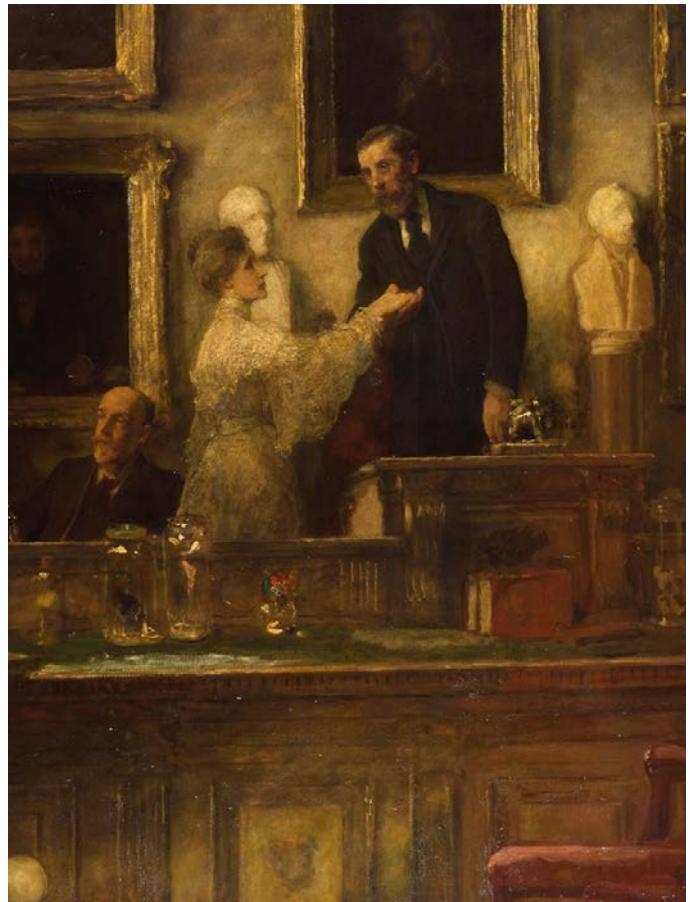




'The Door Was Opened'

Pioneering Women at the Linnean Society
of London and Their Continuing Legacy



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'The Door Was Opened': Pioneering Women at the Linnean Society of London and Their Continuing Legacy

Compiled and edited by Gina Douglas Hon FLS and Leonie Berwick

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Introduction

This issue celebrates the role of women within the Linnean Society, a story told in some detail in the *Bicentenary History of the Linnean Society* (Gage & Stearn 1988: 88–93). Obtaining the Supplementary Charter, which incorporated key changes to the wording permitting the Society ‘to elect such persons without distinction of sex to be Fellows’, is explored in detail in *The Linnean* 34(1) (Watson 2018).

Here, our contributors give biographical accounts of some of those pioneering women, with some more detailed narratives clarifying the role of Marian Farquharson, whose relentless campaigning eventually turned the tide for women to be accepted as Fellows, but was initially rejected for Fellowship herself. We also offer an enriched treatment for Ethel Sargent, clarifying her role as a mentor for Agnes Arber FRS (elected to Fellowship in 1908, with copious biographical information now available) as well as Marie Stopes, widely known for her involvement in sex education (alongside her controversial promotion of eugenics), but featured here to focus on her science. It also reviews the experiences of present-day women working in the field of natural sciences.

The 15 women elected to Fellowship on 15 December 1904 came from different backgrounds and educational achievements. Some were already forging professional careers and their lives have been reasonably well documented, others are only now emerging from obscurity; as research focusses more on achievements by women across many disciplines, a few still have only outline information. Some of the initial cohort of women Fellows are still shadowy ‘wives and daughters’, identified only as having an interest in botany, but may also benefit from closer attention in the future. Only 11 were present for admission on 19 January 1905 and only seven are shown in the group portrait of the *First Admission of Women Fellows* by James Sant RA, commissioned by Frank Crisp, who was Treasurer of the Linnean Society at the time the first women were elected. He also paid for the costs of the Supplementary Charter and gave a celebratory dinner in May that year for the women who had been elected (Walker 1984).

In reviewing a much wider group of women, elected before 1939, there are many that give us intriguing glimpses of their independence and pioneering spirit. Lilian Clarke’s (FLS 1905) legacy as a pioneer in teaching in the field lives on at James Allen’s Girls’ school in London. Kate Manon Hall (FLS 1905) was the first female Natural History curator (the Borough of Stepney Museum, 1893–1909). Nina Layard (FLS 1906) and other earth scientists and archaeologists have benefitted from the attention of the TrowelBlazers (celebrating women’s contributions to archaeology, geology and palaeontology). Others, such as Clothilde von Wyss (FLS 1914) developed the use of broadcast media that has transformed awareness of the natural world. Some achieved notoriety for reasons beyond their academic achievements, like the adventurer and divorcee Lady Lilian Alice Mabel Richmond Brown. We hope that growing interest and recognition of their achievements will encourage future research on the lives of some of the hitherto overlooked female Fellows.

Gina L. Douglas Hon FLS

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Pioneers



Victrices scientiarum of 1904: Who were the first women elected as Fellows of the Linnean Society of London?

I hate to hear you talk about all women as if they were fine ladies instead of rational creatures. None of us want to be in calm waters all our lives.

Anne Elliot, *Persuasion* (1817)
(Jane Austin, 1775–1817)

(This paper focusses mostly on those Fellows who have not been formally biographed, and less about those for whom commercial or research biographies are easily available.)

Mary Russell, Duchess of Bedford FLS FZS (26 September 1865–c. 22 March 1937)

Mary Du Caurroy Tribe was the daughter of the Rev. Walter H. Tribe (Archdeacon of Lahore) and Sophie Lander. The Rev. Tribe valued the education of his daughters, sending Mary to Cheltenham Ladies' College, under Dorothea Beale (founder of St Hilda's College, Oxford), studying chemistry and Latin. She stated in later life that her 'interest in matters medical began at Cheltenham [...] lectures on Anatomy were given and I attended' (Buxton 2008).

Joining her parents in India, she met and married Lord Herbrand Russell, youngest son of the 9th Duke of Bedford, at St Bartholomew's Church, Barrackpore, India (1888). On the death of his brother George (10th Duke of Bedford, 1852–1893), Herbrand became 11th Duke of Bedford and Mary was elevated to Duchess. A keen photographer and accomplished painter, she moved into the emerging fields of radiology and radiography, becoming an acknowledged expert and worked professionally as a radiographer after World War I. An animal lover, keeping an otter and a bat as a child (Buxton 2008), she became a Fellow of the Zoological Society of London (1892) and was one of the first Honorary Life Members of the British Ornithological Union (1910). Her ornithological journals from Fair Isle (1909–1914) were privately published as *A Bird-watcher's Diary* (Duncan 1938).

An accomplished aviatrix, having taken up flying in 1926, she broke records for flights to India (1929) and Cape Town (1930), getting carbon monoxide poisoning on the latter! She died at 77 when her plane crashed into the North Sea near Great Yarmouth in 1937; her body was not recovered. A privately-published biography was commissioned by her family, and a scholarship endowed in her name at Cheltenham Ladies' College.

Her interests on her nomination form are 'zoology', and the form was signed by the His Grace the Duke of Bedford, The Lord Avebury, Henry Seeley, Albert Günther and Henry Elwes. She was formally admitted as a Fellow of the Society on 24 May 1905.

The biographies by Buxton (2008), Curtis (1993) and Gore (1938) are particularly recommended and contain many photographs.



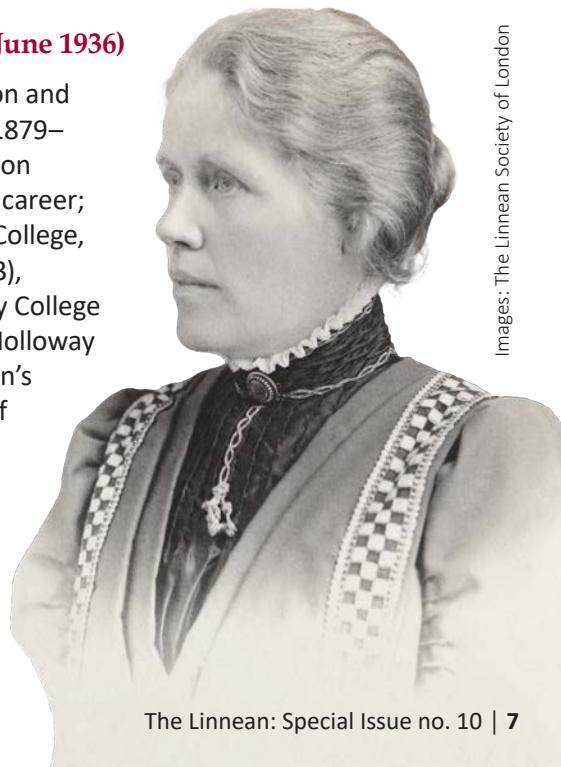
Fig 1. (ABOVE) James Sant's 1905 *First Admission of Women Fellows*, original without the erasure of The Rev. and Mrs Stebbing. From left: Miss Turner, Miss Lorrain Smith, B. D. Jackson (General Secretary), Miss Silver, Dr Veley (signing the Book), Mrs Sladen, D. H. Scott (Botanical Secretary), Mrs Crisp (receiving the Hand of Fellowship), W. A. Herdman (President), Mrs Stebbing, F. Crisp (Treasurer), the Rev. T. R. R. Stebbing (Zoological Secretary).

Fig 2. (RIGHT) Prof. Margaret J. Benson. From a cabinet print by Maul & Fox of Piccadilly, accessioned 22 February 1911 (Linnean Society ref. PP/B/25). The original photographer's reference is 236762.

Professor Margaret Jane Benson FLS (20 June 1859–20 June 1936)

Margaret Benson (Fig 2) was born to architect William Benson and Edmunda Bourne, a painter. She attended Bedford College (1879–1880), eventually gaining a BSc from University College London (1891) and would go on to achieve a distinguished academic career; she was awarded a DSc (1894) and Fellowship of Newnham College, Cambridge (1892–1893) and University College London (1903), becoming Head of the Botany Department at Royal Holloway College (1893–1922) and Professor of Botany (1912). In 1927, Royal Holloway College dedicated a botanical laboratory in her name. Benson's herbarium, fossil slides and portrait are held in the archive of Royal Holloway College.

A palaeobotanist, she collaborated with D. H. Scott and F. W. Oliver, both of whom nominated her for Fellowship of the Linnean Society, and recognised her work on chalazogamy (fertilisation in which the pollen tube penetrates the chalaza and not the micropile). Several fossil ferns



were named and described by her: *Telangium scotti* M.J.Benson (Benson 1904), *Cordaites felicis* M.J.Benson (Benson 1912) and *Botryopteris antiqua* Kidston (Benson 1911). She died at Highgate in London on her 77th birthday, having never married. Her effects were valued at £10,540 13s [2022 economic power, £4.9m].

Her interests on her nomination form are ‘botany’ and it was signed by Dukinfield H. Scott, Percy Groom, Benjamin Daydon Jackson, Sir John Bretland Farmer, Francis Wall Oliver and Reginald W. Phillips.

Mrs Catherine Crisp FLS (August 1846–2 January 1931)

From a surprisingly humble background, Catherine Howes was daughter of carpenter George Howes and Maria Gymer, a blacksmith’s daughter—she was illegitimate yet formally acknowledged by Howes at his death at 31 (1850), stating that Catherine was his daughter in his will, leaving her £4,000—a fortune with a current economic power of over £455,000. Educated in a Norwich boarding school, she married Frank Crisp in 1867, then a trainee solicitor, before moving to Adelaide Road, Hampstead in London (where the Chalcots Estate now stands). Later in 1889, Frank would build a second home near Henley, in Oxfordshire, a Gothic revival palace named Friar Park (which in time would go on to be owned by George Harrison of The Beatles). Once fully qualified, her husband became an expert in company law, and his legal services gained him a knighthood in November 1907, and a baronetcy in 1913. Frank also served as Treasurer of the Linnean Society from 1881–1905. Catherine would be mother to four sons and two daughters, and was amongst the first group of elected women. Her interests were listed as ‘botany’, and she was nominated by Sidney H. Vines, William C. Carruthers and Albert Günther—notably *not* Frank Crisp, in contrast with Mrs Mary Anne Stebbing, whose husband (as we’ll see later) *did* sign her form! Frank was Vice President of the Linnean Society and died in 1919, after which Friar Park was sold, and Catherine resigned her Fellowship.

Miss Alice ‘Alick’ Laura Embleton FLS (8 April 1877–14 March 1960)

Born in 1877 to John Embleton and Elizabeth Martin, Alice ‘Alick’ Embleton was educated at Sutton High School, leaving at age 15 for financial reasons. Alick then attended what is now the University of Cardiff on a scholarship, one of the first women to study for a science degree, graduating with a BSc First Class in 1899. In 1900, Alick received an *1851 Exhibition Science Research Scholarship* which was used to undertake research at Newnham College, Cambridge and the Sorbonne, Paris. Insecticide research (to improve crop protection) led to the Mackinnon Scholarship (Royal Society 1904) and a grant from the Percy Sladen Memorial Fund (1905) for research on insect physiology at the British Museum (Natural History) or BM(NH), now the Natural History Museum, London (NHM). Alick also worked as Sub Editor of the *Zoological Record*.

Alick was regularly involved with the Linnean Society, and was the first woman to give a lecture in the Society’s Meeting Room in 1911, on the developmental biology of the genus *Parthenolecanium* Šulc of the Hemiptera. While staying in Barnsley, Yorkshire, as a guest of Charles and Cecelia (Celia) Wray, a pig dealer and his daughter, the 1911 census identifies Alick as a ‘cancer researcher’. Celia was a suffragist (and a passionate one, based on the graffiti on the census card!). A photograph shows Celia, Alick and others petitioning at the *Barnsley Chronicle* in 1910 for women’s suffrage (Fig 3).

From 1909, Alick became more involved in the suffragist movement and less in science, resigning from Fellowship in 1917. Alick went on to have a close, probably romantic, relationship with Celia, and they are recorded as living together at Saxmundham, Suffolk in the 1939 England and Wales Register. Alick appears on the Society’s records as ‘Miss Alice Embleton’, but was known for many years as ‘Mr Alick Embleton’. It is tempting to view Alick through the modern lens as a trans man or gender non-binary person, but those concepts did not exist, and it is not possible for us to say.

It is worth noting that many gay or bisexual women of that time used male names and pronouns and some wore ‘male’ clothing, effectively living ‘as men’, including Vera ‘Jack’ Holme (1881–1969), chauffeur to the Pankhurst family and friend of Embleton. Letters between Wray, Embleton and Jack Holme during World War I are held in the *Women’s Library Archives*, in which masculine names and pronouns are used for Alick and Jack. A typical example of their correspondence, Holme begins ‘My dear Alick’ and ends ‘my best love to Celia, and consider yourself properly kissed dear’ (Holme 1915a), yet in another Jack claims ‘the censor reads letters and one does not like to discuss one’s private business’ (Holme 1915b).

Celia died in 1954, with Alick passing shortly after in 1960 at their estate in Bradfield, Essex (their estate was valued at £10,850 7s 8d [2022 economic power, c. £1m]). Images of Embleton can be found on the *Special Collections and Archives* blog for the University of Cardiff (<https://scolarcardiff.wordpress.com/2018/03/05/scientist-and-suffragist/>) and in the *Women’s Library Archives* of the London School of Economics—specifically a 1914 portrait catalogued as GB 106 7VJH/5/10/07, part of Jack Holme’s papers.

Embleton was perhaps not someone who would be happy to be called a *victrix scientiarum* (‘victorious woman of the sciences’) but could have preferred to be a *victor scientiarum* or even *victen scientiarum* (whilst L. masc. n. *victor*, victorious man, and L. fem. n. *victrix*, victorious woman, are viable options as good Latin words, there is no L. neut. n. with an equivalent meaning one can apply to Alick, or indeed anyone else who is gender non-binary, thus I have created N.L. neut. n. *victen*, victorious person, following the Latin third declension).

Mrs Grace Coleridge Toynbee Frankland FLS FRMS (3 October 1858–5 October 1946)

Grace Coleridge Toynbee Frankland (Fig 4, OVERLEAF) was born on the outskirts of London in Wimbledon to Sir Joseph Toynbee (for whom Toynbee House that the Society owns was named) and his wife Harriet Holmes.

Grace would later marry Professor Percy Faraday Frankland (1882), son of the chemist Sir Edward Frankland.

Mrs Frankland was self-educated in bacteriology, and whilst credited as Frankland’s ‘loyal secretary’, she was also undertaking research. One highlight was the discovery of *Bacillus cereus* (Frankland and Frankland 1887), which had been isolated from the air of a cow shed. *B. cereus* is an important human pathogen, causing gastrointestinal illness following consumption of improperly stored, cooked rice. It is key in defence microbiology as the safer mimic organism for *Bacillus anthracis*, the causative agent of anthrax. She also discovered *Flavobacterium aquatile* (‘*Bacillus aquatilis*’, Frankland and Frankland 1889), type species of the genus *Flavobacterium*. Her most significant work was probably her popular science book, *Bacteria in Daily Life* (1903). Grace also co-authored several books with her husband including *Microorganisms in Water* (1894) and the biography *Pasteur* (1898).



Fig 3. Alick Embleton (FAR LEFT) and Celia Wray (CENTRE) petitioning for women’s suffrage in front of the *Barnsley Chronicle*.

An interesting comment on her scientific ability appears on the front page of a Swedish women's newspaper:

och dessutom genom själf ständigt studium gjort sig väl bekant med de modärna bakteriologiska ska metoderna, såsom de utöfvas af Kochs skola.

(and by continual self-study, [she] made herself familiar with the modern bacteriological methods, as practiced in [Robert] Koch's school). (Eivor 1905.)

A male UK scientist also commented: 'there are only a few men in the country that are Mrs Frankland's equals and probably no women in the world.' (Note: The author back-translated this from Swedish into English but cannot find any record of the original English quote in a newspaper archive.)

The Franklands had a son, Dr Edward Frankland, a chemist who took up farming and writing fiction following renal issues. He had three children: Dr Anthony Noble 'Bunny' Frankland CBE CB (1922–2019, Director General of the Imperial War Museum), Mr Raven Frankland (d. 1997, farmer, husband of Dr Juliet Frankland, mycologist), and Dr Helga Frankland MBE (1921–2015, former academic at the University of Keele). Mrs Frankland's great grandniece is the journalist Polly Toynbee (b. 1946).

Her papers and laboratory books are in the *John Rylands Library* at the University of Manchester, along with those of Sir Edward and Professor Percy Frankland. *Mrs Frankland's nomination form was signed by The Marquis of Ripon, The Lord Avebury, Sir Michael Foster, Henry Elwes, Joseph R. Green and William C. McIntosh.*

Dame Dr Maria 'May' Matilda Ogilvie Gordon FLS (13 April 1864–24 June 1939)

Born to the Rev. Dr Alexander Ogilvie and Maria M. Nicoll, May's father was Headmaster of Robert Gordon's College in Aberdeen, Scotland, from 1872–1901. She spent nine years at the Edinburgh Educational Institute for Girls, then studied piano at the Royal Academy of Music, London. However, she left within a year to read science at Heriot-Watt University, moving to University College London where she completed her BSc at 26 in 1890, having read geology, botany and zoology.

In 1891 she moved to Berlin on a Royal Society grant, but could not be admitted to the Friedrich-Wilhelms-Universität (FWU, now the Humboldt-Universität zu Berlin), owing to laws concerning women studying in the German Empire. Instead, she travelled from the Kingdom of Prussia to the Kingdom of Bavaria with her friends Ferdinand, Freiherr von Richthofen, Professor at the FWU, and his wife, Irmgard, Freifrau von Richthofen. She was able to study at the Ludwig-Maximilians-Universität (LMU, München) and conducted research privately, outwith the LMU, under Karl, Ritter von Zittel (palaeontologist, Chief Editor of *Palaeontographica*) and Richard, Ritter von Hertwig (zoologist and embryologist).

The same year she began her lifelong focus on the Dolomites in South Tyrol, travelling with the Freiherr and Freifrau von Richthofen. On the evening they arrived, the Freifrau instructed Miss



Fig 4. Mrs Grace Coleridge Toynbee Frankland. From a cabinet print by Maull & Fox of Piccadilly, accessioned 6 March 1906 (Linnean Society ref. PP/F/10) and dated 1906 by the photographer. Photographer's reference is 227425.

Gordon not to open her bedroom curtains, and in the morning she was taken to see the striking view of the Dolomites without having spoilt it the evening before with the inferior view by twilight. Judging by her later recollection, it was love at first sight:

I saw the Dolomites before me, a wonderful sight such as I had never experienced before [...] it made an impression that stayed with me later in life like a sight from God (Von Klebelsberg, 1932).

For her thesis (Ogilvie 1893) she was awarded the first DSc awarded to a woman by the University of London, and indeed the first in the UK (Kölbl-Ebert 2001). In 1900 she became the equivalent at the LMU: the first woman awarded a PhD (for the same work, though nowadays this would be self-plagiarism!).

She married Dr John Gordon, an Aberdeen physician, in 1895, and had three children, but continued her research in the Dolomites. Her husband died in 1919 and she moved to London, becoming an active member of the Liberal Party.

Dame May Gordon's accomplishments are far and wide. She stood as the Liberal Party Candidate for Hastings in the 1923 General Election (Craig 1949).

She was Honorary President of the Associated Women's Friendly Society, National Women's Citizens Association, and President of the National Council of Women in Great Britain and Ireland (1916–1920), as well as a Justice of the Peace and first woman to chair a London borough court. She formed the Council for the Representation of Women in the League of Nations, and served on several committees of the National Council of Women, including that on Maternity and Child Welfare (1922). It is for all of this work that she was awarded a DBE and an honorary LL.D (University of Edinburgh), both in 1935.

Amongst the many commemorations to her memory is the fossil fern genus *Gordonopteris* (van Konijnenburg-van Cittert *et al.* 2006); the type species (*Gordonopteris lorigae*) was discovered in the Dolomites.

Her nomination form was signed by Sir Michael Foster, William C. McIntosh, J. R. Green, The Lord Avebury, Sir William Abbott Herdman and George S. Boulger. An extensive research biography with photographs can be found in Wachtler and Burek (2007).

Miss Gulielma Lister FLS (28 October 1860–18 May 1949)

From a Quaker family, Gulielma 'Gulie' Lister was the daughter of Susannah T. Lister and Arthur H. Lister, and was probably named for early Quaker Gulielma Penn (1644–1696). The Listers were a dynasty of biologists; her father was an expert on the class Myxogastria—the genus *Listerella* E.Jahn (Jahn 1906) is named for him. Miss Lister's brother—Joseph J. Lister FRS—was a zoologist and botanist, with four species endemic to Christmas Island named for him. It is easy to see where Miss Lister's early inspiration came from! At 16 she spent a year at Bedford College, where she studied botanical systematics (Ramsbottom 1949; Creese 2004).

She then worked at the BM(NH) with her father in the 1880s, principally in drawing and painting specimens as he catalogued members of the Myxogastria. Gulielma took over his mantle when he died in 1908, becoming responsible for the 1911 and 1926 editions of *A Monograph of the Mycetozoa*. It has been noted that she affectionately dubbed the Myxogastria 'my creepies' (Wakefield 1950)! Through her life, Miss Lister published over 20 reports of the Myxogastria (Lister

1913; Lister 1927; Lister 1930; Lister 1932) including many novel species (e.g., Lister 1921). It is of note to the Linnean Society that her first publication was in the *Journal of the Linnean Society, Botany*, in 1884. A Foundation Member of the British Mycological Society (BMS) in 1903, and later its President (1912, 1932), she was made an Honorary Member (1924). Equally involved with the Essex Field Club (President 1916–1919), she regularly attending fungus forays for both groups. She chaired the School Nature Study Union and was trustee of the Botanical Research Fund (1917). She served on the Council of our Society (1915–1917, 1927–1931) and also became Vice President (1929–1931).

She was noted for her kindness and lack of selfishness (Haskins 1999) and was cultured and artistic, described as ‘a perfect gentlewoman with an old-world courtesy’ (Waterhouse 1973) who ‘possessed [...] the qualifications of the true scientist, an unbiased mind to search after truth, and readiness both to learn and to teach’ (Wakefield 1950). She inspired a number of other women, including Dr Agnes Arber FLS, whom she met when the latter was at school, gifting her a mounted collection of the Myxogastria.

Botanist Elizabeth Blackwell remembers Miss Lister attending meetings at the Linnean Society, ‘entering the [Meeting Room] and turning left into the fourth or fifth row from the front’, sitting with another Fellow, Miss Lorrain Smith. Miss Lister was a trend-setter when it came to the behaviour of female Fellows at meetings:

remov[ing] her hat in deference to the sexless character of a Fellow. It was an unusual thing for a lady to remove her hat, but we all took our cue from Miss Lister and did the same (Waterhouse 1973).

She was also a correspondent of the Emperor Shōwa of Japan (Haskins 1999). Following her death, Wakefield wrote: ‘Mycology has lost yet another of its outstanding workers, and the [British Mycological] Society an old and much loved friend.’ Her specimen collections were given to the NHM, Stratford Museum and the Royal Botanic Gardens, Kew (RBGK). Seventy-four research notebooks were donated to the former (Creese 2000 and 2004). She did not marry and had no issue and left an estate valued at £37,448 13s 5d [2022 economic power, £7m]. Her papers at the NHM include a large number of fine watercolour paintings of specimens (advance notice is required to view these items at the NHM Library).

Her paternal great grandfather was microscopist Joseph Jackson Lister FRS. The genus *Listerella* Cushman (1933) of the Retaria is named for him. His son—Miss Lister’s uncle—was Joseph, the Lord Lister, pioneer of antiseptic surgery, famously using phenol as a surgical disinfectant. It was for the Lord Lister that the genus *Listeria* (Pirie 1940, Pirie 1927) in the *Bacteria* was named—though there was some controversy over this, cf. Gibbons (1972). He discovered an organism used extensively in the dairy industry, now *Lactococcus lactis* (Lister 1873; Schleifer *et al.* 1986).

Her nomination form was signed by W. C. Carruthers, G. Murray, D. H. Scott, J. G. Baker, A. Gepp and A. C. Seward. Haskins (1999) is a particularly good biography of Miss Lister that also contains photographs.

Miss Annie Lorrain Smith FLS (25 October 1854–7 September 1937)

Shown in Figs 1 and 5, Miss Lorrain Smith is variably styled as ‘Lorrain Smith’, ‘Lorraine Smith’, ‘Lorrain-Smith’, and ‘Smith’! The name originates from the surnames of her parents, the Rev. Walter Smith and Annie Lorrain Brown. The latter’s mother was Jannet Lorrain, thus ‘Lorrain Smith’ is a double-barrelled surname: some of her siblings hyphenated it, but Miss Lorrain Smith did not.



Fig 5. Miss Annie Lorrain Smith FLS. From a cabinet print by Maul & Fox of Piccadilly, accessioned 21 February 1907 (Linnean Society ref. PP/S/33). Photographer's reference is 230365.

She was raised in Scotland, educated at Edinburgh, Tübingen and Orléans, and worked as a governess until she was 34. She studied botany at the Royal College of Science (now Imperial College London) under D. H. Scott; he was impressed by her ability and found her work at what is now the NHM. As women could not be employed there, she was paid from some external fund: this continued for 40 years. Working on cryptogamic botany and fungal identification, she remounted the de Bary Collection and set up the exhibition of the Fungi in the Botanical Gallery. In 1884, the Rev. J. M. Crombie FLS FGS produced the first edition of *A Monograph of the Lichens Found in Britain, Part I*. She took over the *Monograph* after his death and wrote *Part II* (1911) and a second edition of *Part I* (1918), followed by a summary version, *A Handbook of the British Lichens* (1921) and *Lichens* (1921), a more general text. Multiple copies of her published monographs and handbooks are held in the Society's Library.

She lived with her sister in West London, working until she was 80 when her health began to fail, dying just before her 83rd birthday. Cultured, well-travelled, warm-hearted and generous, she was much like her friend, Miss Lister. A Civil List pension was awarded in 1931 'in recognition of her services to botanical science', and an OBE in 1934 'for

services to mycology and lichenology'. She had many impressive familial connections, being the sister of James Lorrain-Smith (1862–1931), inventor of 'Eusol', the surgical disinfectant. Her niece was nurse Dame Isabel Graham-Bryce (1902–1997) and her grandnephew was Dr Alastair Graham-Bryce (1935–2012), engineer and co-founder of the Imagineering Foundation. Her papers are in the NHM Library, and include her lecture notes from when she studied under Scott.

Miss Lorrain Smith's nomination form was signed by G. Murray, J. Britten, A. Gepp, E. G. Baker, A. B. Rendle, V. H. Blackman and D. H. Scott.

Miss Ethel Sargent FLS (28 October 1863–16 January 1918)

Miss Sargent is treated in more depth elsewhere in this publication and in Arber & Stearn (1968), the latter including photographs. After working for D. H. Scott at Kew in the early 1890s, she removed herself to her private laboratory in Reigate, Surrey and at Girton, where she completed studies of plant development, studying both palaeobotany and botany, employing several key women in biology, *viz.* Dr Ethel Thomas FLS (1897–1901) and Agnes Arber were her Research Assistants (1897–1901; 1897 and 1902–1903, respectively). She had a lasting influence on Arber, based on an offprint of the obituary the latter wrote on Miss Sargent's death, which the Author obtained, with a small handwritten note in which Arber expressed sadness re: Sargent's passing—she was writing to Professor Seward. This has not been authenticated but it is unlikely to be fake—the Author has since gifted it to Professor Dianne Edwards PPLS, should any readers be interested in it. Miss Sargent died in her early 50s from a stroke in Sidmouth, Devon—where she is buried—not at Girton per some reports.

Her nomination form was signed by D. H. Scott, P. Groom, B. D. Jackson, Sir J. B. Farmer, F. W. Oliver and R. W. Phillips.

Miss Sarah Marianna Silver FLS (1879–1920, later Mrs Sinclair)

Shown in Fig 1, we know little about Miss Silver, but more about her father, Stephen W. Silver, FLS, who, with his brother, owned a mercantile company, supplying clothes to people emigrating to the British colonies as well as the civil and military authorities. The Silvertown area of London is named for them. His wife was Sarah Constance, Lady Bodkin. Sarah Marianne Silver was born at York Gate, Regent's Park and in 1905 was living at Letcombe Manor, Vale of White Horse, Berkshire. Miss Silver died young, in 1920, at the age of 40. Mr Silver's considerable private library was purchased on his death by the Royal Geographical Society of Australasia and shipped to Adelaide (1908). It is now the York Gate Library, in the State Library of South Australia (Henderson 2008). A cabinet stands in the stairwell of Burlington House, gifted to the Society by Miss Silver in 1908 (Anon. 1926)—this was then sold by the Society to raise funds, but was bought by a Fellow and given back to us!

Her nomination form gives her interests as 'botany' and was signed by her father, S. W. Silver, J. Britten and E. A. Petherick.

Mrs Constance Sladen FLS (July 1848–17 January 1906)

The Royal Albert Memorial Museum, Exeter, UK has a fine 1903 oil by Wells of Mrs Sladen (a digital version is available *via* their website), she is also shown in Fig 1. Born Constance Anderson in York, daughter of surgeon William Anderson and his wife Sarah, one of four siblings—her brothers had the delicious names of Yarborough and Tempest! (Tempest, an ophthalmologist and volcanologist, was closely involved with the Yorkshire Philosophical Society and is commemorated in Tempest Anderson Hall, part of the Yorkshire Museum.) As a young lady, Constance was an artist of some note, with works exhibited widely (Nichols 2003), and an expert on the archaeology of Yorkshire, contributing to works on Castle Howard, York Minster, etc. Her painting *York Minster (South East)* was exhibited in the 1879 *Fine Art & Industrial Exhibition* in York (Anon. 1879).

She met Walter Percy Sladen in 1870 in her early 20s, though they did not marry until she was 42 (1890). Percy was a skilled natural historian with an emphasis on the *Astroidea*. He was elected as a Fellow of our Society (1876) and the Zoological Society of London (1877). By 1880, Percy was an authority on the Echinodermata. In 1881 he identified and published starfish found in the voyage of HMS *Challenger*—it took 10 years to write and was almost a thousand printed pages. In 1898 he inherited Northbrook Park in Devon (demolished in 1954) and retired there. He died in Florence in 1900.

Constance, meanwhile, we know *relatively* little about—there are no specific interests declared on her nomination form, or Certificate of Recommendation. After Percy's death, she curated and doggedly promoted his works, taking some interest in natural history herself (Nichols 2003). She endowed the *Percy Sladen Memorial Fund* to support field biology. It was her wish that Percy's Library and Collection remain intact, but the major museums would not accept it; however, in 1903, it was accepted by the Royal Albert Memorial Museum in Exeter (Rowe 1974). Sadly, she did not live to see it open to the public (1910), as she died in 1906, aged 57. She left an estate valued at £329,808 12s 8d (2022 economic power, £375m). She had no issue.

Her nomination form was signed by Sir W. A. Herdman, F. D. Goodman, W. C. Carruthers, H. G. Seeley and B. D. Jackson.

Mrs Mary Anne Stebbing FLS (11 September 1845–21 January 1927)

Mrs Stebbing was born Mary Anne Saunders to William W. Saunders FRS FLS FZS (Treasurer of the Society, 1861–1873) and his second wife, Mary Anne Mello. Her family was scientific: her father

founded the Holmesdale Natural History Club (1857) and collected the Coleoptera, the Lepidoptera, the Diptera and the Hymenoptera published on his collections, *viz.* the *Insecta Saundersiana* and the *Refugium Botanicum*, each published for over 20 years. Her brothers George S. Saunders FRS FLS FES and Edward Saunders FRS were also entomologists. She married the Rev. Thomas R. R. Stebbing FRS FLS (1835–1926) in 1867, already a keen botanist and scientific illustrator. Her husband was a zoologist with an interest in the Crustacea and worked as a teacher and clergyman (ordained into the Church of England aged 24)—they ran a boarding school near Torquay. The Rev. Stebbing was influenced by William Pengelly FRS FGS, and became an avid supporter of Darwin after reading Darwin (1859), resulting in his publishing several popular essays on ‘Darwinism’—he was then banned by the Church from preaching! He produced monographs on Amphipoda collected during the HMS *Challenger* expedition (1872–1876) and on the Cumacea, to which Mrs Stebbings contributed, but not in her own name (Shteir & Lightman 2006).

The Rev. Stebbing was elected as a Fellow of the Linnean Society (1895) and the Royal Society (1896), winning the Linnean Medal (1908) and actively campaigned for admission of female Fellows; he obtained the supplementary Royal Charter that permitted female Fellows (1904). Mrs Stebbing and her husband were both ‘erased’ from the 1905 painting by James Sant CVO RA, showing the first female Fellows around the dais in the Meeting Room (right centre foreground facing left, Fig 1). Frank Crisp (husband of Catherine) commissioned this at a cost of £300 (2022 economic power, £363,900). Crisp wrote in 1905 to Benjamin Daydon Jackson, the Society’s Secretary, enraged that Mrs Stebbing took centre stage: ‘if I pay £300 for a picture I should prefer that another Fellow’s wife should not be the selected figure’ and ‘we must surely have at the table a lady fellow who has done something [...] not one without a record’. Newspapers were negative about the painting—*The World* found it ‘rendered comic by the figure of Mrs Stebbing’. Crisp withheld it from the Society and it was not until his death (1919) that Lady Crisp gifted it to us, albeit altered, having erased both Stebbings. This overpainting was probably undertaken by the son of James Sant, and their outline can sometimes still be seen if the angle of light is right.

Her nomination form was signed by B. D. Jackson, D. H. Scott, W. A. Herdman, H. G. Seeley, the Rev T. R. R. Stebbing (her husband), and G. Saunders.

Miss Emma Louisa Turner FLS MBOU (9 June 1866–13 August 1940)

Miss Turner (Fig 6) was the youngest of five children born to John Turner (a high-end grocer and draper) and Emma Overy (a farmer’s daughter). There were no scientists in Emma’s family, but she was privately educated and taught some science (Haines 2001). Her life before 1900 is somewhat obscure, but she comments (Turner 1924) that prior to c. 1912, she needed to be ‘within easy reach of [her family] home’. As her mother died when Turner was 13, she had to undertake a maternal role in her father’s household. She discovered photography in 1900 after meeting Richard Kearton (1862–1928), then dedicated her life to photography and study of birds in



Fig 6. Miss Emma Louise Turner FLS. From a cabinet print by Maul & Fox of Piccadilly, accessioned 17 February 1908 (Linnean Society ref. PP/T/20). Photographer’s reference is 232544.

East Anglia. Her book *Broadland Birds* (Turner 1924) is a delightful autobiography of her life on what is now known as Turner's Island, and the myriad avine friends she made, each of which she describes as though a family member. Her actual family have now deposited her archives with the British Trust for Ornithology. A new biography by Parry and Greenwood (2020) has just been published, which included first-hand accounts of her, from her great nieces. The BBC Radio 4 series *Nature* in 2012 dedicated an episode to her work, 'Emma Turner; a life in the reeds', which is available online.

Her nomination form was signed by B. D. Jackson, W. A. Herdman, the Rev T. R. R. Stebbing, G. S. Boulger and G. Saunders.

Dr Lilian Jane Veley FLS (19 February 1861–2 December 1936)

Shown in Fig 1, Dr Veley was daughter of Katherine E. Gould and the Rev. John N. Gould. Educated at Somerville College, Oxford on a scholarship (E. B. Poulton was her advisor), she was awarded a First Class B.A. in Natural Sciences (animal morphology) in 1894. Whilst at Oxford, her first research papers had been on butterfly larvae and amoeba.

Shortly after, she married Victor H. Veley (1856–1933) in 1895. She was awarded her DSc from Trinity College Dublin in 1905 (Lilian was a 'steamboat lady'—a group of several hundred women scholars from Oxford and Cambridge who travelled to Trinity College by steamboat to be examined for doctorates that former institutions would not award to women at that time). On marriage she became Director of the Braddow Brewery Co., Essex and a microbiologist of alcoholic beverages, with papers in *Nature*, including work on organisms living in rum, as well as a book on the latter (Veley & Veley 1898). She was one of the first to breed Siamese cats in Europe and co-founded Siamese Cat Club (1901). Her brother, Edward B. Gould (1847–1916), was Consul in Siam and brought two cats back in 1884; the first in the UK. Photos of her cats are in the National Archives.

Miss Ellen Ann Willmott (19 August 1858–27 September 1934)

Miss Willmott was an avid—some would say obsessive—gardener. She lived at Warley Place, Essex, the daughter of Frederick Willmott and his wife Ellen. Miss Willmott inherited wealth and transformed the grounds of Warley Place into one of the most famous gardens in the UK, with over 100,000 species of plant! She spent obsessively on propagation, acclimatisation and supporting plant hunting expeditions. Numerous horticultural awards and her landmark book *The genus Rosa* (Willmott & Parsons 1910) recognise her achievements. As she got older, she suffered from a progressive form of dementia and became increasingly eccentric, booby trapping her garden and carrying a gun, paranoid about intruders and thieves. She was arrested for shoplifting at one stage. Her fortune was entirely spent on gardening, eventually dying near-penniless, her hobby having

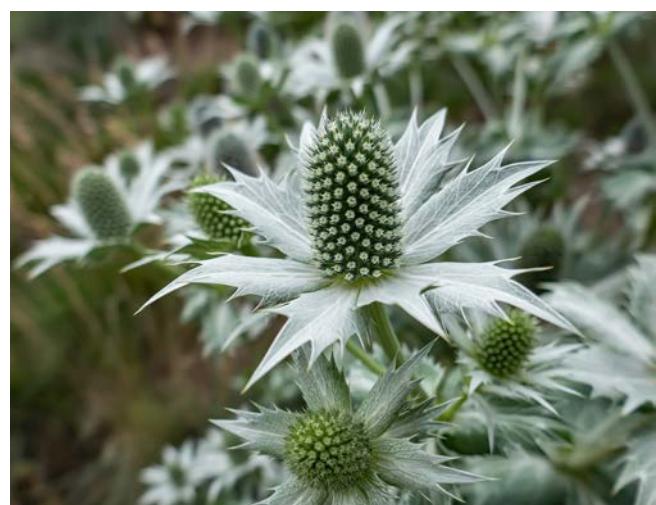


Fig 7. The sea holly species *Eryngium giganteum*, more commonly known as 'Miss Willmott's Ghost'.

become an obsession that consumed her. Eventually, the prickly species *Eryngium giganticum* (Fig 7) would be more commonly known by many as ‘Miss Willmott’s Ghost’, as she would carry the seeds of this plant (which would have been considered somewhat vulgar-looking by the standards at the time) in her pockets and scatter them in other people’s gardens with the intention of disrupting their compositions horticultural!

For a more detailed account of her life, the biography by Le Lievre (1980) is recommended, which was re-published in 2008 with an e-book version available. It contains abundant photographs of Miss Willmott, and details of her life and gardens.

Her nomination form was signed by The Lord Avebury, H. Deuce, Sir J. B. Farmer, F. D. Godman, O. Stapf and F. Crisp.

Dr Rich Boden FLS FRSB FRSA FRMS FZS FHEA

School of Biological and Marine Sciences, University of Plymouth, UK
 Sustainable Earth Institute, University of Plymouth, UK
 Marine Institute, University of Plymouth, UK
 rich.boden@plymouth.ac.uk

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Marian Farquharson and the Struggle for Admission of Women Fellows

In April 1900, women, or rather one woman, began to knock at the [Linnean] Society's door, and the knocking continued, to the embarrassment of the Council, for the next few years until the door was opened.

A Bicentenary History of the Linnean Society of London, Gage & Stearn (1988)

That person was Mrs Farquharson (Fig 1), born Marian Sarah Ridley in 1846, and since 1883 the wife of the 'gentleman agriculturalist', Robert Francis Ogilvie Farquharson, laird of the 4,500-acre Haughton estate at Alford, Aberdeenshire (Fraser-Mackintosh 1898). Her immediate motivation to challenge the Linnean Society of London in 1900 was a resolution agreed the previous year by the Lady Warwick Agricultural Association for Women—that women should have the advantage of full fellowship in scientific and other learned societies, such as the Linnean, the Royal, and the Royal Microscopical. In Marian's 1901 paper, *The Work of Women in Science*, read to the Women's Institute by Mrs Alfred Pollard, Marian summed up the position:

...a woman, because she is a woman, is not eligible for election to the following Societies, which are beyond question centres of science and progress—the Royal, the Linnean, the Royal Geographical, the Royal Astronomical, the Geological, the Chemical, the Quekett, and the London Pathological (Blackburn & Mackenzie 1901).

Marian's resolve to challenge the bastions of male privilege had earlier origins, for in 1885 she was admitted as a Fellow of the Royal Microscopical Society, albeit without having the right to attend meetings; in other words, without the rights of *full* fellowship demanded by Lady Warwick's Association. The outcome only strengthened Marian's resolve.

Marian was determined and, above all, self-confident. She could trace her family history back to Bishop Nicholas Ridley, a Protestant Martyr (1555), whom, she said, 'preferred to suffer death by burning rather than shirk the courage of his opinions'. His was an example she was pleased to follow. The church played a large part in Marian's life. Her father, Nicholas James, was vicar of St Thomas', East Woodhay, near Newbury in Berkshire (Ayres 2017). Both his brothers were also clergymen. In later life, Marian was to confront not only scientific societies, but certain Presbyterian and Church of Scotland ministers on subjects such as baptismal regeneration and the historical Christ.

Marian's father is among those in the first list of members of the Newbury District Field Club (NDFC), published in 1870–1871 when Marian was approximately 24 years old. What is known is that in 1881, aged 35, Marian was able to publish *A Pocket Guide to British Ferns* (Ridley 1881). If not guided by her father, she may have been inspired by another member of the NDFC, Henry Reeks FLS, whose

Fig 1. The Society holds this carte de visite of Farquharson (Linnean Society ref: PP-F-3), photographed by Elliott & Fry, 55 Baker St in London. The carte de visite was given to the Society by Henry N. Ridley of the British Museum in 1938.

...a woman, because
she is a woman,
is not eligible for
election...



paper, 'A list of flowering plants, ferns and mosses observed in the parish of East Woodhay' was published in the first volume of the NDFC's *Transactions* (Reeks 1870–1871).

Marian was dogged by ill health throughout her life. Her ambition as a young woman was to study for a degree in music (Royle 1904). Illness forced her to abandon her studies in London and return to East Woodhay, where she turned her energy to a healthy outdoor pursuit, the study of ferns. Later in her life, she and her husband would settle in Hampshire, escaping the more rigorous Scottish winters. As her health often rendered her unfit for travel, several of her papers for meetings were read on her behalf by others. As life went on, she was reduced to staying at home, communicating with friends, societies, and newspapers by letter (she wrote more than 140 letters to the Aberdeen newspapers).

Botanical interest...and a shattering blow

To return to a younger Marian: in October 1881, she was elected a member of the Essex Field Club, presenting to the Club's reference library an album of 38 herbarium sheets of British ferns. As she entered her forties, and married life in Aberdeenshire, Marian was still an active field botanist, now sharing her husband's interest in desmids. *Dodidium farquharsonii* was named in his honour by its discoverer, John Roy, who stated that he was 'greatly indebted' to Mr Farquharson and 'his accomplished wife...for collections of Desmid material from all parts of the country', though much of it, he noted, was from the South of England where they latterly spent their winters (Roy 1890). Marian joined the Alford Field Club and East of Scotland Union of Naturalists' Societies, and it was not long before she was publishing 'Notes on mosses of the north of Scotland' (Farquharson 1885–1886) and 'Ferns and mosses of the Alford district' (Farquharson 1889–1890). In September 1885 she presented a paper, 'The identification of British mosses', to the annual meeting of the British Association for the Advancement of Science (BAAS), held that year in Aberdeen (Farquharson 1886).

After seven happy years of marriage, Marian suffered a shattering blow in May 1890 when her husband died of influenza. He was 66 years old; she was only 43. As well as losing her husband, she lost her home, Haughton House, and all its happy associations, for ownership passed to her step-daughter, Miss Maria Ogilvie Farquharson (Fraser-Mackintosh 1898). Well provided for, and in love with Scotland, she moved to Meigle, in Perthshire, and later to Kincardine O'Neil, 16 miles from Alford (Royle 1904). Her botanical interests continued—a likely diversion from the sorrows of widowhood—for in the next three years she conducted a lively correspondence with Edward Morrell Holmes FLS, an expert on algae and mosses (GB-110/235, Archives of Linnean Society).

Auspicious connections

There is a gap in our knowledge of the next few years of Marian's life. In 1899, however, she was not only submitting a paper supporting the key resolution of Lady Warwick's Agricultural Association for Women, but she was delivering a paper, read for her by Lady Marjorie Gordon, on the subject of 'Work for Women in the Biological Sciences', to The International Congress of Women held in London from 26 June–7 July (Farquharson 1899). How had she managed to get herself into that position? There are a few clues.

Marian's husband had been a deputy Lord Lieutenant of Aberdeenshire, mixing socially with the Lord Lieutenant and his wife, Lady Aberdeen (Ishbel Hamilton-Gordon, Fig 2). Lady Aberdeen was the President of the International Council of Women, under whose auspices the 1899 Congress was organised. Marian was related to Lady Aberdeen through Lady Aberdeen's sister, Mary Georgina, who was married to Marian's distant relative, Matthew White Ridley, the 1st Viscount Ridley (Ayres 2017).

The Congress was remarkable for the attention it paid to the sciences, possibly deriving from Lady Aberdeen's familiarity with the leading scientists of the day, most of whom she had met as the wife of the Governor General of Canada, and as a hostess when the British Association for the Advancement of Science had visited Toronto in 1897 (Higgitt & Withers 2008). (She was also the first woman in Canada to receive an honorary degree from Queen's University in 1897.) Other contributors to the Biological Sciences section of the Congress' published report were Grace Frankland and Ethel Sargent, both future Fellows of the Linnean Society: FLS. The section devoted to the physical sciences was led by Hertha Ayrton (née Marks), the first woman to be nominated (unsuccessfully) for Fellowship of the Royal Society.

The Women's Congress was one important indicator that women were becoming more organised, and less patient with their position in scientific society. At the Linnean Society, women had effected minor breaches of male defensive positions, as summarised in Table 1.

Men holding paid positions in universities, such as Francis Darwin and Harry Marshall Ward in Cambridge, or museums, such as William Carruthers at the then British Museum, Natural History (BMNH), were increasingly prepared to utilise women as research assistants—though in the cases of Annie Lorrain Smith and Ethel Barton the BMNH's rules meant they had to be paid through unofficial routes.

Table 1: Women present at General Meetings of the Linnean Society (from Gage & Stearn 1988)

1887	Anna Bateson hears Francis Darwin read their joint paper on geotropism
1890	Ethel Barton and Annie L. Smith hear their paper read
1898	Ethel Barton demonstrates her own paper and brings a female friend
	Elizabeth Dale hears Harry Marshall Ward read their joint paper about a rare Somaliland plant
	Henry John Elwes brings two female guests to a meeting
1901	Ethel Barton and Annie L. Smith attend without a link to paper being read
	Mrs Farquharson is refused permission to attend along with two female guests, Grace Frankland (a future Fellow) and Clara Whitmore



Fig 2. Ishbel Hamilton-Gordon, Lady Aberdeen (image accessioned to the New York Public Library c. 1900, The Miriam and Ira D. Wallach Division of Art, Prints and Photographs: Print Collection).

A bittersweet victory

Marian's first approaches to the Linnean Society—and to the Royal Society—made in 1900 were thus a product of their time. She was, nevertheless, taking the lead, prepared to be the focus of male dissent. On 18 April 1900, she petitioned the societies that suitably qualified women should be eligible for election for full fellowship. If elected there should be no restriction on their attendance at meetings. She did not mention women's right to use the libraries and reference collections, although she did explain that she was not asking for eligibility to 'Executive posts in your Society' (Gage & Stearn 1988).

The Royal Society spent some time considering Marian's petition, consulted its lawyers, and then refused her petition. The Linnean Society responded quickly, pointing out that her petition should have been submitted through one of its Fellows, so in June she did exactly what was asked, submitting her proposals via Lord Avebury FRS FLS. There then followed, over many months, a mixture of procrastination and rejection, neither of which daunted Marian. The Linnean Society's case for excluding women rested on the fact that its original Charter of 1802—drawn up at a time when women in Britain had no legal status—used only the masculine pronoun 'he'. Her persistence paid off. On 15 January 1903, a Special Meeting approved by 54 votes 'for' to 17 'against' a motion that a Supplementary Charter and Bye-Laws should be drawn up incorporating the key words, 'without distinction of sex' (Marsden 2003). The proposal was put to the meeting by the Rev T. R. R. Stebbing and seconded by Professor J. Reynolds Green. Another year was spent writing the Supplementary Charter but finally, on 8 April 1904, it was ready for approval by Council. After revisions to the Bye-Laws had been approved on 3 November, the names of 16 potential women Fellows were presented for ballot on 17 November 1904. From among those 16, only Marian was refused Fellowship.

Making good use of connections

An examination of the men Marian involved in her struggle during the previous four years reveals much about how she was ultimately successful in making the general case for women fellows, while making herself unacceptable.

In submitting her initial petition via Lord Avebury (formerly Sir John Lubbock), Marian was doing what any successful tactician would do, exploiting her connections. The 70-year-old Avebury was not only a Past President of the Linnean (1881–1886), Fellow of the Royal Society, and member of the Essex Field Club, the ex-MP was still an influential Liberal politician who had worked with Lords Farrer and Hobhouse, both of whom were related to Marian (and present at her wedding reception)—all three men had an interest in improving the legal rights of women (Ayres 2017). Lord Farrer FLS had served as vice-chairman of London County Council when Avebury was its chair. Among Avebury's many friends was Sir Dudley Coutts Majoribanks (1st Baron Tweedmouth), father of Ishbel, Lady Aberdeen. Marian's Certificate of Recommendation for Fellowship was signed by another Liberal peer, Lord Ripon, formerly Sir ME Grant Duff, a President of the Royal Geographical Society (RGS).

Marian's approach to the Linnean Society received support when, in November 1900, Professor Marcus Hartog FLS of University College, Cork in Ireland wrote to the Society supporting the admission of women and urging the Linnean to revise its Charter. Hartog was well aware of what women could offer to science, as his cousin was the forementioned Hertha Ayrton, who had been brought up in the Hartog household after Hertha's own family had fallen on hard times. Whether Hartog's letter to the Linnean was prompted by Marian remains a fascinating possibility, but what is certain is that she maintained pressure on the Society. In April 1901 she directed her requests to

Council via Frederick DuCane Godman and George Bond Howes (the Zoological Secretary) both seen as sympathetic to her arguments. Marian appended to her request a list of 23 supporters which included three lords, five knights, eight professors, a reverend, a doctor, and just five with the plain title ‘Mr’. While strengthening the case for women Fellows, it probably did little to endear her to ordinary ‘rank and file’ Fellows of the Linnean. It was at this time that the Society refused Marian’s plea that she and two other women should be able to attend one of its meetings (Table 1).

Signs that resistance might be crumbling came when Joseph Reynolds Green (another sympathiser) resubmitted her petition in December 1901, adding that ‘a considerable number of Fellows favoured it’. When challenged to show the names, Green responded within a month, providing a list which caused Council to reconsider its opposition, a course which led Council to agree to revise its Charter 12 months later (Gage & Stearn 1988).

In addition to Lords Avebury and Ripon, Marian’s Certificate of Recommendation was signed by Michael Foster, Joseph Reynolds Green, William Carmichael McIntosh and Henry John Elwes, each thereby defining himself as a supporter of the woman as well as the cause.

Newly retired from the Chair of Physiology at Cambridge University, and now a Liberal Unionist MP representing the University of London (in succession to Lord Avebury), Foster had spent most of his working life building what became known as the Cambridge School of (Animal) Physiology. A student of Foster’s was Green, who while at Cambridge studied also under the plant physiologist Sydney Vines—one of the many young Cambridge staff to receive intellectual and practical support from Foster (Geison 1978). In later life, Green was appointed Professor of Botany at the Royal Pharmaceutical Society where Marian’s friend, E. M. Holmes, taught *materia medica*, so plugging a gap in Green’s expertise. If Green did not know Marian personally, he could have learned much about her from his colleague, Holmes. Vines was President of the Linnean during the most critical period (May 1900–May 1904), although illness prevented him chairing the meeting of 15 January 1903 which agreed to the writing of a new Charter (Marsden 2003). The impression left by Vines is one of nervously cautious support.

One man who definitely did know Marian in person was William Carmichael McIntosh, zoologist and Professor of Natural History at St Andrews University. The two were on cordial personal terms. On 1 August 1902, after lunch at Marian’s home, McIntosh had addressed a meeting of the Scottish Association for the Promotion of Women’s Public Work, which had been founded by Marian in that year (Anonymous 1902; *Aberdeen Journal*, 28 March 1902, p. 7). The first secretary of the Association was Maria Ogilvie-Gordon (Lindy Moore, pers.comm.), one of the first group of female Fellows. It was clearly a movement McIntosh was happy to support.

Marian’s last backer was Henry John Elwes, a botanist, entomologist and horticulturist. Elwes was a great traveller, often with his friend and brother-in-law Frederick DuCane Godman. He had proven his sympathy with women’s involvement in the Linnean’s activities when, in December 1898, he had introduced two ladies to one of the Society’s meetings at which they could hear him ‘discourse on the flora and fauna of the Altai mountains’, which he had recently visited (Table 1) (Gage & Stearn 1988).

Why was she rejected?

If enough Fellows of the Linnean supported the cause of women’s membership—as proved to be the case—and Marian had such illustrious backers as the six men above, why was her own candidature was rejected? Were her scientific credentials not sufficient, or was she personally objectionable?

Marian's list of publications was short and her papers were descriptive rather than analytical, but some of the women admitted at this time had as their only recommendation the fact that they were married to an Officer of the Society, as in the cases of Catherine Crisp and Constance Sladen, or, as with Marianne Silver, the daughter of a longstanding Fellow. A weakness may have been that Marian had never collaborated with any of the leading botanical FLS of the day, such as D. H. Scott at the Jodrell Laboratory, Royal Botanic Gardens, Kew (RBG Kew), or F. W. Oliver at University College, London (UCL). She was also not part of the small coterie which involved those men and the future Fellows Margaret Benson, Emily Berridge, Ethel Sargent, and Helen Gwynne-Vaughan. These facts would, however, not seem to be reason to alienate many of the male Fellows. It seems more likely that she upset them in other ways.

She could be forthright in her views. The abstract of her address to the 1885 meeting of the BAAS shows her criticising Dr Robert Braithwaite's *British Moss-Flora*, which to modern eyes is a work of scholarship, judged against which her own field guide is lightweight:

...no one who commenced the study of this order of Cryptogamia can have failed to experience difficulty in the earlier stage of his [Braithwaite's] work. Without wishing to depreciate the several valuable works on this subject, I have noticed the absence of any work which deals with the distinctive characters of moss, apart from those of a general nature. I feel sure the want is much felt by young students (Farquharson 1886).

She associated herself with men from the 'Establishment', lords, knights, and senior professors, something which may have distanced her from ordinary members of the Linnean Society. She was always proud to sign herself, 'Mrs Farquharson of Haughton FRMS', and word would have spread about her connections with Lady Aberdeen and the Countess of Warwick, all potentially leaving the impression of a woman who was both proud and haughty. What is odd, and part of Marian's enigma, is that most of the 'great and the good' who supported her (and women's rights in general) were of a Liberal persuasion, whereas the Ridleys were traditionally Conservative, several having served as MPs.

Although an anonymous obituarist described Marian as, 'loveable, kind-hearted, unselfish, tolerant, broad-minded, generous, and sincere' (Anonymous 1912), her own step-daughter did not concur. She asked readers of the *Aberdeen Free Press* of 11 December 1903 not to hold her responsible for letters signed 'Mrs Farquharson of Haughton':

I have to submit to a good deal of inconvenience and annoyance through the sayings and doings of a lady who, in letters to the press, ...subscribes herself 'Marian S. Farquharson of Haughton' without having the smallest right to the designation. As my name so closely resembles Mrs Farquharson's (not of Haughton), I find myself sometimes credited with peculiar views about things...which I in no way share.

Maria O. Farquharson of Haughton

How was it that Marian's reputation, whether justified or not, was known within and beyond the Linnean? E. M. Holmes may have been a conduit, but a more likely candidate was W. C. McIntosh's brother-in-law, Albert Günther (Keeper of Zoology at the BMNH, 1875–1895, and President of the Linnean Society, 1896–1900). McIntosh may have knowingly, or unknowingly, described Mrs Farquharson's social connections and attitudes in faraway Aberdeenshire. Günther is significant because he helped arrange finances for Mary Kingsley, the celebrated explorer of West Africa. When in 1899 a number of women, seemingly led by Marian, made a bid to join the Royal Geographical Society, Kingsley called the applicants 'shrieking females and androgyns', refusing to



FORM OF RECOMMENDATION

FOR A FELLOW OF THE LINNEAN SOCIETY OF LONDON.

(Mrs.) Marian Sarah Farquharson,
 Tilghurstine, Kincardine O'Neil,
 Aberdeenshire
*a gentlewoman attached to the study of Natural History, especially Pteridology and
 Muscology*

being desirous of becoming a Fellow of the LINNEAN SOCIETY OF LONDON, we, whose names
 are underwritten, beg leave to recommend ~~her~~ to that Honour.

Avebury	Joseph Reynolds Green
Grace C. Frankland	E. M. Holmes
Catherine Crisp.	E. Willmott

This recommendation must be signed by Three or more Fellows.

N.B.—The Christian name of the Candidate must be stated at length, as well as his Residence, and
 any special qualifications he may possess.

This Certificate was read at a General Meeting of the Society, on the 6th day of February
 The Ballot will take place on the 5th day of March 1908.

Writing to John Scott Keltie,
 Secretary of the RGS, Kingsley
 described Marian as, 'a
 dangerous female...I am
 terrified of her' (Blunt 1994).

Perhaps most telling of all was the reaction of two normally warm, kind, tolerant people to the news that the Linnean had rejected Marian. D. H. Scott, Botanical Secretary of the Linnean, wrote coldly in his diary for Thursday 15 December 1904, '15 ladies elected. Mrs Farquharson rejected, 31 for 19 against' (Diaries of D. H. Scott, Archives of RBG Kew). Ethel Sargent, who was to be an immediate beneficiary of Marian's efforts, admitted to her young protégée Agnes Robertson (the future Agnes Arber FRS), 'I couldn't help rejoicing in Mrs F's non-election. It would be disastrous if they felt bound to elect every woman put up' (Letter of 20 December 1904, Archives of Girton College, Cambridge).

Sadly, Marian did not endear herself to her peers. Other women were able to enjoy the Linnean's celebrations marking the first female Fellows, but she was left out. That was until 1908 when attitudes had changed and she was finally offered a Fellowship. Her Certificate was again signed by Lord Avebury and Joseph Reynolds Green. E. M. Holmes supported her as, fittingly, did three of the women who had been the beneficiaries of her efforts—Catherine Crisp, Grace Frankland and Ellen Willmott. But Marian's health had deteriorated further. Twice she had to ask Council to postpone the date when she might attend a meeting at which she could sign the Declaration that would

Fig 3. Farquharson's second, and successful, Certificate of Recommendation from 1908, signed by Lord Avebury, Joseph Reynolds Green and Grace Frankland.

formalise her Fellowship. She visited Nice in France in the hope that its gentler Mediterranean climate would restore her health. It did not, and she died there on 20 April 1912, a Fellowship of the Linnean Society having eluded her to the very end.

Peter G. Ayres
ayres44@btinternet.com

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Ethel Sargent (1863–1918)

Independent botanical researcher and mentor of Agnes Arber

Ethel Sargent was born on 23 October 1863 at 45 Regent's Park Road, London, into an affluent family of intellectuals. The third youngest of eight children, she was the only scientist. Indeed, her brother Sir Charles Henry Sargent became Lord Justice of Appeal, while her brother Francis created the Florence Nightingale memorial in Lower Regent Street. She never had to earn a living, but was selfless in caring for her mother, Catherine Emma, and sister, Maudie, the latter described by Agnes Arber (née Robertson) as one 'whose mind had never fully developed' and 'had to be cared for like a child' (Arber 1926). Agnes Arber (1879–1960), eminent botanist and philosopher (48th female Fellow of the Linnean Society in 1908 and the third woman—the first botanist—to become a Fellow of the Royal Society), is mentioned here because Sargent had recognised her potential as a schoolgirl at the North London Collegiate for Girls (Sargent's own alma mater). Sargent was immensely proud of her protégée, and subsequently even more so as someone who became her scientific equal.¹ She described her feelings as maternal, while not aiming 'to being your mother-in-law', and eventually felt 'grandmotherly'. This account will rely heavily on her own words,² having had access to a remarkable series of 411 letters (now archived in Girton College, a gift from Arber's descendants), written to Arber from 1897 to a month before her death (Fig 1). Such

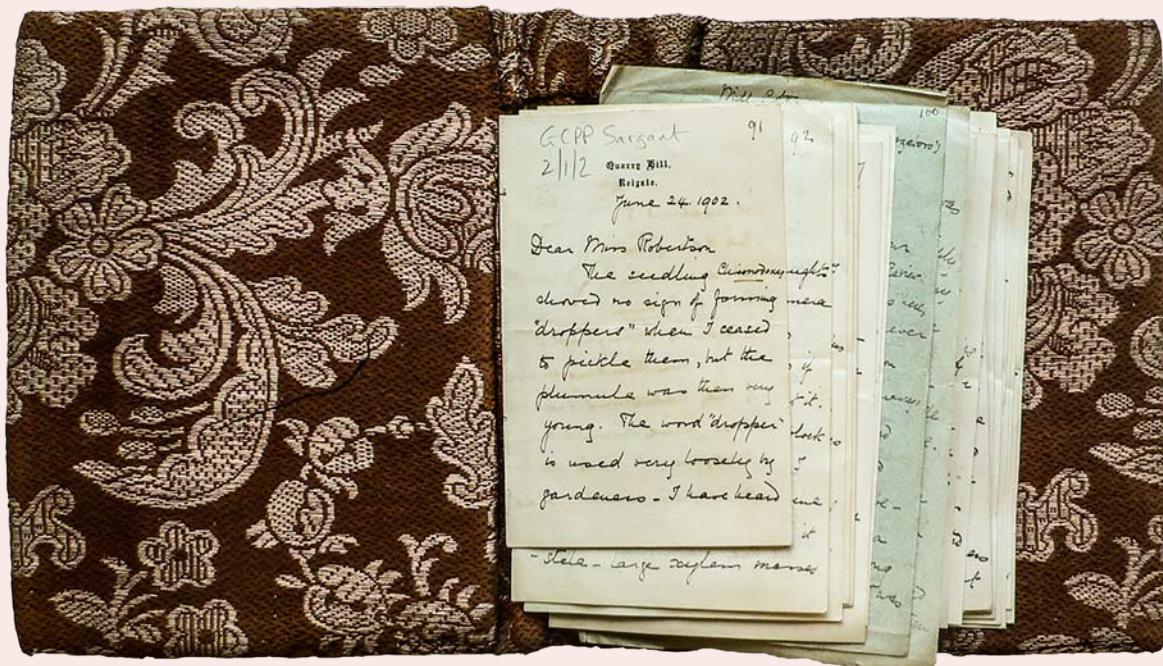


Fig 1. An example of Sargent's letters to Agnes Arber (née Robertson), held at Girton College, Cambridge.

1 She is commemorated with an English Heritage blue plaque at 9 Elsworthy Terrace, Primrose Hill, London, NW3 3DR (London Borough of Camden).

2 The numbers in brackets refer to those on the letters in the Girton College archive (year: letter no.).

one-sided correspondence resulted from Sargent's vow 'to rarely keep letters, never any which are at all confidential'. When tidying up her study, she mentioned packaging 'systematically "done" letters', labelling most packets to be destroyed by her executors (1903: 115). These letters provide unprecedented insights seldom available to a biographer, revealing her great sense of humour, her enjoyment of her family, her passion for botanical work and her love of the arts, including paintings and particularly poetry. Many of the letters include discussions of the form and content of sonnets, with assessments of her favourite poets.

Sargent (Fig 2) entered Girton College in 1881, among the first cohort of women permitted to attend lectures and practicals at the University of Cambridge, although at the discretion of teachers, who cited overcrowding to prevent them. They were allowed to try and be assessed in the University's tripos examinations, gaining a certificate. She wrote that 'science is abominably neglected at Girton', 'the lecturers deplorable', 'the laboratory is a howling wilderness' and 'I say nothing about the time wasted in by Girtonians on the road to and from Cambridge' (1898: 13). She later wrote, 'But when we turn from the purely intellectual to the education standpoint, the advantages of Girton are conspicuous' (1898: 14). Indeed, while advising Agnes Arber on her selection of subjects on entering Newnham College, Cambridge, she queried her choice of geology as a second subject, writing that 'I look on my Physical training as the greatest gain of my life at Girton' (1898: 30).

She did not excel academically, leaving in 1885 with a Class II in Pt I and Class III in Pt II. Agnes Arber attributed this to family distractions and, given Ethel's financial circumstances, to an absence of the necessity to pursue a paid career. Sargent herself later celebrated this freedom because it allowed concentration on her research and that teaching/demonstrating would have been a great distraction, paralysing her facility for original work. Apart from occasional lectures to clubs and societies, her teaching was confined to a series of lectures on angiosperm origins at University College London (UCL) in 1907.

Ethel Sargent and botany

She became a very proficient microscopist and cytologist, preparing her own material via hand sectioning and microtoming, possibly the first to apply the latter technique on plant material. Seven years after leaving Cambridge, she spent a year (1892–1893) at the Jodrell Laboratory at the Royal Botanic Gardens, Kew, where she received her only formal research training in methodology and techniques, under the direction of eminent botanist and palaeobotanist, Dukinfield Henry Scott (D. H. Scott), first Keeper of the Jodrell, and with whom she co-authored a paper entitled 'On the pitchers of *Dischidia rafflesiana* (Wall.)' in the *Annals of Botany* (1893); her first of 17 papers (see bibliography). She also collaborated with his wife, Rina, and became a life-long friend of the family.

On leaving Kew, she set up what Arber described as 'an almost perfect laboratory' in the grounds of her mother's home at Quarry Hill, Reigate, and named it 'Jodrell Junior'. What the neighbours thought of this very respectable lady is not difficult to imagine, especially as there are reports of unannounced visits by excise inspectors who were not convinced that her still was used to produce distilled water, and not illicit spirits. Later appreciating that her family's demands would limit the amount of time she was able to spend there, she employed assistants, most notably Miss Ethel N. M. Thomas FLS from 1897–1901, and Agnes Robertson (later Arber). (Agnes was particularly appreciative of this financial support, being in her 'gap year' between her undergraduate studies at Cambridge and postgraduate studies at UCL (£100 in 1902–1903, equivalent to around £8,000 today and approximately what a skilled craftsman would have earned for c. 300 days' work)). Sargent initially studied nuclear division in the Turk's cap lily, *Lilium martagon* before concentrating on the process of fertilisation, the results being published in four papers (1895–1897). She wrote of the



Fig 2. Portrait of Sargent by F. E. Jackson, held at Girton College, Cambridge.

earlier (sections cut free-hand with a blade) and realised that they demonstrated the sequence. She wrote to Arber saying, ‘a slide which I possess has suddenly become very famous’ and ‘I missed a splendid chance four years ago and all this fuss comes to writing myself down an ASS in large gold letters’ (1898: 33). She would later give a talk and demonstration at the Royal Society that confirmed the validity of the process to the community, recorded in the *Proceedings of the Royal Society* (1899–1900).

Problems with eyesight may have made her move to a new area of previously understudied research, that of monocot seedling developmental morphology and anatomy. In the intervening years after leaving Girton, she studied vasculature in flowers, but never published. She subsequently developed a theory on the early evolution of the flowering plants, based on her hypothesis that the single seed leaf (cotyledon) of the monocotyledons was formed by fusion of the two seed leaves in the dicotyledons. This led to the inference that the dicots evolved before the monocots, thus overturning the then-conventional theory of flowering plant evolution. The results were published in a series of four papers between 1903–1908. Her previous mentor Scott considered her 1903 paper as one of the ‘most valuable contributions’ published in the *Annals of Botany*.

frustration of persuading her mother’s gardener to plant the lilies in rows rather than clumps, until she told him to consider them vegetables.

In 1897, she had travelled in Europe with a friend, another founder female Fellow of the Linnean Society, Margaret Benson (1859–1936). They met Eduard Strasburger (1844–1912), the most eminent European botanist of the day, in Bonn. Soon after there was great excitement in the global botanical community following the demonstration of double fertilisation, where one male gamete fuses with the egg, eventually forming the embryo, and the other a diploid nucleus, which later divides to form endosperm—a process that links all flowering plants. The discovery had been made independently by a Frenchman, Léon Guignard (1852–1928), and a Russian, Sergei Navaschin (1857–1930), but there remained some scepticism, particularly in the UK. Sargent revisited some hand sections she had made

Sargant was very apprehensive about adverse reactions to her ideas, and her letters list their supporters, antagonists and fora (e.g. the Linnean Society of London and British Association annual meetings), where debate occurred. As Arber had forecast, they are no longer accepted, but have provided reliable, detailed data that subsequently fuelled debate. Indeed, this scientific rigour was the cornerstone of her activity. Throughout her letters we find comments on her philosophy, and guidance (particularly on drawing) to Arber. She was insistent that independence was the essence of research commenting, ‘before attempting to solve a difficulty make sure the difficulty really exists, keep copious notes (think of Charles Darwin!)’, and ‘remember that 20 days of drudgery will be followed by one of true joy’, and so on. The greatest tribute to her research comes from Arber herself in the preface to *Monocotyledons: A morphological study* (1925)—the book that they had intended to write together, but was dedicated to Sargant after her death:

I received from her a training for which no gratitude can be adequate. That my study of monocotyledons has led me to depart fundamentally from the views she herself advocated is a result she would have welcomed; she was keenly alive to the fact that scientific hypotheses have in their nature no pretensions to permanence and that they should be judged by their capacity for bringing to light further generalisations to which in turn they yield their place. To work with Ethel Sargant was to realise the pursuit of science as an unending adventure of the mind.

Sargant and the Linnean Society

Sargant first mentioned the Society in November 1903, although she was clearly aware of the earlier ‘debates’. She wrote, ‘I wonder if I shall be able to add FLS to my name ... the wheels of that society seem to move slowly. Heaven help that they may keep to the time path’ (1904: 157). Sometime later, she wrote of Mrs Marian Farquharson that she ‘couldn’t help rejoicing in Mrs F’s non-election, it would be disastrous if they felt bound to elect every woman put up’...a rather strange comment given that Farquharson had done more lobbying than anyone in the struggle to elect women to the Society.

Sargant became the first woman elected to the Society’s Council (1906–1910) and attended as often as she could obtain a ‘mother-sitter’. At her first meeting, she described the president, Sir William Abbott Herdman (1858–1924), as an ‘almost ideal chairman’ in having the ‘grace of simplicity and does the right thing not from “savoir faire” or what people call that but from sheer humanity’ (1906). For reasons unknown, Arber was against this role. Sargant wrote, ‘I daren’t ask for congratulations on my nomination to the Linnean Council from one of your principles’ (1906: 202, Fig 3) and later: ‘I attended my first Council Meeting and enjoyed it. As you foretold the atmosphere was pure 18th Century—that is the moral and emotional atmosphere. The physical air can hardly date from earlier than 1870 or so, and intellectually we were quite late in XIXth century.’ D. H. Scott was also a member of Council, serving as Botanical Secretary, and surprised Sargant by ‘his lightning act of disappearance more like Harlequin at the pantomime rather than a steady going scientific gent [the convention of the day when the individual’s paper was being discussed] and reappearance. I was reminded of games at a children’s party. Everyone was friendly and no fuss was made’ (1906: 209).

During this time on Council she became increasingly uncomfortable with such meetings. In 1900, she wrote that ‘on neutral ground I have always found the attitude of scientific man most generous to women workers. We cannot but regret that we are so often excluded from the stimulus of comradeship’. With this in mind, she was against the establishment of all-women scientific clubs writing that it would be a mistake to establish women-only clubs just as the men were coming round (1903: 117): ‘The Linnaean (sic) will be open about Xmas I believe, and I wd emphasise the bond between all workers—sex apart—in the same subject team between a certain nos of

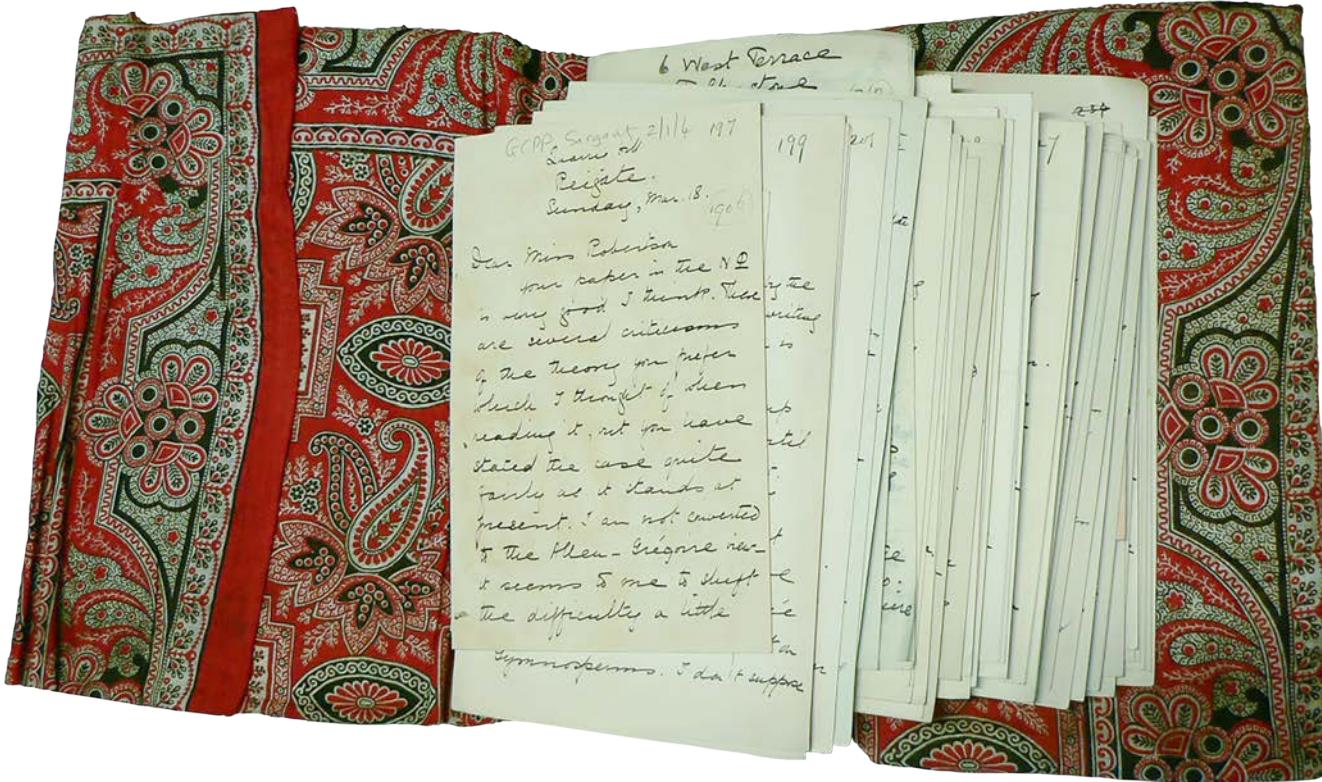


Fig 3. This particular set of letters from Sargent to Agnes Arber date from the period in which Sargent became the first woman to be elected to the Council of the Linnean Society (1906).

workers in allied subjects merely because they are women.' She was later, to her dismay, placed on a subcommittee for an evening reception (clearly seen as a woman's job), protesting that they couldn't have chosen someone less suitable to the task than her: 'I must try to disguise my ignorance.'

Later, at a time of increasing pressure (due to the illnesses of her mother and Maudie), she wrote that 'I dread meeting acquaintances now. The Linnean Council are different: no-one knows me at home but DHS [D. H. Scott] who is all consideration and by avoiding the tea table I can escape anything but business' (1909: 256). An exception was her regard for Arber's future husband, as 'somehow I don't mind M'r Arber'. On their engagement, she wrote, 'My blessing is yours. It is not often that anyone can congratulate both parties in an engagement with equal sincerity, but I can this time...his luck impresses me more than yours!' (1907: 236).

In 1908, she offered Arber life membership of the Linnean Society as a wedding present, and it was accepted. She wrote 'You are a perfect brick to take my wedding present. A gift takes two people, just as the truth does' (1908: 243) and in 1908 there was considerable discussion on the credentials of potential supporters on the nomination certificate form and the choice of these 'godparents'. However, according to D. H. Scott, there was no problem: 'Certificates generally get filled up by kindly members of Council who plant their names down on blank spaces—...plus ça change.'

In an earlier letter to Arber, instead of her customary 'Dear Miss Robertson', she wrote 'Dear Agnes. I use the address conditionally on your calling me Ethel in return. I have never consented to a one-sided arrangement except with children.' However, the letter ended with her usual 'Yours ever, Ethel Sargent'.

Sargent and women's franchise

Sargent and Arber disagreed on three major issues: religion, Ethel's war work and women's suffrage. Although both supported women's equal rights and opportunities—when her assistant in 'Jodrell Junior', Arber was paid the same as a man in similar position—Agnes was bitterly opposed to women's suffrage, leading Sargent to describe her as 'retrograde'. However, Ethel was not a radical, feeling the time was right for at least partial franchise. In a long letter she wrote, 'If I shd hold the casting vote ... I should not hesitate to give it [property qualification] for the enfranchisement of women at the same terms' (1809: 241). She might have been influenced by her unconventional elder sister, Mary Sargent Florence (1857–1954), an artist specialising in frescoes. (Following a visit to her home, Arber described Mary as wearing loose clothing and sandals, with amber hair tied in a loose knot and possessing 'murals on the kitchen wall'.) Mary had co-authored a book *Militarism and Feminism* (1915) and was a well-known suffragist. In 1905, Sargent wrote that 'they [women] have too much freedom now to be safe without the steady influence of responsibility' (1905: 187) and soon afterwards 'I do not think that women's franchise can be proposed much later' (1905: 187). She resented that women's views were usually reported by men—'sometimes a benevolent guardianship'.

For Ethel, the next steps would be enfranchisement of married women without means, provided that their husbands were qualified, and those with property. In considering the possibility of universal suffrage, she favoured votes for educated women, and for mothers who, as 'guiding spirits of families', were better placed to give an opinion on policy than their husbands. After moving to Tunbridge Wells in 1909, she had the opportunity to become more active, because the town hosted one of the most vibrant of 17 branches that emerged from the London Society for Women's Suffrage. Dedicated to peaceful, non-confrontational approaches, their members were mainly middle- and upper-class property-owning women. In December 1910, on polling day, Sargent wrote to Arber that she was helping the 'Suffr-g-Society' by sitting 'at the receipt of custom in the shop this afternoon', ending 'All this last paragraph in a whisper—you needn't hear it unless you choose!' (1910: 277).

1909–1912: 'How little I am mistress of my time'

In 1909, following the death of her sister Alice, the family moved to a smaller house in Tunbridge Wells. This necessitated the closure of 'Jodrell Junior' and the transfer of 'books and bottles' to a new laboratory adjoining a sitting room. Botanical activity was sporadic due to the illnesses and subsequent deaths of her sister Maudie in 1910 and mother only a year later in 1911. This led her to writing 'all botanical things seem very far off as if I had been interested in a former life' (1909: 257) and 'how little I am mistress of my time' (1909: 266). However she managed to make occasional visits to Girton College and Cambridge, and made plans to return there, using Arber as an estate agent. In 1909, Agnes, having married E. A. Newell Arber, had set up home on the Huntingdon Road and in 1912, Ethel purchased the Old Rectory in Girton village just a couple of miles away. She was offered a bench in the Botany School by Professor Seward, and resumed her research at home_. In 1913, she was awarded an honorary Fellowship at Girton College and elected as President of Section K of the British Association, the first woman President in any section. Her penultimate publication was her Presidential address: *The development of botanical embryology since 1870*. It is most appropriate that her final publication, comparing morphologies of grass embryos and seedlings, was published in 1915 with Agnes Arber.

Final years in Cambridge and London

At the Old Rectory, the largest room became her study and an adjoining room, a lab. She first kept chickens in the grounds, then a cow, Barbara, and eventually a pony, Pixie. These and her accounts—but not the typing—were initially looked after by a Miss Insull. Although now living in relatively close proximity, Ethel's correspondence with Agnes continued, referring to the heretics

along the road. Agnes' agnosticism was one of the major areas on which they agreed to differ. In a tribute to Sargent, delivered sometime after her death (Arber 1927), Agnes commented that in later years her, 'Christian beliefs touched with mysticism played a greater part in her life'. She regarded it as lying altogether outside the province of scientific thought. Her Christian compassion was very evident in her poetry, an extract from which is reproduced here:

Holy week 1915

So nature smiles, while women desolate
 Here on this hillside count the heavy days
 While further off the shattered homestead's blaze
 While men kill men, and glorify their hate
 Dear Lord in human hearts Thou couldn't reign
 Did we not feel that Thou hast-suffered pain

Ethel's and Agnes's differences came to light in discussions over the future education of the Arbers' daughter, Muriel Agnes Arber (1913–2004; palaeontologist), because they wished to avoid the early traditional Christian upbringing that both Agnes and Ethel had experienced. However, they consented to Muriel's christening in St Andrew's Parish Church in Girton and a reception at the Old Rectory, hosted by Ethel, who had agreed to be a godmother. She was delighted to have been given 'a little bit of anything so precious' (Muriel was one of four godchildren mentioned in her will). With tongue in cheek, Ethel wrote 'Godmothers, of course, never spoil their godchildren, but carry them to hear sermons' (1913: 314). To the contrary, she took great interest in Muriel who visited her frequently with her nurse, and enjoyed her eggs, butter and milk (sold at 3D a quart if collected or 4D if delivered to the door either by omnibus or the trap pulled by Pixie). Such happy days in Cambridge were marred by the outbreak of World War 1, and Sargent was determined to become involved. Agnes felt that this was a risk too far but was admonished by her friend for continuing with research at that time. So, in 1915–1916 she went to London (leaving a Miss Scott to look after her small holding) and embarked on producing *The Register*—a list of University women who could make a contribution to the war effort. She wrote 'I was prepared if necessary to risk wrecking my health for the rest of my life in order to carry it out'. Her efforts were recognised when she was elected President of the Federation of University Women for 1918. Although cared for by her brother Charlie, she was often physically incapacitated, leading to an angry Agnes chiding her for a foolhardiness and abandoning her botanical interest. Sargent returned to Cambridge, her vitality at a low ebb, but following reconciliation with Agnes, they continued to correspond and were contemplating further botanical collaboration (1917: 408). This subject occupied her final letter (16 December 1917: 411), written just weeks before she died in Sidmouth on 18 January 1918, while on a family holiday.

Epitaph

As early as 1901, Sargent wrote an article in *The Girton Review* entitled 'The Inheritance of a University'. Although concentrating on the advancement of women's education at Cambridge, her conclusions were generic and still have resonance today. They extolled the value of universities in the education of good citizens, both in the workplace and at home, and in their role in learning for learning's sake—being the 'guardians of a great tradition the temples in which was kept alive the sacred flame of scholarship'. She then cautioned 'if we continue to train successive generations to look on a good place in class lists as the only end of University teaching, we shall justly be considered as money changers in the Temple'. She was also concerned that, particularly in women's colleges, lecturers, when paid only for their teaching, should have sufficient 'leisure' for research. To counteract this and emphasise the importance of endowment, she and a number of colleagues contributed to a fund for studentships. After her death, her colleagues and friends initiated the

Ethel Sargent Studentship for research in Natural Sciences (especially in botany), more recently extended to Ethel Sargent research fellowships. It is an enormous pleasure to report that the initial year of botanist Irene Manton's (1904–1988) postgraduate research in Stockholm—the first woman President of the Linnean Society—was made possible by the fund, and the author of this paper—the Society's second woman President—was allowed to take the third year stipend of her Ethel Sargent research fellowship to Cardiff, thus facilitating the start of her long career there.

Professor Dianne Edwards CBE FRS, Past President of the Linnean Society (2012–2015)

Research Professor, School of Earth and Environmental Sciences, Cardiff University

edwardsd2@cardiff.ac.uk

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Marie Charlotte Carmichael Stopes (15 October 1880–2 October 1958)

In a list of ‘Our favourite Britons’ (Cooper 2002), Marie Stopes stood at number 100, where she was described as ‘Palaeobotanist; pioneer and advocate of birth control; Scottish born Edinburgh (1880–1958)’. With some 50 papers and books on fossil plants (mostly as sole author), Stopes published over 70 other works, chiefly books and pamphlets on sociology (e.g. contraception), but also poetry, plays, one travelogue and a film script. Stopes was superlative: first woman to obtain a joint BSc (Hons) in University of London after two years; first female PhD in botany at University of Munich; youngest DSc in the UK; first female lecturer in science at Victoria University, Manchester; first female western scientist to visit Japan; and the first woman to set up a birth-control clinic in the British Empire.

Born in Edinburgh, at age 13 she moved to Norwood, London SE27; aside from a year’s doctoral research in Munich and two in Japan, she lived mostly in Hampstead, London NW3, plus lodgings in Manchester, and finally at Norbury Park near Leatherhead, Surrey. Biographers point to her parents for influences on her character and she described herself as ‘a child of the British Association’ [for Advancement of Science]; her parents met in 1876 at its Annual Meeting. Henry Stopes, engineer and architect, was an amateur palaeoanthropologist and Marie helped him work on flints and Plio-Pleistocene fossils (Stopes 1912b); he died a week after Marie graduated in 1902. Her mother, née Charlotte Carmichael, was a Shakespeare scholar and suffragist. Charlotte encouraged Marie’s education and instilled women’s rights in her. At North London Collegiate School for Girls, Marie’s headmistress encouraged Marie to study chemistry. In 1900 Marie applied to University College London (UCL), being accepted for BSc. in botany with zoology. She was taught by ecologist A. G. Tansley (Boulter 2017), palaeobotanist D. H. Scott (Andrews 1980) and anatomist F. W. Oliver, who Rose (1992) called ‘Marie’s fatherly mentor’. Tansley instilled in her the value of fieldwork; three of her early papers are on living plant ecology (Stopes 1903, 1907, Stopes & Hewitt 1909). She hastened graduation by also registering at Birkbeck College, London, studying geology in evenings; she achieved first class honours (plus a Gold Medal) in botany, and a third in geology. Funding for what would have been her third undergraduate year (i.e. 1902–1903) was used to research Carboniferous plants, supervised at UCL by Oliver and by Scott, Honorary Keeper of the Jodrell Laboratory, Royal Botanic Gardens, Kew.

Industrious years

The year 1903 saw a major advance in palaeobotany (Pearson 2005, Falcon-Lang 2008c)—recognition of seed ferns (pteridosperms) by Oliver and Scott. Stopes observed cupular glands found on the ovule *Lagenostoma lomaxii* Oliver & Scott and stems of *Lyginopteris oldhamia* (Binney) H. Potonié; she drew five figures for Plate 10 in Oliver & Scott (1904). This, plus three papers she published in 1903 (references in Chaloner 2005) earned her funding to research gymnosperm ovules and seeds at Munich’s Botanical Institute under Radelkofer and Göbel. She telescoped time needed for her PhD, defending and publishing her doctoral thesis in 1904. F. E. Weiss FLS, Professor of Botany at Manchester, made her Assistant Lecturer and Demonstrator in Botany, a post she held 1904–1907. In these industrious years, Stopes got the London DSc., clarified archegonial physiology in gymnosperms (Stopes 1905), introduced Captain R. F. Scott (of the Antarctic) to



Fig 1. A ‘cabinet print’ of Stopes from the Society’s collections, taken by photographers Maull and Fox on London’s Piccadilly. Photographer’s reference: 236667, taken in 1911, when Stopes was 31.

1910a) and attended conferences in Canada and USA, using plant adpressions to age the ‘Fern Ledges’ fossil flora of St John, New Brunswick, as Carboniferous. Making useful contacts in America (Chaloner 1995), some 40 years later she claimed, ‘I did myself find Coal Balls in America, and before Noé, but like so many things I have [done], I never published about them’ (Andrews 1980).

From Manchester back to UCL

An offer in May 1910 of a fellowship with research facilities at UCL led Stopes to leave her Manchester post November 1910; Watson (2005) reported on both jobs Stopes held at Manchester. She took up additional offers of work: she lectured on palaeobotany to female students at Bedford College, London (Audus 2001), and catalogued Mesozoic plants at the British Museum (Natural History) [BM(NH)—now the Natural History Museum, London, or NHM] to support the three

palaeobotany, lectured to the 1905 International Botanical Congress at Vienna and visited Lancashire coal mines to research (with D. M. S. Watson) permineralisations of Carboniferous plants called coal balls (Stopes 1906a, b). Around 1905, Stopes (Fig 1) began work on Mesozoic plants; she visited Lignier at Caen, France (Rose 1992) and found Jurassic plants at Brora, Scotland (Stopes 1907, Falcon-Lang 2008a). She published her first elementary textbook on botany (Stopes 1906c). In July 1907 she quit Manchester to work with Professor K. Fujii on Japanese permineralised plants relating to that perennial issue in palaeobotany, Darwin’s ‘abominable mystery’ of the origin of angiosperms. They collected a monocotyledonous fruit and other plants of Upper Cretaceous age, plus fossil insects (Rose 1992). Her insects, NHM; I13771-4 from Shiobara are Tertiary (Stopes 1910c).

In May 1909, Stopes was re-appointed at Manchester as Lecturer in Fossil Botany. She wrote up the Japanese fossils, published a textbook (Stopes

graduates then in its Geology Dept. (Stopes 1913, 1916). Stearn (1981) states Stopes got on well with Keeper of Geology, Sir A. S. Woodward, and his wife (their tablecloth embroidered with Stopes's signature is framed and displayed at the NHM). Her inaugural UCL lecture, August 1913, looked at the history and future of palaeobotany; demand for coal rose to its peak during the First World War and Stopes emphasised its applied aspects (Lessing 1959). She called for international cooperation between fossil botanists, e.g. to share and record new or revised names of plant fossils; in a pre-digital age, her idea for universal card indices of names was prescient (Stopes 1914). She supported the collection of over 15,000 specimens of Coal Measures plant fossils from S. Wales now held at the National Museum of Wales, Cardiff (Thomas 1986). Stopes remained at UCL until 1920, but her work at BM(NH)/NHM and wartime employment at a coal laboratory of the Department of Scientific & Industrial Research resulted in two major aspects of her scientific career.

Stopes described five British permineralised angiosperm woods, then all considered of Lower Cretaceous age (Stopes 1910b, 1912a). Her assertion that some them were 'like quite highly placed Angiosperms in all their details' was challenged by Thomas (1959), and Chaloner (2005) explains some of their ages are queried. Of these, Crawley (2001) considered *Aptiana radiata* Stopes Lower Cretaceous, three others as Tertiary and her *Woburnia porosa* of uncertain age, under its junior synonym *Dipterocarpoxylon porosum* (Stopes) Kräusel. Stratigraphical definitions have changed since 1912 and Scott (2018) overstated uncertainties of provenance and age for her museum specimens.

The first and last palaeobotanical papers by Stopes (1903, 1951) dealt with plants in Carboniferous coal; she began work with coal chemist R. V. Wheeler in 1916 and this continued after the War. Scott (2018) explains they examined coals as petrologists scrutinise rocks in thin section. Stopes (1935) coined coal terms—'maceral' for the physicochemically distinct components of coals—and she defined four categories: clarain, durain, fusain and vitrain (Stopes 1951).

Elected to Fellowship of the Linnean Society

Stopes did not rank in the first tranche of women to become FLS in December 1904 (Gage & Stearn 1988), but was elected on 18 March 1909 and admitted on 1 April that year. Her sponsors were: F. W. Oliver, F. E. Weiss (later a President of the Linnean Society, or PLS), E. A. N. Arber (Palaeozoic plant researcher at Cambridge), F. E. Fritsch (phytologist and subsequent PLS) and E. N. Thomas. Stopes (1920) published one of her papers in a Linnean Society journal: her account of the permineralised Cretaceous bennettitalean stem she named *Bennettites scottii*; now *Cycadeoidea scottii* (Stopes) Wieland. This type material was a rare instance of a fossil plant stem with both leaves and pollen organs in attachment. However, Dr H. H. Thomas PPLS (1959) stated that she 'took a real interest in the Society until a short time before her death'. As Chaloner (1985) recalled, Stopes refused to accept that charcoal was preserved as fusain. Chaloner recalled:

One of her last public appearances, when she spoke before a scientific audience, was at a Linnean Society meeting in 1957 in which T. M. Harris defended the fire origin of fusain. He wrote ... she opposed my revival of the old fire theory with vigour and in a pleasant voice. If I could have talked it over [with her] I doubt if we would have got far, because we were thirty years out of phase... (Chaloner 1995).

Chaloner told me (pers.com.) Stopes visited him at UCL in 1957/8; she was interested to see plant fossils that she had used herself to teach botany there some forty years earlier. These, plus letters, photographs and notes for teaching and research are at the NHM, South Kensington (Cleevely 1983); further Stopes letters are at the Linnean Society Library.

Thank you for your letter of the 8th. You may rest assured that I would not think of using your rooms for propaganda: as you yourself will perceive they are not big enough for that! The lecture is to be purely technical, on human aspects of physiology.

Fig 2. After inquiring into the use of one of the Society's rooms for a medical lecture on human biology, namely 'the technique of contraception', the then-Secretary of the Society Spencer Savage responded that it was not the custom for the rooms to be used 'for propaganda' but that he recognised this was not Stopes's intention. She humourously replied: 'You may rest assured that I would not think of using your rooms for propaganda: as you yourself will perceive they are not big enough for that!'

What of her botanical legacy?

Over 60 years since her death, how does posterity assess the biological career of Marie Stopes? Her four textbooks (Stopes 1906c, 1910a, 1911, 1919) popularised botany; her publications on contraception and sexual equality (plus her fictions) outnumber her palaeobotanical papers. Biographers and obituarists of Stopes speak volumes on her life too: Andrews (1980), Anon. (1958), Begbie (1927), Brett (1958), Chaloner (1958, 1995, 2005, 2008), Desmond (1977), Eaton & Warnick (1977), Falcon-Lang (2008b, d, e), Falcon-Lang & Miller (2007), Fraser & Cleal (2007), Haines (2001), L. A. Hall (2004), R. Hall (1977), Lessing (1959), Maude (1924), Pontolillo (1996), Rose (1992), Thomas (1959), J. Timson (1980), Tomkeyer & Yoblokov (1959), DMS Watson (1959) and J. Watson (2005). A 1935 survey of American academics ranked *Married Love* (Stopes 1918) below *Das Kapital* but above *Mein Kampf* in their 25 most influential books of 1885–1935 (Hall 1977). What led to her fall in ratings from 1935 to 2002? Falcon-Lang (2008a) criticised palaeobotanical predictions by Stopes that she termed 'geoprophesy' (Maude 1924). Boulter (2017) praised her work in fossil botany, but commented on her support of eugenics; Stopes was influenced by genetic ideas and philosophies of the Malthusian League and Eugenics Society. This produced tumult not only in her public life but in her domestic affairs too. The Second World War and current, much more progressive views, cast critical light upon that moral stance. While these critiques are most certainly valid, one might also consider the wider aspects of her personal, emotional and professional life to avoid imbalanced criticism of the advances Stopes made at a time when women in academia were rarities and in geology 'almost an impropriety' (Chaloner 1959).

Amongst contemporaneous female palaeobotanists, Eleanor Reid FLS and Margaret Benson FLS published less than Stopes, with narrower stratigraphic interests. The outputs of Emily Dix and the Belgian Suzanne Leclercq bear closer comparison to Stopes, but their foci were essentially Palaeozoic. Stopes & Watson (1908) remains in bibliographies and her coal maceral terms are still in use. Notwithstanding her critics, Stopes (1912a) stimulated research worldwide on Lower Cretaceous angiosperms. One wonders how many of today's palaeobotanists will have their papers referenced to the same extent as those by Stopes a century after their publication.

Hugh Pearson FLS

hlpearson1833@gmail.com

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A Continuing Legacy



Making the Taxonomic Effort

Acknowledging female role models in botanical and mycological taxonomy

Research shows that fostering a diverse community of people leads to excellence in the field (Powell 2018). However, it can be difficult to find and celebrate representatives of diverse groups of people in many fields because of a lack of available information on those individuals—and even of their existence. Role models for women have been shown to be important in encouraging women to stay in STEM fields (Benjamin *et al.* 2011). Collecting and publishing data on gender representation in STEM is also encouraged as a way to confront gender bias (Grogan 2018). As custodians of plant name databases and women in science ourselves, we set out to uncover female role models for ourselves and others in our profession. Many scientists, and members of the public, can name numerous famous male biologists such as Linnaeus, Darwin or Humboldt but struggle to come up with names of their female counterparts.

The availability of comprehensive information on nomenclature, taxonomy and authorship for botanical and mycological names has historically been high. Publications listing plant names such as *Index Kewensis* (Jackson 1895) and Harvard University Herbarium's Grey Card Index (1984–2000, later combined with the Australian Plant Names Index (2019) into the International Plant Name Index, IPNI 2019a) and mycological compilations such as the catalogues of Saccardo (1882–1931) and later the *Index of Fungi* (1940–2014) gave access to data on taxon names and their authors for over 100 years. The IPNI author database includes authors of fungal names as well as authors of fossil, bryophyte, fern and algal names, and is the *de facto* standard for author standard forms as mentioned in the Code of Nomenclature for plants, algae and fungi (Turland *et al.* 2018). Yet even when author names are cited (in academic papers or after plant names), the use of initials and abbreviations may mask the true contribution of female authors to taxonomic research worldwide and over time. The name *Solanum cheesemanii* Geras. honours the entomologist Evelyn Cheesman and may have accidentally been given a male Latin epithet ending after the author assumed 'Cheeseman' to be a man (Knapp 2019). One of us is embarrassed to report studying towards a doctorate on a plant group in the family Phyllanthaceae where many species were described by 'Pax & K.Hoffm.' on the assumption they were both male, and not learning until many years later that the influential German botanist Professor Käthe Hoffmann was female.

Our research on women in botany (Lindon *et al.* 2015) using the online database The Plant List (2013) and the Authors of Plant Names (a subset of the IPNI database) discovered that only 3% of land plants named using Linnaean nomenclature had been named by women. The aforementioned Professor Käthe Hoffmann is an author of 1,004 species in IPNI and ranked as the sixth 'most productive' female botanist in our 2015 paper. We were able to determine that the first woman to publish a Linnaean binomial plant name was Elizabeth Blackwell (1707–1758), and that one of the women in the top 10 female publishers of plant names, Dr Charlotte M. Taylor, is continuing to be productive, unlike the top 10 most productive male authors, the most recently active of whom was Friedrich Richard Rudolf Schlechter (1872–1925). This paper updates Lindon *et al.* (2015) for the data in IPNI up to 2018 and expands the study to consider mycological nomenclature and vascular plant classification realignment work (i.e. the publication of new taxonomic combinations of names, as well as new species) over the period between 1931–2018.

We felt there were more stories about unsung female scientists to be uncovered in the area of plant and fungal taxonomy, and we decided to better understand the women who describe new taxa and those who make and publish new combinations of names. These nomenclatural transfers (i.e. the publication of new combinations) can be used as a proxy for taxonomic effort as distinct from descriptive effort (i.e. the publication of new species). We also wanted to determine whether women are coming closer to producing 50% of plant name publications by including the data on new combinations and including the more up-to-date records from the IPNI dataset. For botany as a scientific field, it is estimated that 40% of papers are authored by female authors (Holman *et al.* 2017, above the global average of 30% female academic authorship, Larivière *et al.* 2013), and we wanted to examine whether a similar proportion can be seen in plant nomenclature.

Maroske and May (2018) identified women who described species early on in mycological science. Although serving to highlight many female authors in the field of mycology, the paper did not carry out a quantitative assessment and did not consider the situation after 1900, or those publishing new combinations of names. Plant and fungal names follow the same Code of Nomenclature (Turland *et al.* 2018) and thus are directly comparable. In this paper we take the opportunity to look at women who published new names of fungi and those who published new combinations to see how these compare across the sister disciplines of botanical and mycological science.

Materials and methods

PLANT NAME DATA: In Lindon *et al.* (2015) we discussed some disadvantages of using the Plant List (2013) for our analysis. The Plant List contains some significant gaps including the sunflower family (*Asteraceae*) and potato genus (*Solanum*). Although an update is planned, the data in The Plant List have been static since the last update in 2013, meaning that analysis of more recently published plant names is not possible. IPNI, on the other hand, is actively maintained and curated daily, and has no major taxonomic gaps. The IPNI database was established in 2000 and created by merging three plant name databases: *Australian Plant Names Index* (1991–2000), *Grey Card Index* (1984–2000) and *Index Kewensis* (1895–2002). As a result of the way the data were imported, many of the plant names were triplicated with slight variations in syntax making replicable automated deduplication difficult. Many records also had the publication year stored in the collation field instead of a separate year field, making it difficult to perform time series analysis. Manual deduplication of such a large dataset was not feasible, so we decided not to use IPNI for the 2015 study. At the time, the choice to use The Plant List was made because it contains no duplicate name records and recorded publication years are reliable. Recent improvements in the form of a mass deduplication of the IPNI database (The International Plant Names Index 2019b) and ongoing efforts to add publication years or move these to the correct field means that we now feel confident using that source to look at questions regarding the changes in nomenclature over time. There do remain gaps in the publication year field in IPNI, and in literature from geographical areas such as Russia and China. Our results inevitably reflect these weak areas of coverage in the database, but in the future, as the data are improved and updated, many of these gaps will disappear.

DESCRIBING SPECIES VERSUS CHANGING THE CLASSIFICATION: A new combination is made when a species which has already been described is transferred to another genus. Usually (but not always, for nomenclatural reasons) the new combination name comprises the original species epithet combined with the name of the genus to which the taxon has been moved. This may happen multiple times as taxonomic opinion evolves and new evidence to support or refute relationships is revealed. In the International Code of Nomenclature for algae, fungi, and plants (Turland *et al.* 2018), the author(s) of the original name for the species (termed the basionym) is placed in

parentheses after the new combination binomial, with the author(s) of the new combination name placed outside and after the parenthetical author(s). As a result, the presence of parenthetical authors after a taxon name both indicates that the name is a new combination, but also allows the name to be linked back to that original basionym and its associated literature. Before *Index Kewensis Suppl. 9*, which contains names published between 1931 and 1935, only the publishing authors for that binomial were indicated (Hill 1938), and basionym authors were not given in parentheses. In order to explore the hypothesis that women may be more likely to engage in reclassification of names (i.e. publishing new combinations) than in describing new species, names published after 1931 were downloaded from Supplement 9 of *Index Kewensis* onwards, whereafter new combinations were indicated using parenthetical authors. The chosen dates also reflect the time a consensus on the Code of Botanical Nomenclature came into effect around the world after the Fifth International Botanical Congress held in 1930 in Cambridge, England (Sprague 1936). *The Cambridge Code* published in 1935 put an end to the split between the American Code and the Vienna Code, and simplified the rules around making new combinations (Weatherby 1949), thus the data on new combinations becomes standard and consistent after that date.

FUNGI NAME DATA: Lists of fungal names were historically often included in lists of plant names as fungi were considered part of the plant kingdom (Ainsworth 1976). There were few comprehensive lists of fungal names before Saccardo's *Sylloge Fungorum* (1882–1931), Zahlbrückner's 10 volume *Catalogus Lichenum Universalis* (1922–1940), and other major works since Saccardo including Petrak's Lists (1956) and Lamb (1963). The Index Fungorum (2019) database is based on the *Index of Fungi* (1940–2018) which brings these resources together, and today contains both fungal taxon names and a separate dataset of fungal name authors, which is periodically incorporated into the IPNI Author Database to ensure standardisation of names. Index Fungorum is one of three fungal databases along with Fungal Names (2019) and MycoBank (2019) that support registration of names, a step which is necessary for the valid publication of fungi. The fungal author names are entered as they appear in the publication, not necessarily in a standardised form, followed by an automatic process for converting the author names into their standard form. This can very occasionally lead to linking names to the incorrect author (Paul Kirk pers. comm.) but most names are in the same form as in the IPNI Author Database. All the Index Fungorum names listed as validly published at the rank of species were used in our analysis.

PLANT AND FUNGI NAME AUTHORS: The IPNI Author Database has been updated with 3637 author names entered since the 2013 extract used by Lindon *et al.* (2015), and we also analysed 5,490 names from the mycological database Index Fungorum. Between 2013–2018, around 50 updates were made to the author gender list used in this and the study published in 2015, via personal emails to the authors and other research. All new authors added since the previous study had gender assigned manually, and any outstanding authors with unrecorded gender were updated manually when it was possible to determine their gender with reasonable certainty (for example, for plant name authors personally known to the authors of this paper, or names that could be assigned to a gender with a high certainty based on their first or second names). Please note this study uses binary gender for simplicity as a more complete analysis is not yet possible. Non-English names remain difficult for the authors of this study to assign reliably to the appropriate gender, although improvements have been made to the dataset since the previous study, and as with taxonomic gaps in the data, further iterations of this work in the future will improve this situation. Japanese names were updated from the Wikipedia page on Japanese first names. The authors of each plant name were assigned a proportional score based on the number of authors in every name. For example, names with a single author were counted as one name, but names with two authors counted as 0.5

of a name for each author, etc. The numbers referred to in this paper are therefore not the total number of names published, but a representation of the proportional contribution by each author to the publication of each name. The remainder of the methods follow those described in Lindon *et al.* 2015.

Results and discussion

The results of our analyses are broadly congruent with the conclusions made by Lindon *et al.* (2015) and bring additional insights. While the overall contribution of women to plant and fungal taxonomy is shown to be increasing in both number and percentage of names published (Figs 1–4), women's total contribution over the past century still only accounts for approximately 8% of both plant and fungal names. Between 2011–2018, some 13% of new plant species were described by women (Fig 1). The results for mycology are similar, although somewhat lower, accounting for 8–9% of names in the 2010s, with peaks in the 2000s of up to 11% (Fig 3). Plant and fungal taxonomy figures are much lower than the 40% of scientific papers authored by women for both disciplines (Holman *et al.* 2017), and similarly under the global average of 30% female academic authorship (Larivière *et al.* 2013).

Although it is estimated that there are many more species of fungi than of flowering plants, perhaps as many as six times the number (Cannon *et al.* 2018), there appear to be fewer mycologists working on fungal naming and classification. Out of the 51,962 author records included in the current

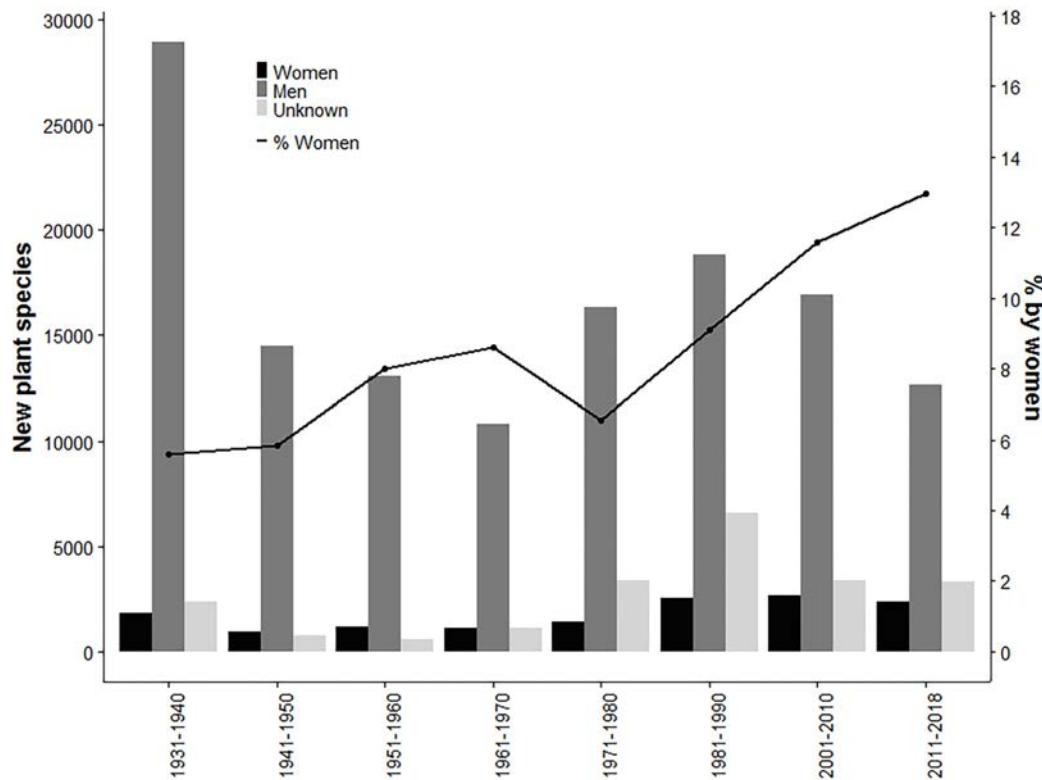


Fig 1. Numbers of new species of plants described in every decade between 1931–2018: by women (black), men (dark grey), and botanists with names not currently assigned to a gender (light grey). The percentage of the total in each decade described by women is also shown (black line).

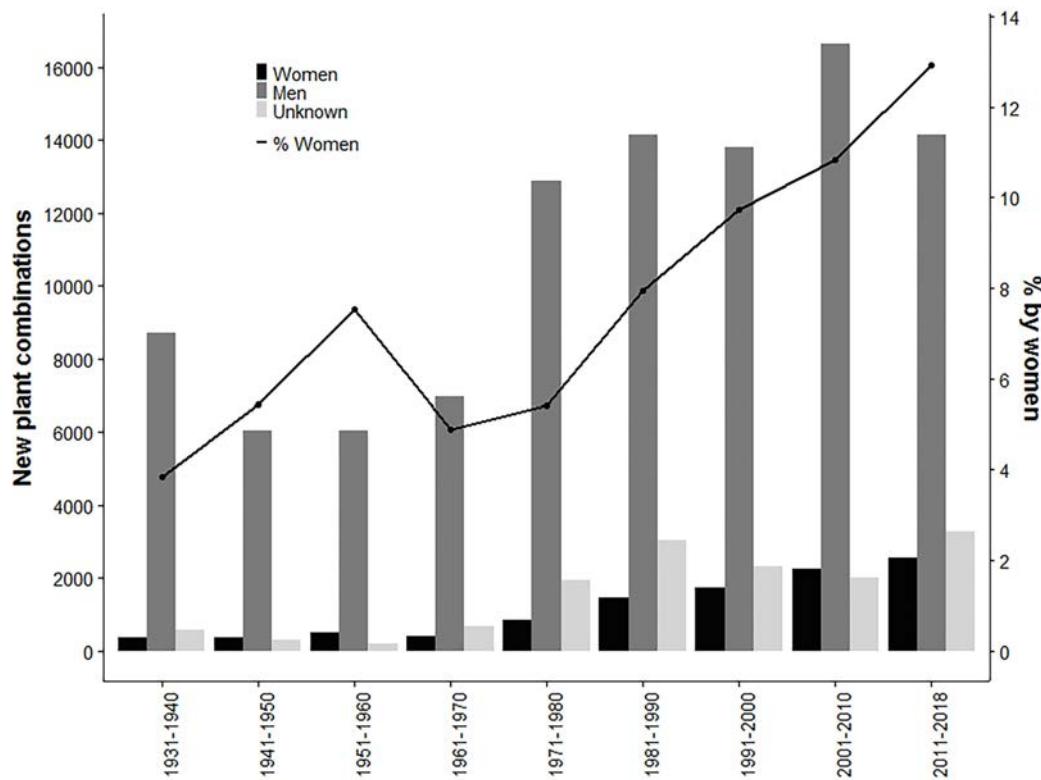


Fig 2. Numbers of new combinations in plants published in every decade between 1931–2018: by women (black), men (dark grey), and botanists with names not currently assigned to a gender (light grey). The percentage of the total in each decade described by women is also shown (black line).

study, 29,526 (57%) were flagged as authors of vascular plant names, whereas just over half this number, only 17,731 (34%), were flagged as mycological authors. Authors of both mycological and vascular plant names accounted for 1,183 records. Of the mycological authors, only 1,615 (9%) were identified as women, whereas there are 3,645 (12%) female authors of vascular plants.

There appears to be little difference in the percentage contribution of women to the slightly different fields of discovering and naming new species versus reassessing their classification and making new taxonomic name combinations. The discovery and description of new species has traditionally taken place following expeditions to new areas, while the refinement of the generic placement typically takes place as part of a dedicated monographic piece of work conducted at a herbarium or other research institution (e.g. Marhold *et al.* 2013). The two types of research are distinct scientific endeavors and often, if not usually, involve different people, under different circumstances, in different locations. Overall during the time period 2011–2018, 18,348 new plant taxa were published, and 19,997 new combinations made, by authors of all genders. Female authors appear to contribute equally to both of these areas (Figs 1 and 2): roughly the same number of new plants were described during this time period by female authors, similar to new combinations made (2,395 plant species and 2,568 new combinations). Over the most recent time period (2011–2018), 10,219 new fungal taxa were published, of which only 905 were authored by women (Fig 3). In contrast to the situation with plant names where a very similar number of new combinations were made as new species described, just 5,800 new combinations of fungal names were made during the same time and of these only 636 were made by women (Fig 4, OVERLEAF).

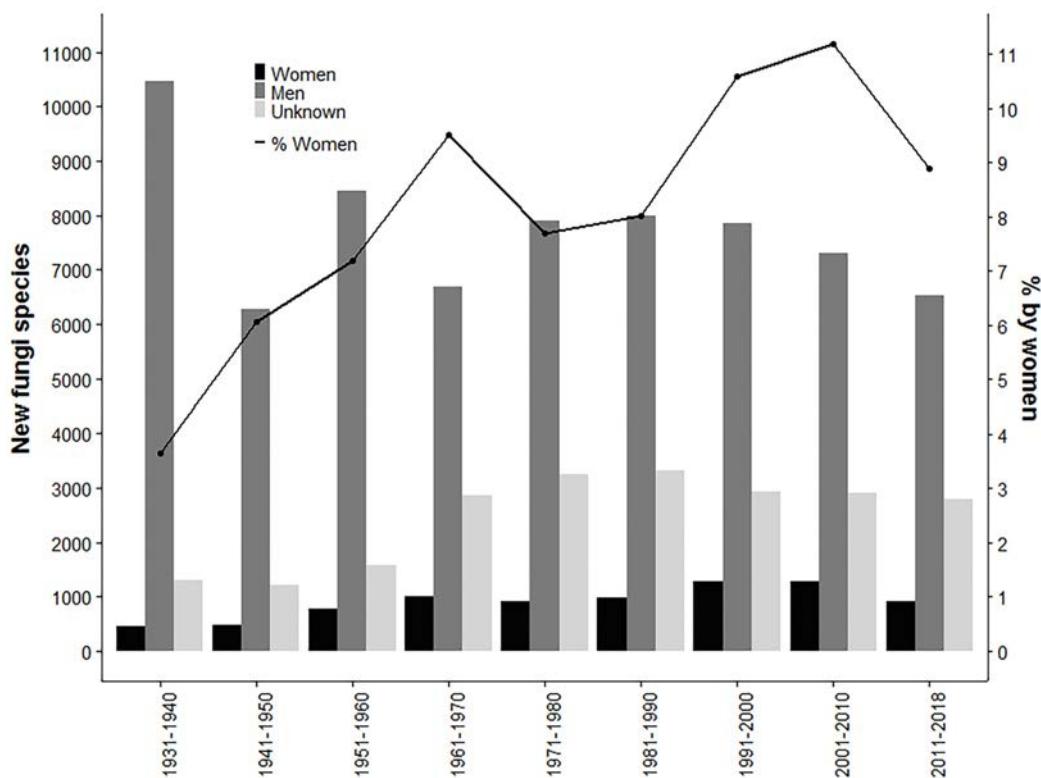


Fig 3. Numbers of new species of fungi described in every decade between 1931–2018: by women (black), men (light grey), and mycologists with names not currently assigned to a gender (light grey). The percentage of the total in each decade described by women is also shown (black line).

Molecular evidence has revolutionised the way fungal taxonomy is practiced (Willis 2018). With an enormous diversity of fungi remaining undescribed, mycologists are still very much in the descriptive phase of their field. Efforts are focused on putting names to the diversity found in nature, and what has already been collected and stored in existing natural history collections, rather than re-assessing and fine-tuning fungal classifications by moving names around and making new combinations. This contrasts with the wider focus on monography and re-classification of plant taxa, with groups often having been originally described one to three centuries ago and, in the light of more recent discoveries and molecular evidence, new combinations more likely to be made now than new species described.

Analysing the IPNI plant name data reveals many of the same women from the 2015 analysis of all names published since 1753, with Harriet Margaret Louisa Bolus (1877–1970) still coming out as the most productive publishing woman, and Charlotte Morley Taylor at the Missouri Botanical Gardens in the top 10. However, including the more recently added names published since 1931 uncovers another female botanist in the top 10, actively publishing today: Ruth Kiew from the Forest Research Institute of Malaysia. Dr Kiew has published mainly in the Begoniaceae, Gesneriaceae and Oleaceae families, among others and is honored in the genus *Kiewia* S.Y.Wong & P.C.Boyce (Low *et al.* 2018).

The results of our analysis of the publication of new species and new combinations for vascular plants between 1931–2018 show that taxonomists in the top 10 ‘most productive’ female category contributed to between 149 and 1,148 new names, and 135 and 370 new combinations each

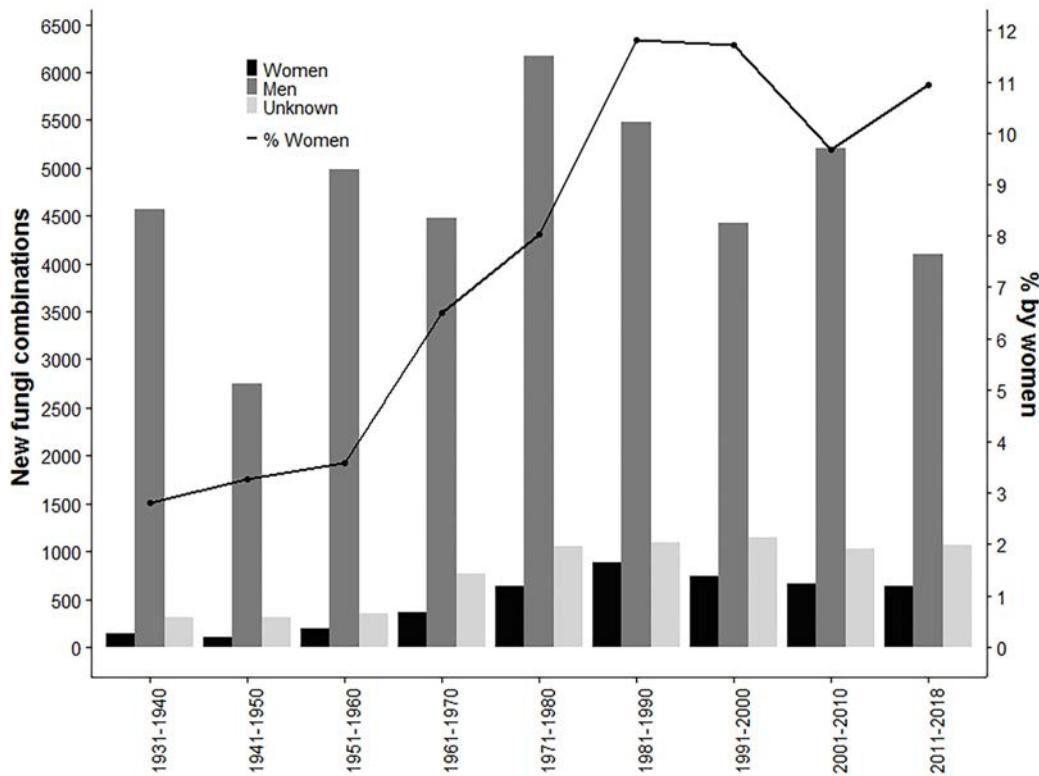


Fig 4. Numbers of new combinations in fungi published in every decade between 1931–2018: by women (black), men (dark grey), and mycologists with names not currently assigned to a gender (light grey). The percentage of the total in each decade described by women is also shown (black line).

(Table 1 and Table 2). In these ‘top 10s’, many of the women highlighted are still actively working and provide us with some inspirational female scientists whose work we can celebrate.

Not only the most prolific currently working female botanist naming new species, Dr Charlotte M. Taylor is also the second most prolific author of new combinations, after Dr Barbara Sydney Parris who studies ferns as the Research Director for the Fern Research Foundation. Dr Lúcia Garcez Lohmann is based at the Department of Botany at the University of São Paulo and Dr Mary Elizabeth Barkworth retired from Utah State University. A number of names appear in both top 10 lists, four for flowering plants and ferns and two for fungi. These include Harriet Margaret Louisa Bolus, Olive Mary Hilliard and Lily May Perry. Interestingly, Heidrun Elsbeth Klara Osterwald Hartmann is the fifth most prolific author of new combinations, but only contributed the equivalent of 37 new taxa and does not appear in the top 10 list for new species.

Three female mycologists on the top 10 list for publishing new fungal names are thought to be still active today: Cheryl A. Grgurinovic, Urmila V. Makhija, and Marcela Eugenia da Silva Cáceres (Table 3, OVERLEAF), and five from the top 10 list for making new fungal name combinations: Amy Y. Rossman, Ana Crespo, Bettina Staiger, Annemieke T. Verbeken, and Karen K. Nakasone (Table 4, OVERLEAF). The rest of the women recorded in these lists had careers from across the 1800s through to the 2010s. As with women in plant taxonomy, the early female mycologists are likely to have faced considerable social barriers in their quest for scientific knowledge and community recognition, but determination and useful connections helped a number to contribute to the field. Born in the late-18th century, one of the earliest female mycologists, Marie-Anne Libert (1782–1865), is also one of the most prolific female mycological authors to date (Maroske *et al.* 2018).

Table 1. Female authors of new species of plants published between 1931–2018. Numbers in brackets are years of birth and death. Top 10 according to the number of species published and recorded in this study. An asterisk denotes women who contributed a statement to this paper.

AUTHOR NAME	NUMBER OF NAMES
Harriet Margaret Louisa Bolus (1877–1970)	1,148
Olive Mary Hilliard (1925–2022)	522
Lily May Perry (1895–1992)	422
Charlotte Morley Taylor (1955–*)	409 (422 in Sep 2021)
Aimée Antoinette Camus (1879–1965)	272
Alice Eastwood (1859–1953)	230
Marie Laure Tardieu (1902–1998)	190
Ruth Kiew (1946–*)	166
Barbara Lynette Rye (1952–*)	157
Susan (Holmes) Carter (1933–*)	149

Table 2. Female authors of new combinations in plants published between 1931–2018. Top 10 according to the number of names published and recorded in this study. Women whose names are printed in bold did not appear on the top 10 for new plant species (Table 1). An asterisk denotes women who contributed a statement to this paper.

AUTHOR NAME	NUMBER OF NAMES
Barbara Sydney Parris (1945–*)	370
Charlotte Morley Taylor (1955–*)	262
Harriet Margaret Louisa Bolus (1877–1970)	249
Heidrun Elsbeth Klara Osterwald Hartmann (1942–2016)	199
Lúcia Garcez Lohmann (1973–*)	187
Olive Mary Hilliard (1925–2022)	176
Lily May Perry (1895–1992)	157
Mary Elizabeth Barkworth (1941–*)	151
Hanna Bogna Margońska (1968–)	139
Rosemary Margaret Smith (1933–2004)	135

with 184 new names. Currently, the Mycological Society of America has a Diversity Committee (Mycological Society of America 2019) working towards ensuring that the field is open and accessible to all.

This study set out to uncover female role models who fit a narrow and somewhat artificial set of criteria: having formally published new names or combinations. There are of course numerous women working in this area of science who we do not mention, but who are nevertheless inspiring and important. Women from diversity rich countries, particularly in the southern hemisphere, face

Table 3. Female authors of new species of fungi, top 10 according to the number of species published between 1931–2018. For women without bibliographic data the year they first published a species is shown (fl. = flourished, which is the first year a name publication is recorded; this is used when the year of birth is not known). An asterisk denotes women who contributed a statement to this paper.

AUTHOR NAME	NUMBER OF NAMES
Ethel Mary Doidge (1887–1965)	392
Marie-Anne Libert (1782–1865)	184
Margaret Elizabeth Barr (1923–2008)	182
Annie Lorrain Smith (1854–1937)	161
Greta Barbara Stevenson (1911–1990)	151
Cheryl A. Grgurinovic (1953–*)	142
Aino Marjatta Henssen (1925–2011)	137
Elsie Maud Wakefield (1886–1972)	134
Urmila V. Makhija (1950–)	116
Marcela Eugenia da Silva Cáceres (fl. 1999)	114

Table 4. Female authors of new combinations in fungi, top 10 according to the number of names published between 1931–2018. Women whose names are printed in bold did not also appear on the top 10 for new plant names (Table 1). An asterisk denotes women who contributed a statement to this paper.

AUTHOR NAME	NUMBER OF NAMES
Margaret Elizabeth Barr (1923–2008)	511
Amy Y. Rossman (1946–*)	211
Annie Lorrain Smith (1854–1937)	164
Isabelle Irene Tavares (1921–2011)	146
Marcelle Louise Fernande Le Gal (1895–1979)	95
Ana Crespo (1948–)	92
Larissa N. Vassiljeva (fl. 1950–1976)	90
Bettina Staiger (fl. 1995)	90
Annemieke T. Verbeken (1970–)	80
Karen K. Nakasone (1953–)	77

additional barriers to research and publication that preclude them from being recognised by our criteria. For example, in order to describe a new plant species from Madagascar new collections must be compared to the largest repository of Malagasy plant type specimens at Muséum National d'Histoire Naturelle, Paris: Malagasy researchers who are not able to travel to France or to consult suitable digitised images of specimens are often effectively unable to describe new species, a situation which is even more likely to present a barrier to female researchers, who are more likely to have childcare responsibilities.

Conclusions

Since 1931, women's contributions to naming plants and fungi have increased steadily but still represent only 8% of the total effort in that time period. This is in contrast to 80% male contribution to plant name authorship and 70% to fungal name authorship. The remaining 12% and 22% respectively are contributed by authors of undetermined gender and represent further refinements needed to the data gathering stage of these analyses. Since 2011, women have contributed to between 11–12% of the new combinations published, the same proportion as that for the number of new species, suggesting there is little difference in gender balance between describing new taxa and making taxonomic changes. Since 1931 there seems to have been an overall decline in the number of new plant species described, with the number of new fungi being described tapering off slightly after the 2000s. While we did not see any differences between women publishing new names and women publishing new combinations in plant or fungal names, our data reinforce the stark contrast between the number of female authors of names versus authors of all academic publications.

In their own words

We invited some of the women highlighted in this study to contribute a paragraph on their experiences and motivation working in diversity documentation and classification (Fig 5). We hope that these stories will inspire other botanists and mycologists.

MARY BARKWORTH

Growing up, I liked physics and math; they had structure. Biology, including botany, meant memorising isolated facts and drawing. Drawing remains a nightmare, but my first botany class, taken by chance at age 28, portrayed algae, fungi, and plants as interrelated entities with different ways of solving common problems. Structure! I completed my doctorate when Agriculture Canada was looking for a grass taxonomist. Being Canadian, I had preference. Working on *Stipa* proved fortunate but started as light relief from my official project. Wanting more research control, I left Agriculture Canada after two-plus years for Utah State University (USU). Again, I was fortunate: USU wanted a taxonomist interested in grasses and familiarity with agriculture. I continued work on *Stipa* and its relatives, but teaching agrostology was frustrating because North American grass treatments were severely outdated. Taxonomic treatments can summarise a wealth of information, but not if regarded as immutable. When Hugh Iltis persuaded the US Department of Agriculture to fund a new grass manual, I volunteered to lead the project. Sometimes, but not always, I see that as another bit of good luck. Today I am helping others make current floristic information available via the web because it is more effective than relying on books, allows me to travel, and is fun.

SUSAN (HOLMES) CARTER

Experience in the scientific world has mostly been positive, although in 1957 when I joined Kew, there was certainly prejudice towards women. At my interview for a post under the Colonial Office to work on the Flora of Tropical East Africa (FTEA), I was told that any ideas I might have of visiting Africa was out of the question because I was a woman—the idea had not even entered my head. I was astonished to find the majority of taxonomists were men, I had expected the world of plants to be inhabited mainly by women. During my two-year probation period, I met Dr Peter Bally, placed as his assistant during his frequent visits to Kew, and it was from him that I began my interest in the succulent species of *Euphorbia*. In 1962 I had to resign, as I was married and we were starting a family, but I kept up my contact with Kew by continuing my work voluntarily. In 1971 Dr Bally



Fig 5. (TOP LEFT TO RIGHT) Mary Barkworth, Susan (Holmes) Carter, Cheryl Grgurinovic; **(MIDDLE LEFT TO RIGHT)** Ruth Kiew, Lúcia Lohmann, Barbara Parris; **(LOWER LEFT TO RIGHT)** Amy Rossman, Barbara Rye, Charlotte M. Taylor.

Images: Supplied by authors, Lucia Lohmann © Léo Ramos

suggested I go to Nairobi on a study visit for which I got a grant from Kew. The visit ended in a weekend safari to the arid regions of northern Kenya, and I surprised him by adapting positively to the heat, wildlife, living under canvas, and the plant collecting aspect. As a result, I re-joined the Kew staff the following year as a Senior Scientific Officer part time. This was followed in 1974 by two months safari in Tanzania and Kenya with Dr Bally, again at his request. His report to Kew was positive and in 1977 I was invited to join two male colleagues on a Kew plant-collecting expedition to northwest Kenya, I believe the first time a woman had been selected—there had been visits by women to Africa before, but not as a member of an expedition. Attitudes had changed and that prejudice had gone. Thereafter I had no problems of any sort.

Motivation for me started at an early age when I became fascinated with flowers, their different shapes and colours following a Nature Study lesson, leading eventually to a BSc in Botany, an MSc, and then my ultimate goal of a post at Kew, as an Assistant Scientific Officer. I enjoyed every minute of my work for FTEA, eventually becoming a Senior Scientific Officer, part-time, working exclusively on the production of family accounts, especially two large groups, the Euphorbieae (Tribe of the Euphorbiaceae) and Aloaceae. I was married, with a family, and had no ambition to advance my position beyond working with the plants I came to know intimately, to the extent that I was acknowledged as the world authority on the spiny succulent species of *Euphorbia* of Tropical Africa. This enjoyment was enhanced enormously when I was able to go into the field, into excitingly remote arid areas of eastern Africa where 'my' special plants occurred, such as the far north of Kenya and especially Somalia. Since retirement in 1995 my involvement has continued, I have written a number of papers, I am President of the International Euphorbia Society, review papers for various journals, and still receive queries from all over the world, primarily about Euphorbias.

CHERYL GRGURINOVIC

As a young university student, during a second-year botany field trip I was captivated by the beauty of larger fungi. When considering a topic for honours, I decided to work on the genus *Mycena* (Fig 6), a genus of beautiful species that I had come to know through reading papers in the *Victorian Naturalist* and through reading the book by Jim Willis, *Victorian Toadstools and Mushrooms*. During honours, I remember being astonished about how little work had been undertaken on larger fungi in Australia, the major person working in this area being Sir John Burton Cleland who, while Professor of Pathology at the University of Adelaide, published a two-volume monograph on the fungi of South Australia in 1934–1935. While working as a Research Fellow in Mycology at the Botanic Gardens of Adelaide and State Herbarium in the 1980s, Cleland's monograph was a constant reference for work on my book—*The Larger Fungi of South Australia* (1997). For my doctorate I continued my work on the genus *Mycena* at the University of New South Wales. This was published in 2003—*The Genus Mycena in South-Eastern Australia*. I loved going out and finding new species, which back then was relatively easy. I had to become adept at Latin with so many new species descriptions to write. As permanent positions for mycologists who are not plant pathologists are very rare in Australia, I turned to science editing in the late 1980s and later to science policy in the early 2000s, where I have had the opportunity to publish on biosecurity issues. It would have been wonderful to have kept working on fungi and discovering new species, which was my first interest in science, but without a permanent position as a taxonomist this was not to be.



Fig 6. *Mycena kuurkacea*, a species of fungus first described by Cheryl Grgurinovic in 2003.

RUTH KIEW

I was fortunate to study in Cambridge (1967–1972) when there was a strong emphasis on tropical botany. Professor E. J. H. Corner was an inspiration and encouraged me to go to Malaysia for field work for my PhD. The primary motivation was boundless interest in the megadiverse tropical rain forest. Prior to the internet and the great botanical institutions opening up their archives, working on taxonomy in the tropics was extremely difficult. Obtaining taxonomic literature through interlibrary loan could take up to two years. Access to types was also difficult. Funding for visits to European herbaria was restricted to infrequent sabbatical leaves. Until oil was discovered in Malaysia, research grants were very small and insufficient to cover local field work expenses. On all accounts, the situation has now drastically changed for the better, but on the other hand the urgency to document biodiversity has become even more crucial as rainforest diminishes at an ever-increasing rate.

LÚCIA G. LOHMANN

From an early age, I was fascinated by the diversity of nature in the tropical rainforests of my native country, Brazil. As a child, I spent a lot of time outdoors, and have been passionate about plants for as long as I can remember. It is perhaps not surprising that at age 16, I decided that I wanted to be a plant systematist. Since my early days as an undergrad at the University of São Paulo (Brazil), I have conducted extensive fieldwork throughout South America. This experience led me to wonder why there are so many different plant species and how such incredible diversity originated. During graduate school at the University of Missouri–St. Louis and the Missouri Botanical Garden (USA), I received a truly multi-disciplinary training that has expanded into my research, which currently includes components of systematics, genetics, evolutionary biology, ecology, biogeography, and palaeontology. A lot of my research has focused on the family Bignoniaceae, which includes prominent Tropical Forest trees and the most abundant and diverse clade of lianas in the Neotropics (tribe Bignonieae). Given the high diversity of Angiosperms worldwide, being a botanist is a humbling experience as we constantly realise how little we know and how much more there is to learn. An endless curiosity to learn more about plants associated with a desire to find ways to preserve them is what drives me to work daily.

Given the high diversity of Angiosperms worldwide, being a botanist is a humbling experience as we constantly realise how little we know and how much more there is to learn.

BARBARA PARRIS

Lab experience from 1969–2019 includes as taxonomic mycologist at Plant Diseases Division, Department of Scientific & Industrial Research in Auckland, New Zealand; Science Research Council Research Associate for the Flora of Turkey project at Royal Botanic Garden, Edinburgh; Section Head of Ferns at Royal Botanic Gardens, Kew and Director, Fern Research Foundation, Kerikeri, New Zealand. Field experience over the same period includes work on ferns in Europe, southern Africa, west, east and south-east Asia, Australia, New Zealand, Pacific Islands, North, Central and South America.

Motivation for research is the publication of revised taxonomies for various taxa, mainly ferns, particularly the grammitid ferns (Grammitidoideae: Polypodiaceae—more than 900 species),

presented as flora accounts, generic revisions and check lists. The DNA phylogeny input of numerous colleagues working on graminitids confirms the taxonomies or provides the spur to further work especially on recognition of cryptic species. The current focus of research is the graminitid treatment for Flora Malesiana, involving c. 360 species, with more than 100 still to be described, in 15 genera, inhabiting the ever-wet tropical montane forests of Malaysia, Indonesia, the Philippines and Papua New Guinea. The thought of making progress on this project gets me out of bed in the mornings.

AMY ROSSMAN

Chair of the Fungal Nomenclature Session at the International Mycological Congress, 2018. I enjoyed a lifetime of studying fungi, mostly small ascomycetes in the Hypocreales. Growing up in Oregon, USA, and graduating from Oregon State University, I became passionate about fungi while collecting in the tropics with Dr Richard Korf and his graduate students from Cornell University where I later met my husband. I was fortunate to obtain employment first identifying all kinds of fungi that come through the U.S. ports of entry and then as the leader of the Mycology Laboratory of the U.S. Department of Agriculture. With colleagues I published a comprehensive account of the non-clavicipitalean genera of the Hypocreales that has resulted in a surge of research on these fungi. I also contributed to the comprehensive book on *Fungi on Plants and Plant Products in the United States*. After that was published, the plant quarantine agency asked if it would be possible to produce an account of fungi on plants throughout the entire world. After the laughter died down, my group proceeded to develop such a fungal database that is maintained to this day. In retirement I have worked to ensure that accurate single scientific names for pleomorphic fungi are known and accepted.

Authors' note: Amy was recently honoured in the name *Talaromyces amyrossmaniae* published in Mycokeys (Rajeshkumar *et al.* 2019).

BARBARA RYE

My workplace, the Western Australian Herbarium, has responsibility for a huge area covering more than 2,500,000 square kilometres. The south-west of this region is a biodiversity hotspot with a Mediterranean climate and is isolated by great expanses of desert from other humid parts of the country. Its ancient landscapes include many sandplains deficient in nutrients, supporting low shrublands with a rich diversity of flowering species and some bizarre adaptations. This is certainly a botanist's paradise! The plant group that I have spent most time on, Myrtaceae tribe Chamelaucieae, is exceptionally rich in this hotspot, yet only a minor tribe elsewhere in Australasia. Of the 800–850 species of Chamelaucieae, more than a hundred have yet to be described and the rarity of most of them makes this a priority. Placement of them in genera is no easy task in such a poorly known group but DNA sequencing is shedding light on this problem. My first research involved counting Myrtaceae chromosome numbers in the 1970s; to have been able to witness the transformation of genetic studies to the level of genome sequencing has been one of the most exciting aspects of my career.

CHARLOTTE TAYLOR

Patterns and puzzles have always fascinated me. Then I discovered that patterns in science have another layer: they can indicate the process that formed them, so they are also puzzles. But knowing the process in organismal biology does not always predict the resulting pattern, so you never know what you will find next. Evolution and development produce patterns that are almost endless, so just when you think you understand things the next plant is a total surprise. I discovered

the Neotropical Rubiaceae in Costa Rica during graduate school, and am still studying them. Rubiaceae are one of the largest plant families and include various unusually large or ‘hyper-diverse’ genera that are poorly known due to their size. The most species-rich Rubiaceae genera in the New World are *Palicourea* and *Psychotria*, my groups of speciality. The species radiations in these large genera provide numerous examples of morphological and biogeographic diversification, which are particularly informative because they are repeated parallel diversifications within a single lineage – once we understand their component species. These Rubiaceae radiations are cases on which to test a wide range of hypotheses about the origins of evolutionary processes, the role of ecological adaptations in diversification, and biogeographic exchanges across these tropical habitats. My work focusses on discovering the species and their morphology, ecology, and biogeography to elucidate their relationship patterns, and in turn to look for the drivers of their diversification.

Heather L. Lindon

Honorary Research Associate, Royal Botanic Gardens, Kew
h.lindon@kew.org

Dr Lauren M. Gardiner FLS

Curator, Cambridge University Herbarium
lmg32@cam.ac.uk

Dr Maria S. Vorontsova FLS

Research Leader (Grasses), Royal Botanic Gardens, Kew
m.vorontsova@kew.org

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Knickers, Knives and Know-how

When my friends hear about me ‘going off on fieldwork’ they just hear the location—‘Oh, Peru’, ‘Oooh, Thailand!’, ‘Oooh, Dominica...’. They gush about how amazing it will be, how jealous they are, how much of a doddle it must be swanning around, swooshing a net and catching a few flies. I cannot lie—it is an amazing experience—but it is nothing like how most folks imagine it to be. I am one of many thousands of people from across the world whose job it is to go forth and find out about the workings of our planet. This is not a novel practice: we have been collecting and describing for thousands of years which has provided invaluable information about the world around us, and this passion for knowledge has not waned.

Yet there has been an historical bias towards the male sex being the explorers of our planet. The great natural historians that spring to peoples’ minds are the Darwins, the Wallaces and the Bateses of this world. That isn’t to say that there weren’t any female explorers or natural historians—there were, and they have been the inspiration to many scientists, both female and male, today...but sadly their stories are less known. Thankfully, a lot of the obstacles that they had to overcome no longer exist, but some of the basic issues still do.

What is it like being a female on fieldwork? Well before many start off on their collecting adventures, there are issues to be overcome. In many countries it is still very difficult for a female to lead, or even be a part of, an expedition. Thankfully, the UK is not one of these countries, but this would not have been the case 300 years ago. The common opinion of many a learned man of the time, from the UK and across Europe, would have been that the ‘gentle sex’ had no business undertaking such work or that they even had the capacity to understand what they were seeing—they were simply not robust enough to deal with the brutal world beyond their knitting patterns. But some extraordinary women shattered these beliefs, and Maria Sibylla Merian (Fig 1) was such a woman.

17th vs 21st-century fieldwork

Merian (1647–1717) was born during an age where women had very few rights, were expected to marry and support their husbands, and were certainly not encouraged to gallivant around ‘science-ing’. Under no circumstances were women deemed suitable for the burgeoning scientific community. The Royal Society was founded in 1660, just 13 years after Merian’s birth, but women were not able to become fellows until as late as 1945 (the only exception being Queen Victoria—after all, it was a *royal* society). Thankfully for us, though, Merian’s stepfather, Jacob Marrel, an artist, encouraged her talents, and she began by drawing the insects she found locally, immersing herself in natural history literature. At that time, though it was uncommon for ladies to paint, it was more uncommon for them to study—yet study and paint she did.

Merian did marry and have children, but later divorced, and devoted her time to her science and drawing. At the ripe ‘old’ age of 52—life expectancy at that time was 30–40 years—she moved to Amsterdam, and it was there she applied for and gained permission from the Dutch government to travel to the country’s colony of Surinam in South America, whose flora and fauna (especially the butterflies) she had been studying for years.

All this was most unusual. It is hard now to imagine how many obstacles Merian would have had to overcome. Most collecting trips at the time were funded by either royalty or government, and

then granted only to men. Merian lacked this resource and so funded herself by selling off her entomological paintings. Her talents and reputation were well known—thankfully to the most influential of people, including the Mayor of her adopted hometown—which resulted not just in permission but also further funding.

To give you some modern context, women can now apply for grants and funding opportunities (luckily, as my talents are not known to lie in artistic endeavours). Wherever I collect I must apply for permits to collect, permits to transport, and permits to import, and these, along with the actual fieldwork, can be very expensive. Many countries understandably restrict access, especially to external parties, and so some charge fees so excessive as to exclude all but the most well-funded of expeditions. Permits often take months to organise, and there is still no guarantee that they will appear at the end of this process. Some you can only organise in person when you arrive in the country, which inevitably means more paperwork, and often more money. Sadly, I have had to face corrupt officials that have issued us with fines for apparent vehicle failures or insufficient paperwork, both of which we knew were not genuine. (This was quickly proven to be the case when we asked for paperwork acknowledging the payment and were threatened in response.) Luckily, those instances have been minor and although all paperwork is a hassle, it does ensure that the biota, the community, and the countries where the collecting is taken place are protected.

Then, after less than a day's plane journey, I can be at my host country on the other side of the world. But Merian's journey would have taken around two months, across the wild Atlantic Ocean. In June 1699, Merian set sail for Surinam, with her 22-year-old daughter Dorothea Maria. Although many females had already made this passage to the then-Dutch colony, they were mostly accompanied by their husbands, or were en route to join them. What an oddity Merian and her daughter would have been, along with their collecting boxes and jars, paint pots and blank canvasses! Today the logistics of organising travel for a seven-week trip to Costa Rica or Dominica are relatively easy, thanks to email. Times are very different by comparison; I can book accommodation, organise the field site and arrange my transportation relatively quickly and cheaply and not have to worry that my request will be denied because of my sex.

Once having arrived at their destination, Merian and her party would have to endure some of the most adverse conditions while undertaking her research. Working with your own offspring in the field may be considered by some as the most difficult! Anyone who undertakes fieldwork agrees that those days are some of the most gruelling, if highly rewarding. Hours of sweat-filled collecting and cramped lab conditions. A collecting trip I participated in based in the south of France involved the group getting up at 6am and working through until midnight, collecting and



Fig 1. Maria Sibylla Merian—a depiction from c. 1700.

processing mosquitoes—a long and arduous task but a necessary one to ensure that the specimens were stored in an appropriate fashion for analysis back at the Natural History Museum in London (NHM). Mosquitoes are one of the groups of flies that I study, and these have an enormous impact on human populations, both past and present. Thankfully, we have many ways today, including medicines, to help us limit the impact of the diseases they spread.

Leopard pits, spiders and snakes...oh my!

In Merian's time, malaria and other tropical diseases would have debilitated many a field scientist. Merian's trip was to last her two years, cut short by an illness that gravely incapacitated her. She was not the first or last person to suffer for science. Another pioneering woman was the British entomologist and traveller Lucy Evelyn Cheesman (1881–1969). In 1920, she became the very first female curator of the insect house at ZSL London Zoo. Three years later, she was off to the Galápagos—the first of many foreign expeditions—to collect plants and animals new to science (more than 70,000 can still be found in the NHM collections). Like Merian, she battled the elements, and contracted both dengue and malaria, but this did not prevent her from becoming a great collector. She even got caught in a spider's web (very *The Lord of the Rings*) for several hours until she freed herself with a nail file! I can but guess at the size or number of spiders that would have created such a formidable web.

Cheesman (Fig 2) decided that machetes were the way forward after this, and I, too, have found them useful in the field, one of the many different types of knives that are necessary in my field kit. I'm asked if this to protect me against dangerous snakes, man-eating tigers or even crazy humans (popular culture has a lot to answer for), and folks are always disappointed when I explain that the most common use for a machete is for cutting away vegetation that may have dangerous caterpillars on it. Indeed, Merian herself encountered many a hairy caterpillar in the jungles of Surinam that caused her hands to swell with considerable pain. I have been shredded by plants, bitten by all manner of insects and spiders, and had branches lobbed at me by spider monkeys. Again, this is the sort of information not detailed in your average nature documentary. My collecting subjects and the environment that they are in don't tend to behave, and I am not lucky enough to have the 'David Attenborough' effect—a well-known phenomenon that suggests if Sir David turns up at your field site, all of your study animals will appear and behave amazingly, unlike the other 364 days of the year.



Fig 2. Lucy Evelyn Cheesman in her fieldwork attire, complete with collecting net.

Who's wearing the trousers?

One of the ways I prevent mosquitoes and other creatures biting me is my choice in clothing. Do not be fooled by popular films showing women in the jungle wearing nothing but revealing shorts and tiny t-shirts. I have seen many a young student arrive wearing such attire only to quickly realise that exposed skin is a very bad idea. But at least our clothing choice is ours, not what society dictates. The idea of ladies wearing trousers is still a relatively recent one, and poor Cheesman had to fashion a pair from old sacks. Not everyone thought that trousers were the best option. Mary Kingsley (1862–1900) was an English writer, explorer, collector and ethnographer who in 1892 inherited enough money to enable her to fulfil her ambition to travel across the west coast of Africa. Kingsley was a young woman travelling alone and was often asked where her husband was. On one trip in 1895, whilst in Equatorial West Africa collecting specimens for the then-British Museum (now NHM), she fell into a concealed leopard pit that had been lined with 12-inch spikes. Although a bold and independent woman, she still dressed in accordance with the fashions of the age, and after being rescued, drolly remarked that ‘it is at these times you realise the blessing of a good, thick skirt’.

Nowadays, I have all sorts of technical clothing, from footwear to headwear to underwear. Yes, even knickers are incredibly important, and are an item that I am very fussy about in the field. These are not made of the latest technical fabric, but one made by insects themselves—silk. It is not that I am fancy—it’s that these dry quickly, and when you are in humid conditions and hand-washing your clothes, that’s a very important consideration. It was not an uncommon sight, on one all-female field trip in Peru, for the locals to see our large land-cruiser drive past with knickers blowing out of the open windows, being air-dried on route to the next field site.

Diligent field notes and local expertise

My life in the field has benefitted from many technological advances—I have hand-held GPS devices to tell me where I am. I have a camera on my phone that can take macro-photographs of flies good enough for identification. And I have a laptop that I can take into the field to write down notes, enter data straight into spreadsheets and upload all my images for study when I return home. Merian had no such devices and illustrated by hand the complete lifecycles of many of the insects that she saw. Her drawings and notes described many species that were new to science, and her fieldnotes provided a plethora of information, much of which is still referred to. Field notebooks were as relevant in Merian’s day as they are now, but I feel that my scrawls and ramblings are never going to have the impact that another formidable note-keeper had.

A huge contribution to entomology was made by the late-Victorian English lepidopterist Margaret Elizabeth Fountaine (1862–1940, Fig 3), who collected specimens from across the globe, including Fiji and Australia, Central America and the Caribbean, East and West Africa and the



Fig 3. Margaret Elizabeth Fountaine in 1886.

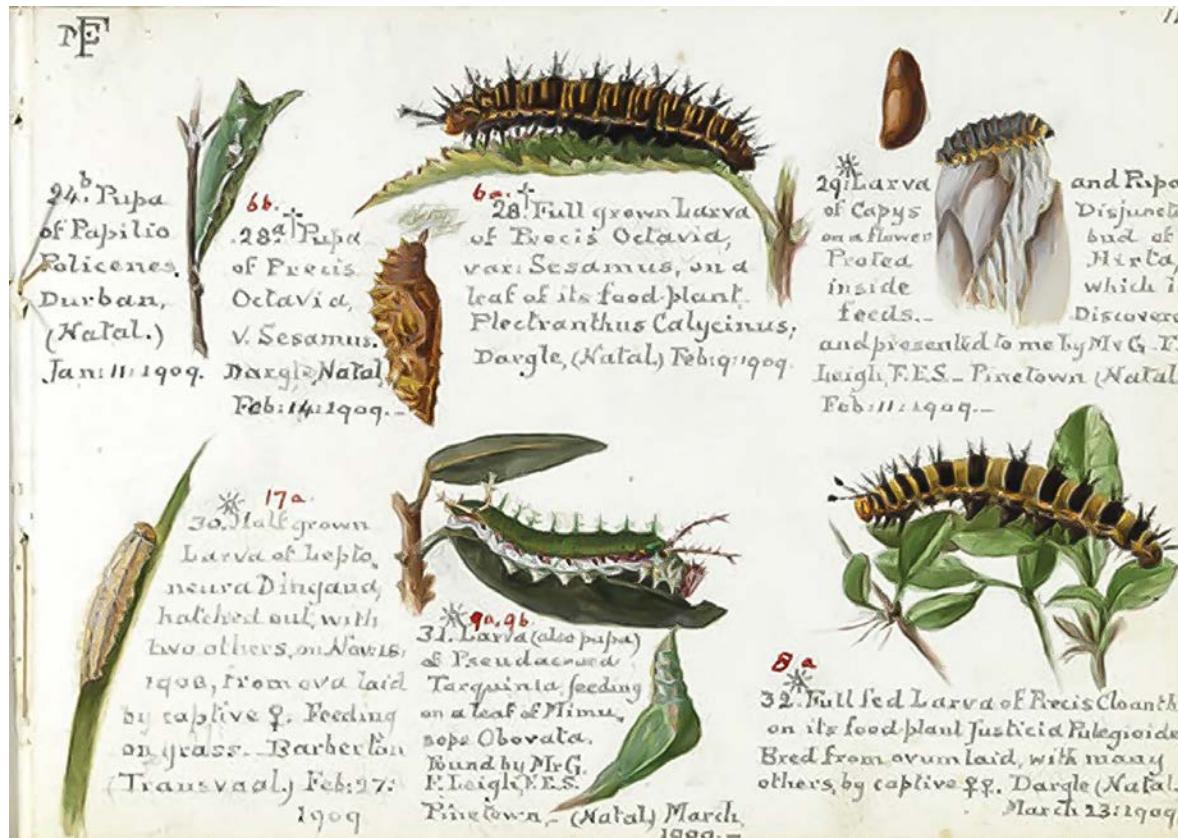


Fig 4. Caterpillars of Lepidoptera from the field notebooks of entomologist Margaret Elizabeth Fountaine.

Near and Far East—and whose notebooks and specimens are still valid and useful today, thanks to her clear and careful observations and recordings (Fig 4). Her notebooks are being scanned along with thousands of others and these can be accessed via the Biodiversity Heritage Library that is collaborating with many museums and institutions to provide over 450,000 pages of content. I can compare my collections to those from over a hundred years prior to see how things have changed with time.

Fieldwork is sometimes solitary, but often we work alongside other folks. These may be colleagues from our own institutions or international collaborators, but often we enlist the help of local field assistants, which I find the most rewarding. Local knowledge is now recognised as invaluable and included as a resource in our permits, and these permits ensure that we all abide by both local and international regulations. My driver in Dominica knew a huge amount about the botany of the island and could read the weather brilliantly. My field assistant in Costa Rica helped me build traps and collect in thick jungle in the middle of the night without complaint. I feel quite lucky that my often difficult and random requests are not questioned but historically, that may not have been the case. The 19th-century English entomologist Eleanor Ormerod (1828–1901), for example, once hired a huge troupe of field assistants to help her to collect as many specimens as possible, only to discover afterwards, that they had all first met in secret to discuss whether Ormerod would be capable of the work. They wondered whether it was too hard for her and not the kind of work that a lady should undertake. Thankfully, their meeting went Ormerod's way. I blush to think about some of the things that I have done in the field that people in Ormerod's day would have considered unladylike: if only my fellow field workers knew what bait I have used in the field for attracting insects.

Transporting specimens

Once collected, the samples must be transported back for further study. Although shipbound for several months and ill at the start, Merian's spirits—both mental and physical—buoyed on her return journey to Europe as she was able to spend many hours studying her material, much of which was still living. I have had to carry live mosquitoes back to the UK before from Indonesia, and I did not have such a joyous time. I was refused permission to go aboard the plane as no live animals were permitted other than Birds of Prey—I had jars of mosquito larvae which I argued were not going to cause anyone any problems. Discourse and tears lead to nothing. I was stuck in the airport with a load of dead and living mosquitoes and not a clue what to do! Thankfully contacting my boss was easy—just a short phone-call and I had permission to buy another ticket. However, this involved flying via Malaysia to a local airport, then finding transport to the international airport. I had no Malaysian currency, no permits for carrying insects in Malaysia, and no guarantee that I would be allowed on that plane either. I arrived at the security desk at the local airport and they had no clue what to do with a problem like Erica! Thankfully their response was to transport me to the international airport and the office of the airline that I was booked on. The local head of the airline was amazed that people like me existed (I took that to mean an entomologist...) but he cleared my path, and soon I was flying back, my mosquito babies with me.

Fieldwork is often eventful, but the work does not finish with the end of the collecting trip. I collect all insects, but my interest lies with flies, and so I spend multiple hours sorting through my samples picking out these fascinating creatures. The rest is labelled and sent off for others to study. Then the fun starts, trying to work out what species of fly I have and what might be new. Luckily, I have resources at my fingertips, like the enormous collection at the NHM, fantastic colleagues to give me advice and I have both national and international collaborators to work and publish with. This was not always the case. Mary Anning (1799–1847), a famous English palaeontologist from the first half of the 19th century, is credited with some of the most important finds from the Jurassic Coast, Dorset, fossils that helped to change how we think about evolution and prehistoric life. Yet no scientific credit was given to her during her lifetime.

Much has changed for women undertaking fieldwork—mostly for the better—but the reason we do fieldwork has not—the need to discover and document our planet is as important today as it was 300 years ago. Whilst collecting in Costa Rica I collected an adorable hammer-headed fly, more commonly called stalk-eyed flies, *Richardia telescopica* (Fig 5). Only two were in the collection at the NHM and the most recently-collected specimen before mine was from 1988. This new specimen was a small-but-important enhancement to the collection, as they are not just hidden away but used by researchers everywhere to help research species distributions, population dynamics and biodiversity (to name but a few reasons). And because of this I know that my fieldwork and resulting specimens may add to this resource, going some way to help build the puzzle that is our planet.



Fig 5. Stalk-eyed flies, *Richardia telescopica*, in the collection at the NHM, London.

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Fig 6. What's new? Well many of these flies, maybe. A sample of *Diptera* collected from Dominica.

Important footsteps to follow

I still feel incredibly lucky to be following in the footprints of these great women, being able to continue the exploration and knowledge sharing of what lives around us. Thanks to many important changes, I do not have to endure most of the physical hardships in the field or not being included in research because of my sex that these women once did. I have only once been asked to be given away for marriage but luckily my colleagues refused (the man had a gun, so we were a little careful about the refusal). Because of my academic achievements and my home institution, my professional role is not queried. I have also found that knowledge on a few key subjects away from science enables me to access some of the more male-dominated regimes—an interest in the British Premier League has awarded me entrance to many a farmer's shed to sample for flies!

I have spent the last five years going to Dominica for a field season, to explore, study and collect thousands of insects. A month on this tropical island is fraught with very little danger, but with much excitement, as many of the insects that I am coming across are new to science (Figs 6 and 7). Maybe I will even name one of these after the inspirational women that have gone before me. Today there is much that can turn hardship into ease, and adversity into adventure. Hopefully I will have many more research trips with my knives and knickers, as I keep working towards increasing the know-how.

Dr Erica McAlister FLS

Senior Curator, Insects Division, Natural History Museum, London
e.mcalister@nhm.ac.uk



Fig 7. The author and team examining insects at night, in the field in Dominica.

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FORM OF RECOMMENDATION
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(Miss) Margaret Benson, D.Sc. Lond.
Royal Holloway College,
Englefield Green, Surrey
a lady attached to the study of Natural History, especially Botany.

Tell Jan 16 Nantes House Hofford Hart Bots

being desirous of becoming a Fellow of the LINNEAN SOCIETY OF LONDON,
are underwritten, beg leave to recommend him to that Honour.

D. H. Scott - Reginald
Ever Groom F.W.
Augusta Jackson M

This recommendation must be signed by
N.B.—The Christian name of the Candidate must be
any special qualifications he may possess.

This Certificate was read at a General Meeting
The Ballot will take place on the 15

FORM OF RE
FOR A FELLOW OF THE L
Miss Alice Lan
of Ewell,
Surrey
a gentleman attached to the study of Natural History, espe
Lady d Economy

being desirous of becoming a Fellow of the LINNEAN SOCIET
are underwritten, beg leave to recommend him to that Honour.

D. Sharp.
W. A. Henderson
Edward Stop

This recommendation must be signed by Three or more
N.B.—The Christian name of the Candidate must be stated at length, as we
any special qualifications he may possess.

This Certificate was read at a General Meeting of the Society, on the
The Ballot will take place on the 15 day of Dec 17 1904.

FORM OF RECOMMENDATION

FOR A FELLOW OF THE LINNEAN SOCIETY OF LONDON.

Wrs Grace Frankland, F.R.M.S.
Wife of Professor Percy Frankland, F.R.S.
The Dell, Northfield, Worcestershire.

a lady attached to the study of Natural History, especially Bacteriology;

has published various original researches on
bacteria, "Life of Pasteur," 1897; "Bacteria in Dark Life," 1902, &c,



COMMENDATION
INNEAN SOCIETY OF LONDON.

ra Embleton, B.Sc.

Insect development

R OF LONDON, we, whose names

John Dottaham

Fellows.

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day of Nov 1907



COMMENT
FOR A FELLOW OF THE LINNEAN SOCI

Miss. Ellen Willmott
Warley Place
Warley - Essex.

attached to the study of Natural History, especially

desirous of becoming a Fellow of the LINN
erwritten, beg leave to recommend him to



FORM OF RECOMMENDATION
FOR A FELLOW OF THE LINNEAN SOCIETY OF LONDON.

Marian Sarah Farquharson,
Tillydrone, Kincardine O'Neil,
Aberdeenshire
a gentlewoman attached to the study of Natural History, especially Pteridology and
Muscology

being desirous of becoming a Fellow of the LINNEAN SOCIETY OF LONDON, we, whose names
are underwritten, beg leave to recommend her to that Honour.

I Reynolds Green.

E. M. Holmes.

E. Willmott

Aubrey
Grace C. Frankland

Catherine Crisp.

This recommendation must be signed by Three or more Fellows.

N.B.—The Christian name of the Candidate must be stated at length, as well as his Residence, as
any special qualifications he may possess.

This Certificate was read at a General Meeting of the Society, on the 6th day of February

The Ballot will take place on the 5th day of March 1908.



FORM OF RECOMMENDATION
FOR A FELLOW OF THE LINNEAN SOCIETY OF LONDON.

Miss Emma Louisa Turner,
Upper Birchett's, Langton Green,
Tunbridge Wells

a gentlewoman attached to the study of Natural History, especially Botany &
being desirous of becoming a Fellow of the LINNEAN SOCIETY OF LONDON.
are underwritten, beg leave to

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