

# REMEMBERING BULLER



Last summer's 10<sup>th</sup> International Mycological Congress (IMC10) in Bangkok featured ten keynote presentations from luminaries of our science. Covering the breadth of research in modern mycology, an unplanned, but perhaps unsurprising recurrent theme was how the fingerprints of the history of both science and society consistently reappear in the present.

For me, the most absorbing keynote was Greg Jedd's presentation on cytoplasmic streaming in *Neurospora*. High speed videos of fluorescently stained nuclei and organelles danced in living hyphae, streaming and colliding through septal pores like flotsam plunging along the rapids of a river, and were projected onto the huge video screen in the darkened plenary hall like a glorious hallucination. All that was missing was a Phillip Glass soundtrack. Fungi engage our imaginations for so many reasons yet we struggle to convey our peculiar fascinations



Fig. 1. Arthur H.R. ('Reg') Buller, 1904 (Agriculture and Agri-Food Canada, Winnipeg; reproduced from Goldsborough 2004).

and passions to stoic audiences of students, colleagues or the curious. But the first thing I do when I want to look at a fungus is put it in a drop of acid, heat it up, and kill it. Jedd's videos reminded us that fungi are conspicuously, unabashedly, gloriously alive.

Arthur H.R. Buller's (1874–1944) drawings of living fungal hyphae (Buller 1933, vol. 5), were a continuo in Jedd's presentation. Buller had no access to high speed video or high resolution laser confocal microscopes, but he had curiosity, patience, stubbornness and persistence in equal measure. When I got my first job in mycology in 1978, I accidentally discovered Buller's *Researches on Fungi* (6 vols. 1909–34, a 7<sup>th</sup> was published posthumously in 1950) in the library of what was then called the Prairie Regional Laboratory in Saskatoon, Canada. The stiff, green, matte binding and the academic design gave the books an encyclopedic and authoritative air, enhanced by the slightly musty smell (?3-octanol). I didn't realize how idiosyncratic these books were or how they came to be written. Apparently Buller, after receiving heavy criticism of a paper he wrote on spore dispersal in *Hymenomycetes* from the Royal Society of London, decided that he didn't want his work censored by reviewers or editors, and elected to publish it on his own, without interference. That paper was expanded to become the subject of his first volume in 1909. The book lacked the economic potential to interest a commercial publisher, so Buller borrowed money from his father and paid a commercial publisher to print it. In this, he followed the footsteps of the notoriously rude American mycologist, Curtis Gates Lloyd (1859–1926), who exploited his family's pharmaceutical fortune to self-publish and distribute his uncensored, unreviewed mycological musings. Buller's books undoubtedly also inspired the stylish taxonomic wonder works on microfungi by the Japanese mycologist Takashi Matsushima (starting with Matsushima 1971).

At the time of my discovery of Buller, I was in the 'dung phase' of my career. Bryce Kendrick planned the winter laboratory exercises of his advanced mycology course around coprophilous fungi. It was an easy lab to run, because after the Canadian frosts and snows killed and buried the

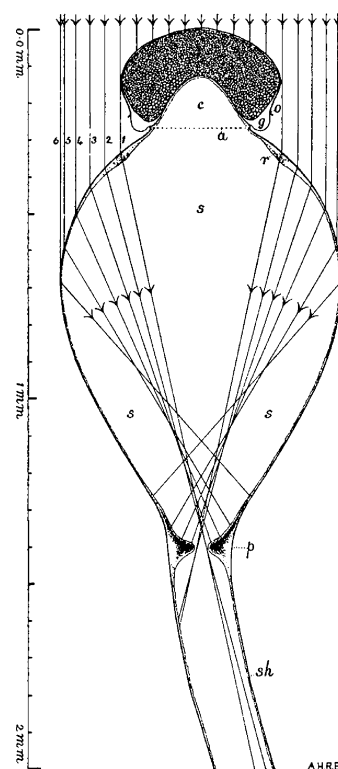


Fig. 2. The subsporangial 'lens' of *Pilobolus kleinii* (Buller 1934).

mushrooms and polypores in the forests and fields, you only needed to find some horses to have another source of living fungi for the lab. Peering at 'dungi' under a dissecting microscope requires that you overcome your squeamishness, but then an amazing world appears. So fascinating, that when my supervisor made it clear that he would tolerate some improvisation during my first summer job in Saskatoon, I went out to the barns on campus and got some horse dung (let's keep the stories of elephant and grizzly bear dung for another time). The technician insisted it must be incubated in the fume hood. Soon, the cover of the damp chamber was peppered with the sticky black sporangia of *Pilobolus*. When you develop curiosity about *Pilobolus*, you stumble into Buller. He recognized the swollen subsporangium as a lens that focused light onto a photosensitive spot (Fig. 2), ensuring that the whole structure remained pointed at the light. When ripe, the sporangium is shot out of the valleys and cracks of the substrate towards the wide world beyond, an

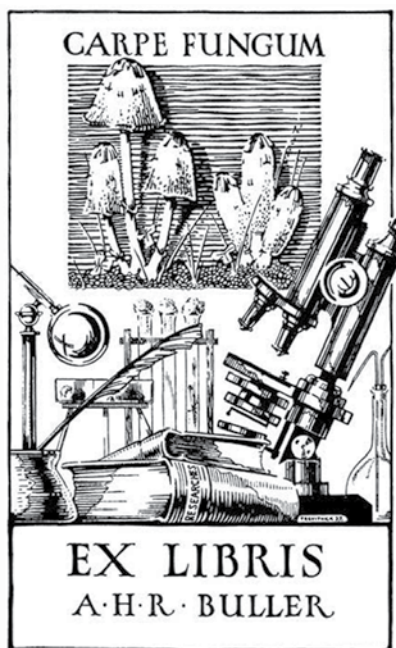


Fig. 3. Buller's personal book plate (Library and Archives Canada, Winnipeg; reproduced from Goldsborough 2004).

explosive process that has inspired not only mycologists, but dancers and artists as well (see [www.pilobolus.org](http://www.pilobolus.org)). The chapters on *Pilobolus* in *Researches on Fungi* (Buller 1934, vol. 6) are mycological classics. The majority of mycologists leave their dung phase behind but not all. I fondly recall a tour of the late John Krug's (1938–2005) office/lab at the University of Toronto in the 1980s, and its book shelves stacked with paper bags of dried samples waiting to be soaked and revived, with evocative labels such as 'Moose, Algonquin Park' and 'Zebra, Kenya'.

Buller was an early example of what might now be considered a global mycologist. He was British, a graduate and later a lecturer at what is now the University of Birmingham, but for most of his life taught at the University of Manitoba in Winnipeg, Manitoba during the school year. He returned each summer to England by boat, sometimes exciting the attention of young ladies on board. At home, he would carry on with his research at Kew

and Birmingham, returning to Canada in the autumn to resume teaching. While in Winnipeg, rather than buying a house or renting an apartment, the bachelor Buller stayed in a series of hotels. His office was his real home, filled with books (Fig. 3) and journals, and unsold copies of *Researches on Fungi*. Further insights into his life, indulgences with limericks, and academic influence are provided by Ainsworth (1996) and Goldsborough (2004).

About ten years ago, the Mycological Society of America produced a T-shirt with the rhetorical question, "What would Buller do?" decorated with drawings from Buller's books. The answer to this question is clear. When his eye set upon something surprising or unexpected, his curiosity engaged, Buller would exercise his creativity, persistence, patience and stubbornness until the puzzle was solved. Instead of forcing the puzzle to fit the tools available, he would find the tools to solve the puzzle, even if it meant inventing new tools. As one question led to another, his intellect followed and the stories expanded. His stories passed on to subsequent generations, as unimaginable new technologies emerged. It is not only Greg Jedd with cytoplasmic flows and Woronin bodies in *Neurospora* mentioned above, but the amazing ultra high speed videos by Nic Money and his colleagues of sporangial discharge in *Pilobolus* (Yafetto *et al.* 2008; lovingly synchronized to Verdi's Anvil Chorus [www.youtube.com/watch?v=TrKJAojmB1Y](http://www.youtube.com/watch?v=TrKJAojmB1Y)), and reexamination of basidiospore discharge in *Hymenomyces* (Pringle *et al.* 2005). You know, the ballistospore discharge phenomenon involving the collapse of a liquid drop on the side of the sterigma and developing basidiospore... the drop called Buller's drop.

The story is not over until the answers are all in hand. This is the core of research. We can all learn from Buller.

The IMA honours young mycologists from each continent at each IMC. The North American award is called the A.H.R. Buller Medal. It was presented this year to Peter Kennedy ([www.cbs.umn.edu/blogs/](http://www.cbs.umn.edu/blogs/)

[cbs-connect/kennedy-mycology-award](http://cbs-connect/kennedy-mycology-award)) of the University of Minnesota, who studies ectomycorrhizal and other symbiotic microbial symbioses in forest ecosystems. On behalf of the IMA, I congratulate Peter and all of the winners of the young mycologist awards at IMC10.

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