

Mosses, liverworts and hornworts: Significant bryophyte collections at the University of Melbourne Herbarium

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Bryophytes are an ancient lineage of plants, with the earliest fossil record found in the Devonian (about 360 million years ago).¹ More commonly known as the mosses, liverworts and hornworts,² bryophytes have also been called 'non-vascular' plants as they lack lignin and true vascular tissue, which are needed to transport water and nutrients around the plant. Most species are small and have very thin leaves, often only one cell thick, and many have the ability to dry out when conditions are unfavourable, then rehydrate, coming back to life with rain.³ In general they are a poorly known group of plants, particularly in relation to their taxonomy, ecology and geographic distribution.

More than 23,000 species of bryophytes have been discovered in the world to date, growing in a wide variety of habitats, including forests, deserts, the Antarctic, caves, cracks in footpaths and even on dung.⁴ Bryophytes are critical as habitat for invertebrates and germinating vascular plants, as soil stabilisers in arid areas, as pioneer plants after disturbance such as fire, and as bio-indicators of environmental change. Historical bryological collections, such as those at the University of Melbourne

Herbarium (MELU), can provide a window to vegetation changes over time, as well as assisting in taxonomic revisions, which are of considerable importance in current global projects investigating the evolution of land plants.

MELU houses one of the most important bryophyte collections in Australia.⁵ This includes about 20,000 specimens, many of which are vouchers for scientific publications including three influential books,⁶ type specimens, and ecologically, systematically and historically rare specimens that are well provenanced. The oldest bryophyte specimen at MELU dates back to the early 1880s.⁷ In its entirety, the collection is important as the specimens come from all geographic regions of Australia—a rarity in Australian herbaria—and the overseas collection is also comprehensive, including many significant Antarctic, sub-Antarctic and south-west Pacific specimens.⁸

Three people have made significant contributions to the bryological collection at MELU. Two of them—Dr George Scott and Dr Ilma Stone—were awarded the highly coveted Doctorate of Science at the University of Melbourne. The other was a distillery manager, Mr Harold Breidahl.

Dr George Anderson Macdonald Scott (1933–1998)

George Scott was a bryologist, ecologist, scholar, teacher and writer. He was born in 1933 in Glasgow and was a proud Scotsman, often donning his kilt and sporran. George was almost lost to botany, initially setting out to be a medical doctor, but in his first year at university he was struck down by tuberculosis and took two years off to recuperate. Upon returning to university Scott completed a BSc at the University of Glasgow, followed by a PhD on the ecology of shingle beaches, at University College of North Wales, Bangor.⁹

In 1961 Scott, with his wife Ann, moved to New Zealand to take up a lectureship at the University of Otago; it was there that his bryological research began to flourish.





He continued and expanded this research theme in Australia, moving to Melbourne in 1970 to take up a senior research fellow position at Monash University; he was later appointed as a senior lecturer and then reader. It was here that Scott followed his interest in classics, which stemmed from the Greek and Roman accounts of moss names, studying for and obtaining an arts degree while employed at the university.¹⁰ Soon after this (1986), Scott's association with the University of Melbourne began when he was appointed as Master of Queen's College and a research fellow in the School of Botany. Unfortunately he had to retire from the former after only six years because of 'heart troubles', but continued the latter until his unexpected death in 1998.¹¹ The School of Botany now awards the G.A.M. Scott Research Award from funds kindly donated by Ann Scott and family, to support a postgraduate research student in the field of either bryophytes or ecology.

Scott became the foremost authority on temperate Australian mosses and liverworts, authoring seminal books on these plants in the 1970s and 1980s,¹² which are still used as standard reference texts today, and publishing 52 papers over

his career.¹³ In these works he named two species of moss, 23 species of liverwort and one liverwort genus. Despite Scott's aversion to naming plants after people, two species have been named in his honour: *Frullania scottiana* and *Bazzania gamscottii*. Scott is attributed with rekindling interest in the study of bryophytes in southern Australia, and was the teacher and inspiration for at least three of today's leading Australian bryologists: Dr Christine Cargill (Australian National Herbarium), Dr Josephine Milne (National Herbarium of Victoria) and Mr David Meagher (MELU associate; PhD candidate). As well as inspiring individuals (his 'protonemata'), Scott instigated five-day bryophyte identification courses, the precursor to the hugely successful Australian Bryophyte Workshop.¹⁴ In 1990 he was awarded a Doctorate of Science from the University of Melbourne for his lifelong dedication to botany.

George Scott worked closely with Bruce Fuhrer, internationally renowned photographer and naturalist, who often accompanied Scott and colleagues into the field, leading them to many collecting sites with his remarkable knowledge of the Victorian bush. If it were not for Fuhrer, then perhaps the extensive Scott collection of hornworts and

Fossombronia (a genus of liverworts) would not be at MELU today.¹⁵ Scott was always eager to explore and discover new things and was extremely committed to fieldwork,¹⁶ which he considered critical to teaching and research. It is reported that on second-year excursions he lowered students down rock faces to assess the percentage of bryophytes, and in turn allowed them to lower him down a shallow mine shaft so he could assess *Fossombronia* population density with decreasing illumination.¹⁷

Scott collected around 4,500 specimens of bryophytes, including more than 1,000 liverworts and several type specimens from all geographic regions of Australia, and hundreds of bryophytes from the UK and New Zealand. In 1996 his collections were consolidated by moving all his specimens from the Monash University Herbarium to MELU.¹⁸ As a result, MELU now has the biggest and most diverse Australian collection of the liverwort genus *Fossombronia*.¹⁹

Scott's specimens at MELU require conservation to bring them up to current herbarium standards, which will preserve them for future generations of scientists. This is vital because bryophyte specimens, including those collected by Scott,

Page 3: Dr George A.M. Scott. Photograph from the School of Botany, University of Melbourne.

Opposite: *Dawsonia superba*, a moss collected by Dr George A.M. Scott in sub-tropical rainforest of Lamington National Park, Queensland, May 1971. MELU B106614, donated 1996 from the Monash University Herbarium collection to the University of Melbourne Herbarium.

Right: Dr Ilma Stone. Photograph courtesy of the Archives, Royal Botanic Gardens, Melbourne.



are the most frequently requested loans from MELU and are therefore some of the most handled specimens in our collection. The Russell and Mab Grimwade Miegunyah Fund has generously supported our application to conserve and curate the George Scott collection. The project will begin mid-2011.

Dr Ilma Grace Stone (née Balfe) (1913–2001)

Ilma Stone studied at the University of Melbourne's School of Botany from 1930 to 1934, receiving her MSc for an investigation of disease-producing fungi in ornamental plants. She had the opportunity to study at Cambridge University but chose to stay in Australia and raise a family with her husband Alan for 20 years.²⁰ It was not until 1957 that she fortuitously returned to botany through an advertisement on the radio for a chemistry demonstrator at the University of Melbourne. She heard the advertisement while doing the ironing and wished the job was in the School of Botany. At the encouragement of her husband, Ilma contacted Botany to see if it also had positions available, which it did, and she returned to the school, aged 44, to teach and undertake research.²¹

Stone initially researched ferns but at the completion of her PhD in 1969 she turned her attention to mosses, a greatly neglected field in Australia and much in need of critical revision.²² This was the beginning of a significant chapter in Australian bryology, which included the landmark publication of *The mosses of southern Australia* that Stone wrote with George Scott in 1976.²³ She retired from the School of Botany in 1978, but remained active as a senior associate until her death in 2001. During her career, Stone published a total of 71 papers, the first at 45 years of age, and 52 after she retired, including 11 after the age of 80.²⁴ It is not surprising therefore, that at age 76 Stone was awarded a Doctorate of Science. She was highly regarded in the bryological community and has been honoured with two genera (*Stonea* and *Stoneobryum*) and two species (*Macromitrium stoneae* and *Syrrhopodon stoneae*) being named after her.²⁵

Stone had a penchant for small ground mosses, including the very tiny earth mosses which inhabit Australia's semi-arid areas, and did not consider 'any specimens bigger than a few millimetres' very interesting.²⁶ She also hated the cold and would head to north-east

Queensland in winter to hunt for fascinating tropical species.²⁷ As a result, the Stone collection is one of the most comprehensive collections of mosses from tropical Australia.²⁸

During her career, Stone described 25 species, several genera and one family of moss new to science, and collected around 25,000 specimens.²⁹ Many of these collections were housed at MELU from 1980, the rest at the National Herbarium of Victoria. In 2001, Stone's collections were consolidated. The MELU specimens were moved to the National Herbarium of Victoria, which had been awarded a grant to curate and database the entire Stone collection.³⁰ Upon completion of this work duplicate specimens were returned to MELU. We currently have several thousand Stone specimens but they are not yet incorporated into the main collection and the data associated with the specimens has not been transferred to the MELU electronic database.

Harold Theodor Wilhelm Breidahl (1853–1942)

Harold T.W. Breidahl was born on 4 December 1853 in Augustenborg, Denmark.³¹ He moved to London in the early 1880s where he worked as a distiller for Haig and Co.³²



Dendrologotrichum dendroides: a large moss, collected by Dr George A.M. Scott in *Nothofagus* forest on the South Island of New Zealand, January 1966. MELU B2686a, University of Melbourne Herbarium.

In June 1887 Breidahl married Marian Evans. Almost immediately they left for Australia on RMS *Oroya*, arriving in Port Melbourne on 15 August 1887,³³ where they settled and had four children: Lilly Anne May, Helga Christina, Harold George and Frederick Axel.

Breidahl continued in his chosen profession in Australia, employed as manager of the new Joshua Brothers Distillery (Port Melbourne) for 54 years.³⁴ Joshua Brothers was famous for its Boomerang Brandy, which was stocked by the Imperial Army and the British House of Commons in the 'old country' (England).³⁵ Perhaps it was Breidahl's interest in the distilling process—he applied in 1901 for a patent to improve the acceleration of maturing of whisky and brandy³⁶—that sparked his interest in mosses, as peat moss is traditionally used to heat the barley mash when making Scotch whisky. However, very little is known about his interest in or contribution to bryology.

Dr Harold George Breidahl, H.T.W. Breidahl's eldest son, donated the moss collection and some of his father's books to MELU in 1948, six years after his father's death. Harold G. Breidahl was a graduate of the University of Melbourne and knew Professor

John S. Turner, then head of the School of Botany, from his student days. Along with the collection the family donated £100 to the University for its upkeep.³⁷ Breidahl's collection, which includes several hundred mosses, dates from the second major period of bryological exploration in Australia (1880 to 1920). The specimens were primarily collected in Victoria, with some from Tasmania, New South Wales, Queensland, New Zealand and South America, and may include duplicates of types lost in the bombing of Berlin in World War II, as many of the specimens were contributed by famous bryologists and collectors, including William H. Archer, Frederick Manson Bailey, Leonard Rodway and William Anderson Weymouth, as well as specimens from the herbaria of Victor Brotherus and Karl Muller.³⁸

A card catalogue of the collection was prepared by Dr Ethel McLennan at some time between 1957 and 1973, when she was Keeper of the Herbarium. At the same time the specimens were repackaged and incorporated into the main MELU collection. Since this time, herbarium curation techniques and the taxonomy of Australian mosses—particularly with the contributions of Scott and Stone—have advanced

significantly. Therefore, we need to curate and conserve the Breidahl collection to bring it up to present-day standards. A project was initiated in early 2011 to curate Breidahl's collections and a research project is being planned through the Cultural Collections Projects Program to investigate the history of Mr H.T.W. Breidahl and his collection.

Future directions for the MELU bryophyte collection

Because of the significance of these collections at MELU, four bryophyte projects have been targeted as high priorities for the coming years and funds are being sought: curation of the George Scott collections; curation and history of the H.T.W. Breidahl collection; curation of the liverwort genus *Fossombronia*; and incorporation of David Meagher's collection (so far this includes several thousand specimens). We currently have three volunteers working on two of these projects but will require many more in the future to enable their completion. Through these projects and databasing the specimens we hope to further understand the significance of the bryophyte collections held at MELU, both scientifically and historically.



Hypnodendron comosus, a moss specimen collected from the Hartz Mountains, Tasmania; collector and year unknown. MELU B106618, H.T.W. Bredahl collection, University of Melbourne Herbarium.

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- 1 R. Bruce Knox, Pauline Y. Ladiges and Barbara K. Evans, 'Evolution and biodiversity', in Chapter 37: 'Plants', *Biology*, Sydney: McGraw-Hill, 1994, pp. 801–807.
- 2 David Meagher and Bruce Fuhrer, *A field guide to the mosses and allied plants of southern Australia*, Canberra: Australian Biological Resources Study, 2003.
- 3 Meagher and Fuhrer, *Field guide*.
- 4 Meagher and Fuhrer, *Field guide*.
- 5 For a general history of the University of Melbourne Herbarium see Linden Gillbank, 'The University of Melbourne Herbarium, from McCoy to MELU: A broken paper-trail', *University of Melbourne Collections*, issue 1, November 2007, pp. 20–28; and Nicole Middleton, 'MELU 2007', *University of Melbourne Collections*, issue 1, November 2007, p. 29; both also at www.unimelb.edu.au/culturalcollections/research/collections1/.
The website of the Herbarium is at www.botany.unimelb.edu.au/herbarium.
- 6 George A.M. Scott and Ilma G. Stone, *The mosses of southern Australia*, London: Academic Press, 1976; George A.M. Scott, *Keys to the liverworts of Victoria*, Clayton: Monash University, 1978; and George A.M. Scott, *Southern Australian liverworts*, Canberra: Australian Biological Resources Study, 1985.
- 7 Nicole Middleton, 'The University of Melbourne Herbarium significance assessment', unpublished report, 2002, p. 10.
- 8 Middleton, 'Herbarium significance assessment', p. 12.
- 9 E.V. Watson, 'Obituaries: George Anderson Macdonald Scott BSc, PhD, BA, DSc, FLS (1933–1998)', *Journal of Bryology*, no. 21, 1999, pp. 165–166.
- 10 Paddy Dalton, 'A tribute: George Anderson Macdonald Scott, 10 March 1933 – 23 March 1998', *Australasian Bryological Newsletter*, no. 38, 1998, pp. 1–6.
- 11 Watson, 'Obituaries: George Anderson Macdonald Scott'.
- 12 Scott and Stone, *Mosses of southern Australia*; Scott, *Keys to the liverworts of Victoria*; Scott, *Southern Australian liverworts*.
- 13 Dalton, 'A tribute'.
- 14 Dalton, 'A tribute'.
- 15 Dr Christine Cargill, Personal communication to Gillian Brown, March 2011.
- 16 David Meagher, 'Obituary: George Scott—ecologist', *The Age*, 11 May 1998.
- 17 Dalton, 'A tribute'.
- 18 David Meagher, Personal communication to Gillian Brown, March 2011.
- 19 Cargill, Personal communication.
- 20 Claire Stone, 'Obituary: Dr Ilma Grace Stone (née Balfé), expert on Australian mosses', *The Age*, 4 April 2001.
- 21 Jessica E. Beever, 'A tribute: Ilma G Stone 1913–2001', *Australasian Bryological Newsletter*, no. 43, January 2001, pp. 2–5, www.utas.edu.au/docs/plant_science/abn/abn_43.pdf.
- 22 Particulars of Ilma G. Stone, 16 April 1974, Botany Departmental file, copy held in the University of Melbourne Herbarium archives at the School of Botany.
- 23 Scott and Stone, *Mosses of southern Australia*.
- 24 George A.M. Scott, 'Ilma G. Stone, bryologist', *Australasian Bryological Newsletter*, no. 29, 1993, Special issue in honour of Ilma Grace Stone to commemorate the occasion of her 80th birthday, pp. 2–3.
- 25 Stone, 'Obituary: Dr Ilma Grace Stone'.
- 26 Helen Ramsey, 'Encounters with Ilma Stone', *Australasian Bryological Newsletter*, no. 29, 1993, Special issue, p. 4.
- 27 Ramsey, 'Encounters with Ilma Stone'.
- 28 Meagher, Personal communication.
- 29 Ian C. Clarke, 'The history of the herbarium, School of Botany, University of Melbourne', in Philip S. Short (ed.), *History of systematic botany in Australasia: Proceedings of a symposium held at the University of Melbourne, 25–27 May 1988*, Melbourne: Australian Systematic Botany Society Inc., 1990, pp. 13–21.
- 30 Middleton, 'Herbarium significance assessment', p. 11.
- 31 FamilySearch™ Vital records index, www.familysearch.org/Eng/Search/ancestorsearchresults.asp?last_name=Bredahl accessed 17 March 2011.
- 32 'A new distillery', *The Argus*, 9 February 1889, p. 10.
- 33 Naturalisation certificate of Mr Harold T.W. Bredahl, National Archives of Australia, item barcode 1614760, http://recordsearch.naa.gov.au/name_search, accessed 25 March 2011.
- 34 Naturalisation certificate of Mr Harold T.W. Bredahl.
- 35 'Joshua Brothers' Australian brandy, Boomerang brand', *The Sydney Morning Herald*, 31 July 1897, p. 9.
- 36 'Application for letters patent by Harold Bredahl and Joshua Brothers Proprietary Limited titled – An improved method of accelerating the maturing of whisky brandy and other strong spirituous liquors', 1901, National Archives of Australia, item barcode 7668361, http://recordsearch.naa.gov.au/name_search, accessed 25 March 2011.
- 37 Prof. John S. Turner, Correspondence with University of Melbourne Registrar, 18 November 1984, held in the University of Melbourne Herbarium archives at the School of Botany; Prof. John S. Turner, Correspondence with Dr H.G. Bredahl, Perth, held in the University of Melbourne Herbarium archives at the School of Botany.
- 38 Meagher, Personal communication.