

A. H. R. BULLER: PIONEER LEADER IN PLANT PATHOLOGY

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The illustrious mycologist and widely recognized leader in the developmental stage of plant pathology, Arthur Henry Reginald Buller, was born in Birmingham, England, on August 14, 1874, and died of a brain tumor in Winnipeg, Canada, on July 3, 1944.

After obtaining a B.Sc. degree from the University of London, Buller studied for a Ph.D. in Germany under plant physiologist Wilhelm Pfeffer at Leipzig and forest pathologist Robert Hartig at Munich. In 1901, following a period of research at the International Marine Biological Station at Naples, Buller returned to Birmingham to become a lecturer and demonstrator in botany at the University of Birmingham. At first he taught geology as well as botany, but his major interest lay in the mycological-phytopathological aspects of botany. This became evident in 1903 when he offered a series of 20 weekly lectures, with laboratory exercises, on plant diseases. The prospectus for that remarkably comprehensive course, the second one on plant pathology to be offered in a British university, has been published by Ainsworth (1). Perhaps because of the success of that course, Buller was appointed special lecturer in plant pathology in 1904. However, he did not keep that appointment, because he accepted an invitation to become the first professor of botany at the University of Manitoba in Winnipeg, Canada. In later years, when he had become a well-known mycologist, Buller jokingly commented that he was attracted to that position by an advertisement that referred to Winnipeg as a "mushrooming city."

Buller's investigations, as he called them, for the first five years following his appointment in Manitoba were published in 1909 in a book that the publisher persuaded him to title *Researches on Fungi*. It was to become the



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first of seven volumes under that title. Buller tended to be verbose, and more than one potential publisher suggested that he reduce the text by at least one third. This he vehemently refused to do, and, consequently, he had to bear most of the publication costs. He was able to do this because he had financial resources beyond his university salary.

When Buller arrived in Manitoba in 1904, there were no plant pathologists in Canada, and no major plant diseases in the wheat-growing regions of the province. Nevertheless, he included plant pathology in his teaching and in examinations asked his students such questions as, "Give a careful account of the Rust Disease of Wheat. In what important particular is it not as yet fully understood?"(4). Rust had caused considerable damage in 1896, but it was not again a serious problem on the Canadian prairies until 1916, when the worst outbreak of stem rust that had ever been known there almost completely destroyed the wheat in vast areas.

From that year until the onset of his fatal illness Buller was actively concerned with some aspect of the rust problem. In January 1917, he spent five days at the University of Minnesota to learn more about the rust research that was being carried on by Dr. E. C. Stakman. Buller was so favorably impressed that he urged the Canadian government to hire Stakman to take charge of rust investigation for the whole country. This he did in a *Memorandum on the Rust Disease of Wheat*, dated June 1, 1917. That *Memorandum* included a list of reasons for making Winnipeg the center for research on wheat diseases. It was partly, if not wholly, responsible for the convening of what later came to be known as the First Cereal Rust Conference (14). Buller was an official delegate and a vocal participant in that conference. During its second session he expressed the prophetic view that "immunity to rust was a Mendelian character and as such could be handled by a skillful plant breeder" (unpublished minutes).

Because Canada was at war and rust was not a severe disease for the next few years, the plans envisioned in Buller's *Memorandum* and those proposed by the Rust Conference were not immediately implemented. In the meantime, Buller took a very active part in a campaign to eradicate the barberry shrub from the grain-growing areas of western Canada and became so interested in the history of the development of high-quality wheat that he wrote a book on that topic, and published it at his own expense (6). In the preface of the book, Buller proudly referred to himself as a Canadian citizen, even though it is unlikely that he ever went through the formalities of becoming one. In those days, Canadians were British subjects, and people born in the British Isles who made their homes in Canada didn't concern themselves about citizenship.

When the Rust Research Laboratory of the Dominion of Canada Department of Agriculture was built in 1926, more or less where Buller wanted it, on the campus of the University of Manitoba, his interest in the rust fungi was enlivened again.

During a meeting of the Permanent Committee on Rust Investigations for Canada on January 26, 1925, Buller proposed that dusting should be tried for the control of rust, and the Committee agreed with him (unpublished minutes). As a consequence of this, it was soon demonstrated that sulfur dust could control both the leaf and stem rusts of wheat (3).

Buller had long been interested in the sexuality of fungi, and in a lecture on "Sex and Social Organization in the Hymenomycetes," he outlined a method for demonstrating heterothallism in rust fungi that involved the inoculation of host leaves with basidiospores (8). It is now well known that J. H. Craigie, who later obtained a Ph.D. from the University of Manitoba for research done under the nominal supervision of Buller, used an adaptation of this method to demonstrate heterothallism in *Puccinia helianthi* (9). Although this was an

important step toward a clarification of the sex life of rust fungi, the true role of the pycnia remained uncertain until after Buller suggested to Craigie that he copy the action of a fly that had been visiting one nectar-exuding rust pustule after another on barberry leaves in the greenhouse (8). When Craigie mixed the nectar of a number of pustules, as the fly was presumed to have done, he soon learned the function of the pycnia (10). Thus, Buller played a significant if not crucial role in that historic discovery. For the rest of his life he was somewhat distressed by the lack of recognition he received while honors and awards were heaped on Craigie. Buller believed that ideas and suggestions were as valuable to the progress of a science as the technical work that proved their validity.

In his personal life and in his relations with others, Buller epitomized the popular concept of an English gentleman. Slightly aloof and reserved, he held the respect of virtually everyone who knew him and the admiration, almost to the point of idolatry, of the vast majority of his students. He had a way with young people and took pleasure in entertaining the children of friends who invited him to their homes with sleight-of-hand tricks and puzzles. Although he was an eccentric, cigar-smoking bachelor and never known to have a special girlfriend, Buller did not shun the company of women, several of whom he deliberately chose to serve as technicians, assistants, or research associates in his department. It was not unusual for him to invite one of these women to dine with him in a local hotel, and he often had a female companion when attending a theatrical production in Winnipeg. However, his relationship with the female members of his staff was, to use his expression, "always appropriately distant." Miss Kirk Scott, who was Buller's assistant for about eight years, recalls the time his hand inadvertently touched her bare arm when they were working together in the darkroom, and of how embarrassed and apologetic he was. For years he addressed her as Miss Scott, but after she married Thomas Wright, he called her Mrs. Kirk (K. Wright, personal communication). Buller always addressed students and laboratory or office workers as Miss, Mrs., or Mr. He never used their given names alone. To others he was almost invariably "Professor Buller" or simply "The Professor." In jest, and behind his back, he was occasionally referred to as "Uncle Reggie."

Dr. Dorothy Swales remembers the times she dined with Buller, and the Sunday he accompanied her to church. It was Easter, and the minister, in commenting on a miraculous transformation, made some remark about a rather ugly lily bulb being transformed into a beautiful flower. After the service, Buller remarked to her that any good botanist could see the beauty that was inherent in the bulb as well as the flower (D. Swales, personal communication). Buller's library contained no fewer than eight Bibles (16), but little is known of his religious views. When he occasionally went to

church it was to hear the music, which he loved, rather than the sermon or the accompanying religious exercises.

Buller was a member of the local Natural History Society and the Canadian Club and accepted invitations to address both at various times. Although he usually declined the requests of local organizations to be on their executive committees, he enthusiastically accepted similar invitations from national and international societies. He was elected to the presidency of the British Mycological Society (1913), the Canadian Division of the American Phytopathological Society (1919–1920), the Botanical Society of America (1928), and the Royal Society of Canada (1927–1928). Buller was justifiably proud of being elected to those high offices, but what pleased him most in this regard was being elected President (1928–1929) of the Moseley and Balsall Health Institute, an organization that his father had helped to establish back in Birmingham.

Former students are generous in their praise of Buller's classroom lectures. They remember how he would bound into the room, as if impatient to begin, and remain in almost constant motion throughout the lecture, seldom pausing to glance at his notes. He had the rare ability to infect students with his own boyish enthusiasm and to keep them spellbound throughout the lecture period. After writing on the blackboard he would thrust the chalk at some key word or phrase and then heavily underline it for additional emphasis. At least once a year, when he knew he had the full attention of the class, he would "accidentally" break a piece of chalk while writing and quickly catch the broken piece in midair. Then, with a look of accomplishment on his face, he would declare that such agility in a man of his age was a direct result of his participation in sports when he was a student in England. Thus, he set the stage for a talk on the merits of student participation in local sporting events.

Buller's lectures were memorable because he was such a good showman. He put action and visual displays in all of them. He claimed that a good teacher should make his lectures so simple and straightforward that they could easily be translated into another language. This code of language simplicity is as evident in his published papers as it was in his lectures. He was a stickler for "proper" language and very critical of the American version of English. In this connection he would say, "Open a book written by an American to any page, and I can show you an example of incorrect or imprecise use of the English language" (D. Swales, personal communication).

Buller's laboratory projects for students were as meticulously organized as his lectures, and he made use of fresh, living material whenever possible. He deplored the use of "pickled" specimens and would cut fresh sections by hand with a straight razor rather than use wax-embedded prepared slides. In the laboratory, he would stand at the front to oversee the demonstrators and to ensure that each student got adequate help. He was strict with his demon-

strators and would criticize them severely for any error or carelessness. Largely because of this, he was not well liked by some of them even though he was generous in his praise of good work. During recess periods, he would engage the demonstrators in conversation about some aspect of botany or plant disease, and they would sometimes wager that none of them could get him to talk for longer than two minutes on any other topic. If one of them made the mistake of chewing gum in his presence he or she would surely regret it, because Buller was devastating when he humiliated one student in front of others; consequently it rarely happened.

Field trips to various places and at least one day of mushroom collecting were an integral part of Buller's teaching program. On many of those autumn forays he wore a moth-eaten raccoon coat with patches of leather showing through the thin fur. Except when wearing that coat, Buller was neatly but rather uniquely dressed. He always wore a dark suit, with a six-button waistcoat under a four-button jacket, made especially for him by a tailor in England. He never wore a white laboratory coat.

Buller's popularity as a public lecturer increased over the years, and he was frequently chosen to give lectures in Canada, the United States, and Britain. From the moment he withdrew his lecture notes with a flourish from a special pocket in his jacket to the little nod or bow that signalled his concluding remark, there was seldom a dull moment. When radios and public-address systems were first introduced they had stationary microphones, and Buller found it virtually impossible to stand in front of one. Within minutes he would be gesticulating and walking away from it. In commenting on this aspect of Buller's lecture performance, Newton wrote that he would have been a star performer on television (R. Newton, unpublished memoirs).

Buller always included some original humor in his lectures, and it was often aimed at himself, as when he remarked that the rate of illegitimacy in Germany increased by two percent while he was a student there. When the audience laughed he feigned a shocked expression and said, "Surely you didn't think I was responsible for any of that" (J. Coulson, personal communication). Sometimes his humor was in verse form, because one of his leisure activities was composing rhymes and limericks. His best known limerick, *Relativity*, first published anonymously in the December 19, 1923, issue of the British humor magazine, *Punch*, now appears in each edition of *Bartlett's Familiar Quotations*.

At times Buller was almost fanatically devoted to his research. When a potentially fruitful thought came to his mind he would explore it relentlessly for hours or right through the night without stopping to eat or sleep. Being free of domestic ties, and always living in a hotel, he could miss meals or a night's sleep without inconveniencing anyone. When satisfied that a task had been completed, he would find relaxation at the keyboard of a piano, in a game of billiards, by reading a good novel, or going on a long walk. In

writing his own biographical sketch for *Who's Who in Canada* (12), he listed his recreations as billiards and crossing the Atlantic, which he did 65 times. Buller didn't like to ride a bicycle, never owned an automobile and didn't waste time learning to drive one. If he couldn't walk to where he wanted to go because of time or distance, he travelled by streetcar or taxi.

In his research and in the expression of his ideas, Buller coined new terms and made a number of discoveries or paved the way for others to do so. He discovered nuclear migration through septal pores (13) and in describing its occurrence in a Basidiomycete became the first to draw attention to the "hemispherical or discoid pad of material" (7) that is now known to be part of the dolipore type of septum. He was the first to demonstrate wound healing in the hypha of a fungus (11), and he made such comprehensive studies of hyphal fusions that the dikaryotization (a term that he coined) of a monokaryon by a dikaryon became known as the "Buller phenomenon" (13). Because he was one of the first to critically examine and describe the discharge of basidiospores, the associated drop of fluid became known as "Buller's drop" (2).

Even though most of Buller's published works are more than 50 years old, many of them seem surprisingly fresh, and they continue to be quoted. The second edition of *Fundamentals of the Fungi*, published in 1982, has 19 references to his work and 10 reproductions of his figures (15).

Perhaps it was because Buller took pride in being scientifically exact that he sometimes mistrusted the accuracy of others, especially professional reporters. The following account of one reporter's experience provides an insight into this aspect of his character:

he does not trust the accuracy of newspaper men. He lectures them. . . . Pacing up and down, he composes his own interviews in the third person. An interview with him, verbatim, runs like this: "You may take this" (slowly with emphasis). "Dr. Buller's chair was a double one—botany and geology—g-e-o-l-o-g-y" (spelling it out). "Have you got that?" (a pause). "That continued for five years. R. C. Wallace—comma—relieved him of geology—full stop. It was Dr. Buller who selected Mr. Wallace—well we'd better say—cross out that sentence—was entrusted by the University Council to select a lecturer and his choice fell upon Mr. R. C. Wallace." Dr. Buller interrupts his dictating—"In fact," he says lightly, looking up, "that was one of the best things I ever did, you know" (17).

Such mistrust was not directed at Buller's colleagues and research associates. He encouraged consultation and progress reports, but once a project was carefully outlined, and certain procedures agreed upon, the researcher was left to get the job done (R. MacRae, personal communication). On the other hand, graduate students doing research under Buller's supervision could expect an almost daily visit from him, and the inevitable question, "Well, Mr. . . . what have you learned today?" That was his way of maintaining close contact with each student and of monitoring the progress of each research project while at the same time providing an opportunity for consultation,

assistance, or encouragement as the situation demanded. Buller believed that one of the best ways to develop or stimulate the research interests of students was to involve them in research projects and to have research going on around them. He used to tell them that they would learn more and retain it longer if their studies were accompanied by active participation in research.

From the time he wrote an article for the *Manitoba Free Press* in 1906 expressing his views about the eventual location of the University of Manitoba (5) until some time after the "site question" was settled in the 1930s, Buller was at odds with one or more of the University authorities. When one officious member of the administrative staff complained, during a meeting of the Faculty Council, that Buller had thrown him out of his office, Buller immediately responded by saying, "Mr. President, what the gentleman says is perfectly true. My one regret is that I was just getting over the flu and was not feeling very strong, otherwise I should have thrown him twice as fast and twice as far" (R. Newton, unpublished memoirs).

Buller was very disappointed when it was decided to construct new quarters for his department on a site he had opposed, and insult was added to injury, in his view, when a proposed elevator to his department on the third and fourth floors was cut from the plans, and greenhouse construction was postponed. The prospect of having to climb three or four flights of stairs several times a day was a major factor in Buller's decision to retire in 1936 and devote more time to research and the writing of additional volumes to his monumental *Researches on Fungi*.

The University of Manitoba had honored Buller by awarding him an L.L.D. in 1924, and when he retired it added an additional honor by making him an Emeritus Professor. He assumed that he could continue to use his office but was told by a University official that he would have to vacate the premises. Shocked and infuriated, Buller made an unsuccessful appeal to the president for office space. That was the last straw. He not only left the University, but instructed his executors that his library of more than 1200 books, many of which were costly first editions, was to go to the Rust Research Laboratory, as soon as a fireproof structure was ready to receive it (J. Coulson, personal communication).

During his final illness, Buller bequeathed his collection of verses, his manuscripts, and all miscellaneous papers to the Royal Botanic Gardens in Kew, England, and requested that his body be cremated following his death. This latter request posed a problem because when Buller died there wasn't a crematorium in Winnipeg. His body was sent to Minneapolis for cremation. Eventually his ashes were deposited with appropriate ceremony in a wall receptacle, under his photograph, in a specially designed Buller Memorial section in the library of the Winnipeg Research Station of Agriculture Canada: the station that grew out of the Rust Research Laboratory at the same location. Nineteen years after his death, the University of Manitoba indicated its

continuing esteem for Buller by renaming the Science Building, in which he had worked, the "Buller Biological Laboratories." During the ceremony on October 26, 1963, Mr. Justice Samuel Freedman, Chancellor of the University, not only lauded Buller in full measure but also added a bit of Buller's own humor by reciting one of his limericks. Buller would have been pleased.

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*Further information on Buller's life and scientific career may be obtained from the following obituaries, the third one of which contains the most complete list of his honors, awards, and publications.

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