.

The delay in receiving the carload was both beneficial and detrimental to the work. On the one hand, if the carload of moss had arrived in early summer, the making of dressings would have been hampered by lack of volunteers. The university women had difficulty in attracting members during the summer vacation and the Exhibition time. Requests in the newspapers had to be made throughout the summer and autumn for volunteers, a condition Mills reported to Thomson on 27 August; “we have everything on hand but the workers.” Thomson had estimated that an inexperienced woman could make five dressings in one hour, and an experienced woman as many as ten. Grace Lillian McGregor of the University Women’s Club wanted 100 women to work each day to make the 10,000 dressings within the three-week period but was only able to obtain after the July 3rd appeal “enough response for... one afternoon a week”; and after the October 3rd request, only had 40 present in the morning. On the other hand, if it had arrived early in the season, the sub-committee would have accepted a second shipment from the West which had been delayed while they waited to evaluate the condition of the Prince Rupert moss on arrival in Toronto.
Preparations had been made at the University of Toronto by Gunn and Mills for the volunteers of the University Women’s Club to share Room 26 of the Physics Building with the University Hospital Supply Association. The equipment and materials had been moved there from the Toronto General Hospital and the Forestry Building by August 3rd. On 10 September the University Women’s Club women met in Room 26 to organize their work. They planned to work Tuesdays and Thursdays because the University Hospital Supply Association used the same room on Mondays, Wednesdays, and Fridays. Tea would be served at the price of 10 cents each, and each day would have a convener, inspector, packer, secretary, and tea hostess. Enclosed with the minutes of that meeting were the instructions for sorting the moss into four grades: (1) moss consisting of branches that were thickly covered with small branches and leaves, (2) moss with branches not as thickly covered, (3) dust and small ends of branches that had been broken off, and (4) waste which was to be discarded. Though samples of graded moss could be sent to organizations participating in the sorting and picking of the sphagnum it was expected that all dressings would be made in Room 26 of the Physics building.

The demand for more dressings increased and both women’s groups realized that more time had to be available for the making of the dressings. By 7 October work had been extended to Thursday evening and Saturday afternoons. The pressure to meet the needed quota of dressings was increased by the influenza epidemic of 1918, a calamity which officially arrived in Toronto on 3 October 1918. The committee moved that work should continue but that workers would not be urged to come nor would tea be available, and that an appeal should be made to President Falconer not to close the work-rooms with the rest of the university on 18 October because of the Red Cross’s urgent call for the completion of sphagnum dressings. The women asked that the Physics building be kept open from 10 a.m. to 5 p.m. on Tuesdays, Wednesdays, and Thursdays, and Thursday evenings from 7:30 to 10 o’clock until the University reopened. During the flu epidemic the maximum number of volunteers fell from one-hundred workers a day to twenty or thirty and they worked in groups of eight so that dressings were made and moss picked in small quantities until 5 November. By 28 October the Red Cross had shipped 21,867 sphagnum dressings, prepared by Montreal and Toronto women, to Vancouver; these were destined, at the request of the Canadian Army Medical Corps, for use in Siberia. With the completion of that order all future shipments were to be directed “to Montreal for use in England and France.”

The work continued into November but with increasing difficulty in obtaining volunteers to make the dressings and with the knowledge that winter weather would halt the collection of moss across Canada.
When the armistice was signed on 11 November it became evident to all concerned that the making of sphagnum dressings was nearing an end, but by that time the British were making over a million pads a month; the Canadian Red Cross was working on an order of 20,000,000 dressings, and turning out between 200,000 and 300,000 a month; while the American Red Cross, having completed an order for half a million, had just started another allotment of one million.

The interest of academics in the enterprise as an undertaking of volunteers was waning; J. W. Hotson, a professor of mycology at the University of Washington and a leading American authority on the subject wrote Thomson on 5 February 1919 that:

The fact that the war seems to be over is beginning to make us take on a different aspect regarding what is most advantageous to do. . . . What plans I have made for work on the line of Sphagnum will probably stop now as soon as I can wind them up and get at something else. I do think, though, there is a good future for surgical dressings made from Sphagnum, if one had the time and financial backing to work it out in a commercial way.

The expectation for the continued use of sphagnum as a replacement for cotton was expressed by others. Porter in 1917 expressed the opinion that "there is every reason to believe that sphagnum will in the future prove to be of decided value in ordinary surgical work"; and his colleague at McGill, Dr. Edward Archibald, thought cotton-wool "would eventually go out" and sphagnum, after the war, would "take an important place in all hospitals."

There was, however, no interest at the time and Thomson in November 1919 sold the remaining 62 bales of sphagnum for $31.00 to Mr. T. W. Duggan, florist, of the Dale Estate in Brampton, Ontario. The Hospital Supplies Committee of the University Women's Club ceased on 4 March 1919. Finally, the Ontario Sub-Committee on Sphagnum Moss Dressings submitted to the Red Cross its sphagnum moss account on 30 September 1920 which showed expenditures of $272.81 and a return of $142.25 to the Red Cross Society. Nevertheless, sphagnum did merit a passing comment in the 1921 edition of Dr. W. W. Keen's book on the principles and practice of surgery; there Horace Stephen notes that sphagnum might be used on board fighting ships because it is "an improvement on cotton-wool, provided it is carefully prepared" for it was "a better absorbent" and "less expensive."

CONCLUSION

Sphagnum had been used before World War I but for reasons not known it disappeared as a wound dressing. It is apparent that in the 1880s it was recommended by German surgeons; it had been the
essential substance in a 1889 United States patent; the French War Department in 1895 had made it an official dressing; and in 1907 it was included in a German patent for homogeneous dressings. Nevertheless, its benefits were eclipsed by the commercial development of cotton gauze dressings.

The unexpected numbers of military wounded and the propensity for the injuries to become septic and suppurating during the Great War made it imperative to find sufficient quantities of a material that had increased absorbency, and at less cost than cotton. Sphagnum moss met these requirements.

The relative cheapness of sphagnum, it can be argued, was due to the fact that collecting, picking, and sorting the moss, and the making of the dressings was done by volunteer labor. Though there are no statistics as to the number of people involved it is possible to estimate the number of women-hours necessary to make 200,000-300,000 dressings a month: at the rate of ten per hour, to complete the Red Cross order for 20,000,000 would require 2,000,000 hours; at four hours per day of work per woman, it would require 500,000 women.

The difficulty in obtaining sufficient numbers of women volunteers despite the patriotic fervor present in World War I is evident in the numerous appeals made by the University Women's Club to the public to help with the carload of moss from Prince Rupert. The lack of volunteers to collect and pick the moss, once suitable locations were found, is also apparent in the problems faced by the Prince Rupert Red Cross. Though the process was economically cheap, the emphasis on volunteer labor, in a labor-intensive task, was detrimental to the enterprise and was probably very much responsible for it coming to an end after armistice was declared.

NOTES

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63 University of Toronto Archives, R. B. Thomson papers, Box 67-0004, Letter to Gertrude Wright, Botanical Laboratories, University of Toronto from Helen G. R. Locke, Assistant Superintendent of Nurses, Toronto General Hospital, 7 July 1917.
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64 University of Toronto Archives, R. B. Thomson papers, Box 67-0004, Letter to T. J. Ivey, Toronto, Ontario from Edith W. Mills, Corresponding Secretary, Ontario Section, Sub-Committee on Sphagnum Dressings, 7 July 1917; and Charles W. Cathcart, "Methods of Preparing Sphagnum Moss as a Surgical Dressing," *Lancet*, 190 (1916): 820-22.

65 University of Toronto Archives, R. B. Thomson papers, Box 67-0004, Letter to Jean Gunn [from Dr. Porter?] 13 June 1918; and Letter to Jean Gunn, 13 June 1918 [from R. B. Thomson?].


67 University Women's Club, Minutes of Hospital Supplies Committee, 21 May 1918.

68 University of Toronto Archives, R. B. Thomson papers, Box 67-0004, Letter to J. Roenig, 27 February 1918.

69 University of Toronto Archives, R. B. Thomson papers, Box 67-0004, Letter to R. B. Thomson from Judge F. McB. Young, President, Prince Rupert Red Cross, 17 July 1918.

70 University of Toronto Archives, R. B. Thomson papers, Box 67-0004, Letter to Judge F. McB. Young from E. W. Mills, Honorary Secretary, Ontario Sub-Committee, 27 August 1918.

71 University of Toronto Archives, R. B. Thomson papers, Box 67-0004, Letter to R. B. Thomson, 27 August 1918.

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78 "Need Sphagnum Moss: 10,000 Dressings are Urgently Required—Women Learn the Work," *Toronto Daily Star*, 3 October 1918, p. 19.

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81 University of Toronto Archives, R. B. Thomson papers, Box 67-0004, Letter to Mrs. Grace Lillian (J. P.) McGregor, President, University Women's Club, 3 August 1918.

82 University Women's Club, Minutes of Hospital Supplies Committee, 10 September 1918.

83 University Women's Club, Minutes of Hospital Supplies Committee, 10 September 1918, "Instructions for Sorting Moss."

84 University Women's Club, Minutes of Hospital Supplies Committee, 7 October 1918.

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Plate 1
Women preparing sphagnum moss at the University of Toronto during World War I.
(Photograph courtesy of City of Toronto Archives, James 873A.)