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Agnes Arber, née Robertson (1879–1960): Fragments of her Life, Including her Place in Biology and in Women's Studies

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Born in London into a learned and artistic middle-class family, Agnes Arber, née Robertson (23 Feb. 1879–22 Mar. 1960), was a renowned plant morphologist and anatomist, historian of botany, botanical bibliographer, and philosopher of biology. However, she played a minor role in the botany of Cambridge, where she lived for nearly 54 years, including the last 51 years of her life. Topics discussed include: Arber's place in biology; her publication record; her relationships with husband Edward Alexander Newell Arber (1870–1918), a palaeobotanist and geologist, daughter Muriel Agnes Arber (born 1913), a geologist, and friend and mentor Ethel Sargant (1863–1918), a plant morphologist; Arber's home in Cambridge (1909–61); the denial by the 'botanical establishment' of her 1921 presidency of Section K (Botany) of the British Association for the Advancement of Science; the establishment of her private laboratory in 1927; her concept of 'quiet and independent research' that fostered the erroneous notion of her being a recluse; her burial site in Girton; her place in women's studies; and archives for Arberiana. A table presented as a curriculum vitae gives a synopsis of biographical information for Arber. A second table analyses her 218 non-book publications (1892–1961), one edited book (*Devonian floras*) and four edited papers (1919–22) for Newell Arber, and eight books (1912–57) and their two later editions (1938, 1986), 13 reissues (1953–99), and five translations (1960–2002): *Herbals* (1912, 1938, 1986), *Water plants* (1920), *Monocotyledons* (1925), *The Gramineae* (1934), *Goethe's botany* (1946), *The natural philosophy of plant form* (1950), *The mind and the eye* (1954), and *The manifold & the one* (1957). Arber was sole author of all of her works except for six items (four papers, one note and one abstract) junior-authored early in her career. A third table details bibliographic information for Arber's books and their reissues and translations.

Key words: Agnes Arber, Agnes Robertson, Edward Alexander Newell Arber, Muriel Agnes Arber, Cambridge University, Ethel Sargant, Edith Rebecca Saunders, herbals, philosophy of biology, plant morphology, women's studies, Girton College.

AGNES ARBER'S PLACE IN BIOLOGY (1)

Agnes Arber, née Robertson (23 Feb. 1879–22 Mar. 1960) was born in Primrose Hill, London, UK, into a learned and artistic, but not scientific, middle-class family. She lived a long and productive life, the last 51 years of which were spent in Cambridge (Table 1). Arber became a renowned plant morphologist and anatomist, historian of botany, botanical bibliographer, and philosopher of biology. Arber's influence on subsequent botanists has been substantial, as this symposium amply testifies. 'Her technique was simple, that is by orthodox transverse sections, but her reconstitution of what the eye saw was consummate. She represents what may be called the escarpment of morphology.' Thus wrote E. J. H. Corner (1961*b* p. 197) in his inimitable flowery prose. More prosaically, but no less appropriately, Arthur G. Tansley (1952 p. 400) wrote that Arber (Figs 1, 3–5) is 'the most distinguished as well as the most erudite contemporary British plant morphologist'. To quote Corner (1961*a* p. 128) again: 'To many she was the "lady of botany" '. This statement applies to Arber not only during her long and illustrious botanical career, but also posthumously following her death in 1960 at the age of 81.

Elizabeth M. Wilkinson (1960 p. 94), secretary of the English Goethe Society devoted to the great German poet, playwright, philosopher and naturalist, Johann Wolfgang von Goethe (1749–1832), stated in an obituary:

> Mrs. Arber was one of those who, not unlike Goethe himself (to me it is a moving coincidence that she should have died on the same date, 22 March), reached a position of eminence in one field without ever foregoing the pleasure, duty, or right to move freely across its frontiers and explore its relations to other modes of knowledge and other kinds of activity. From the beginning her work was marked by grace and style, both in the writing and in the illustrations with which she adorned it (she was a great admirer of Goethe's botanical drawings); but as she grew older it [her work] became, without ever ceasing to be scientific, increasingly distinguished by philosophical insight and immense erudition in subjects other than her own.

The very first obituary of Arber in *The Times* of 24 Mar. 1960, 2 d after her death, was by the indefatigable William T. Stearn (1911–2001), whose 'privilege, from [his] late teens onwards, for over thirty years until her death, was to have the friendship of Agnes Arber' (Stearn, 1986 p. xxxii). Stearn's obituary still has not been surpassed for its insightful encapsulation of her place in biology [Stearn, 1960*b* pp. 261–262, which republished Stearn (1960*a*), his obituary in *The Times*]:

> Stimulated by the work of Ethel Sargant [1863–1918; Fig. 6; section 14, note 3], with whom she collaborated, Mrs. Arber's most important early investigations concerned the monocotyledons, . . . more especially their anatomy and morphology. This . . . culminated in three books, *Water Plants* (1920), *Monocotyledons*

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TABLE 1. *Curriculum vitae of Agnes Arber, née Robertson (1879–1960)*[1]

Contact information: 52 Huntingdon Road, Cambridge, UK (phone 3144)

Personal:
Born 23 Feb. 1879 in Primrose Hill, London
Married 5 Aug. 1909 to palaeobotanist and geologist Edward Alexander Newell Arber[2] (born 5 Aug. 1870 in Bloomsbury, London, died 14 Jun. 1918 in Cambridge, age 47)
One child, Muriel Agnes Arber[2] (born 21 Jul. 1913 in Cambridge), a secondary school teacher and geologist
Died 22 Mar. 1960 in Cambridge, age 81[3]

Education, positions held, and sites of residence:
London, 1879–99:
1879–87: childhood
1887–97: primary and secondary school student, North London Collegiate School for Girls
1897–99: undergraduate student, University College London (UCL) (B.Sc., June 1899)
Cambridge, 1899–1902: Undergraduate student, Newnham College, Cambridge University (no degree[4]); also a student at the Woodwardian Museum (now the Sedgwick Museum)
Southwest of London, 1902–03: Research assistant to Ethel Sargant in her laboratory ('Jodrell Junior') at Quarry Hill, Reigate
London, 1903–09:
1903–08: graduate student, teaching assistant (D.Sc., June 1905[5]), and researcher, UCL
1908–09: Lecturer in Botany, UCL
Cambridge, 1909–60:
1909–11: researcher and writer at 52 Huntingdon Road, Cambridge, Arber's home[6]
1911–14: Demonstrator in Systematic Botany and researcher, Balfour Biological Laboratory for Women,[7] Newnham College, Cambridge University
1914–27: researcher, Balfour Laboratory,[7] Newnham College, Cambridge University
1924 (June): titular M.A.,[8] Cambridge University
1927–59: researcher and writer at 52 Huntingdon Road, Cambridge, Arber's home and private laboratory[7]
1959–60: Hope Nursing Home (November 1959 until her death on 22 Mar. 1960)

Formal teaching experience: Lecturer in Botany, UCL (1908–09); Demonstrator in Systematic Botany, Balfour Biological Laboratory for Women, Newnham College, Cambridge University (1911–14)

Memberships in professional societies (dates elected or admitted):
1904: British Association for the Advancement of Science (BAAS)
1908 (3 December): Fellow, Linnean Society of London (proposed 5 Nov. 1908, admitted 21 Jan. 1909)[9]
1936 (March): Founder Member (one of 58), Society for the Bibliography of Natural History
1936 (?December): Corresponding Member, Botanical Society of America
1946 (21 March): Fellow, Royal Society of London (see below)
1951: Life and Founder Member, International Society of Plant Morphologists
19??: Membre honoraire, Société d'histoire naturelle de Cherbourg*
19??: Honorary Member, Indian Botanical Society*

Offices held in professional societies:
1907–08: Section K Committee (Botany), BAAS
1915 (29 May)–1919 (24 May): Council, Linnean Society of London[10]
1921 (January): denied the 1921 presidency of Section K (Botany) of the BAAS[11]
1925–26: Secretary, Grants Committee, Research Committee of BAAS
1926 (late): declined the nomination for the 1927 presidency of Section K (Botany) of the BAAS[11]
1930 (August): Vice President (one of seven), Section M (Morphology and Anatomy), Fifth International Botanical Congress, Cambridge, 16–23 Aug. 1930
1935 (September): Vice President (one of nine). Section MOR (Morphology and Anatomy), Sixth International Botanical Congress, Amsterdam, 2–7 Sep. 1935[12]

Major honors, fellowships, and scholarships (post-secondary school): See also memberships and offices preceding and dedications and eponymy following.
1899 (June): B.Sc., UCL, with First Class Honours in botany, including several prizes and medals
1899 (October)–1902 (June): scholarship, Newnham College, Cambridge University
1901 (May): Natural Sciences Tripos, Part I, First Class Honours (studied chemistry, physics, botany, and geology), Newnham College, Cambridge University
1902 (May): Natural Sciences Tripos, Part II (Botany), First Class Honours (studied botany and geology), Newnham College, Cambridge University
1903 (autumn)–1908 (June): Quain Studentship [i.e. scholarship] in Botany, UCL
1904–20: Associate, Newnham College, Cambridge University*
1906–60: Life Fellow, UCL*
1912–13: Associates' Research Fellow, Newnham College, Cambridge University
1918–20: Associates' Research Fellow, Newnham College, Cambridge University
1920–23: Fellow, University of London and holder of a Keddey Fletcher-Warr Studentship
1936–38: Leverhulme Research Fellowship, to study the morphology of angiosperms and the history of botany
1946 (21 March): elected Fellow, Royal Society of London, the first female botanist and only the third woman overall to be so honoured[13]
1946–49: Associate, Newnham College, Cambridge University*
1948 (24 May): Gold Medal of the Linnean Society of London, the first woman to receive the medal[14]

Book dedications:
1910: Edward Alexander Newell Arber, *Plant life in alpine Switzerland, being an account in simple language of the natural history of alpine plants*
1920: Henry Robert Robertson, *More plants we play with* [Dedication from Agnes Arber's father reads: 'To my children, my children's children, and all other children'.]
1931: Charles [Joseph] Singer, *A short history of biology: A general introduction to the study of living things.* [American title: *The story of living things: A short account of the evolution of the biological sciences.*]
1934: John Hutchinson, *The families of flowering plants. Vol. 2. Monocotyledons, arranged according to a new system based on their probable phylogeny*
1950: Charles [Joseph] Singer, *A short history of biology: A general introduction to the study of living things.* 2nd edn. [Dedication to Arber not in the 1959 3rd edn.]
1951: Muriel Agnes Arber, *The old mermaid and other poems*
1959: John Hutchinson, *The families of flowering plants. 2nd edn.* **Vol. 2.** *Monocotyledons, arranged according to a new system based on their probable phylogeny*
1973: John Hutchinson, *The families of flowering plants, arranged according to a new system based on their probable phylogeny.* **3rd edn.** [Two volumes combined into one.]
1996: Paul Westmacott Richards, *The tropical rain forest: An ecological study.* **2nd edn.** [Dedication to Arber not in the 1952 1st edn.]
1999: Frederick Gustav Meyer, Emily Walcott Emmart Trueblood & John Lewis Heller, *The great herbal of Leonhart Fuchs: De historia stirpium commentarii insignes, 1542 (Notable commentaries on the history of plants). Vol. 1. Commentary*

Table continued opposite

Other dedications:

1975: R. Schmid & D. W. Stevenson. '*Arberia*, a proposal for a new journal of structural botany', *Taxon* **24:** 493–494, and *Plant Science Bulletin* **21:** 39–40.[15]
1999: Symposium entitled 'From Agnes Arber to new explanatory models for vascular plant development' and organized by B. K. Kirchoff & R. Rutishauser, held 6 Aug. at the XVI International Botanical Congress held Aug. 1–7, 1999 in St. Louis, with seven presentations
2000: R. Schmid (ed.), May 2000 'Reviews and notices of publications' column of *Taxon: Journal of the International Association for Plant Taxonomy*, to Arber 'on the 50th anniversary of her *The natural philosophy of plant form* (28 Apr. 1950)'

Eponymy for Agnes Arber and Edward Alexander Newell Arber:[16]

1906 (21 September): *Arberia* D. White in I. C. White (*Science*, n.s., **24**: 379) to commemorate Newell Arber, a nomen nudum for the next
1908: *Arberia* D. White in I. C. White (*Commissão de estudos das minas de carvão de Pedra do Brazil*, pp. 536–537), for a ginkgophyte fossil (fertile fronds), to commemorate Newell Arber
1916 (13 March): *Arberia* J. A. Nieuwland (*American Midland Naturalist* **4:** 376), for a sac fungus, to commemorate Arber, but the name is illegitimate (=*Asteridium*) due to the previous
1960 (June): *Arberiella* D. D. Pant & D. D. Nautiyal (*Palaeontographica*, Abt. B, **107:** 53), for a glossopterid fossil (sporangia), to commemorate Newell Arber
1972 (February): Arberiaceae J. F. Rigby (*Palaeontology* **15:** 116) based on *Arberia* D. White in I. C. White (1908)
1979 (27 November): *Arberella* T. R. Soderstrom & C. E. Calderón (*Brittonia* **31:** 433), for a New World bamboo, to commemorate Arber

Botanical field experience: southern England, Austria, Belgium, France (Normandy, Brittany), Germany, Italy, Netherlands, Sweden, Switzerland

Research interests: plant morphology; plant anatomy; history of botany, especially herbals; botanical bibliography; philosophy, including philosophy of biology; metaphysics; especially interested in the 'linkage between morphological and philosophical thought' (Arber, 1950*a* p. vii) and the metaphysical basis for research

Research grants:

1919: £100 publication grant, Council of the Royal Society of London, to prepare and publish works of E.A. Newell Arber (1919, 1920, 1921*a*,*b*, 1922)
1925: £20, Research Committee of BAAS, for work on the morphology of monocotyledons

Publication summary:[17]

Eight books (1912–57): *Herbals* (1912), *Water plants* (1920), *Monocotyledons* (1925), *The Gramineae* (1934), *Goethe's botany* (1946), *The natural philosophy of plant form* (1950), *The mind and the eye* (1954), and *The manifold & the one* (1957), including two later editions (*Herbals*, 1938, 1986), 13 reissues (1953–99), and five translations (1960–2002)
218 other publications (1892–1961), only six of which were coauthored: 93 papers, 45 notes, 20 obituaries, three obituary bibliographies, 24 book reviews, 16 letters, 13 poems and four abstracts
Five edited works for E.A. Newell Arber (1919–22): one book (*Devonian floras*, 1921), four papers

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[1]Information compiled from various sources (see works coded '†' in Literature Cited). *The Newnham College register* (Newnham College, 1979 p. 35) contains much information on Arber, including some not seen in other sources and marked with an asterisk here. A questionnaire for the first edition (1964) of this register was sent out in 1955. Presumably Arber had a chance to submit and verify information.

[2]For biographical information (including degrees) for E.A. Newell Arber and M.A. Arber see main text, section 2.

[3]For details see main text, section 10.

[4]Until 1923 women at Cambridge University received only a certificate; from 1923 until 1948 they received only the title of the degree (i.e. titular degree), not the actual degree or degree proper; women received the last only from 1948 onwards, when they gained full membership in the University (McWilliams Tullberg, 1998). For details see main text, section 14, note 2.

[5]D.Sc. received June 1905 for research on the reproductive morphology of the gymnosperm *Torreya californica* (Taxaceae) (Arber, 1904*a*,b).

[6]Newlywed to E.A. Newell Arber (5 Aug. 1909), Arber was involved with the preparation of four books: her *Herbals* (1912) and *Water plants* (1920) and her husband's *Plant life in alpine Switzerland* (1910) and *The coast scenery of North Devon* (1911).

[7]In summer 1914 Newnham College officially closed the Balfour Biological Laboratory for Women as a teaching unit (Richmond, 1997). However, until late 1927 the laboratory remained a physical reality for research purposes, including to persons such as Arber and Edith Saunders. Arber established her private laboratory in November 1927 due to the final closure of the Balfour. For details see main text, section 8A.

[8]Arber also had a titular M.A. 'The M.A. was from Cambridge University; until 1948 it was only the title of a degree' (M.A. Arber, 26 Mar. 2001), not a degree itself (see note 4 preceding). Muriel Arber (26 Mar. 2001) did 'not know the date it was awarded'. The *Newnham College register* (Newnham College, 1979 p. 35) dates Arber's titular M.A. as '1926' but '1924' must be the correct date. 'M.A., D.Sc.' appears on the title page of Arber's *Monocotyledons* (1925) and after her byline on most of her major papers published from October 1924 onward, whereas just 'D.Sc.' appears on her earlier works published prior to April 1924. Arber's April and October 1924 papers appeared in *Annals of Botany* (Arber, 1924*a*,*b*), are successive works in her publication record (M.A. Arber, 1968a; Schmid, unpubl. res.), and conclusively date her titular M.A. as 1924, undoubtedly in June.

[9]Arber and four other women were the 44th to the 48th women elected to the Linnean Society, nearly 4 years after the first group of 15 women had been elected to the society on 15 Dec. 1904 (Schmid, unpubl. res.).

[10]Arber and mycologist Gulielma Lister (1860–1949) were the 4th and 5th women elected to the Council of the Linnean Society (Schmid, unpubl. res.).

[11]For details of the controversies about the 1921 and 1927 presidencies see Boney (1995, 1997) and the main text, section 7A and B.

[12]Arber did not attend the congress due to its expense.

[13]The previous two women were elected in 1945. For details see main text, section 1.

[14]For details see main text, section 1.

[15]Alas, an *Arberia* as a 'journal of ideas' never materialized, although the proposal evoked some discussion (Barabé, 1977; Hirsch, 1975; Schmid and Stevenson, 1976). I maintain that 25 years later, the need for *Arberia* is as great, if not greater.

[16]See also Brummitt (2001) and Schmid and M.A. Arber (1977).

[17]For details see main text (section 4), Literature Cited, and Tables 2 and S1.

(1925), and *The Gramineae* (1934). Her first book was, however, her *Herbals, their Origin and Evolution* (1912; second edition, much enlarged, 1938) [third edition, 1986]. All have become classics within their field; all are characterized by breadth of outlook, philosophical insight, profound learning, and meticulous attention to detail, and are written with a clarity and charm of style which places them outside and above ordinary botanical literature...

Over the years the metaphysical problems implicit in the study of botanical detail came to have an ever greater fascination for her; she became convinced of 'the vital necessity of a linkage between morphological and philosophical thought' [Arber, 1950*a* p. vii]. From the study of botany and of Spinoza [the Dutch philosopher Baruch de Spinoza, 1632–77] she went on to metaphysics in general. Out of this study came a paper on Boethius [the Roman philosopher and statesman, 475?–525?] and Spinoza ([Arber], 1943), *Goethe's Botany* (1946), *The Natural Philosophy of Plant Form* (1950), *The Mind and the Eye* (1954) *and The Manifold and the One* (1957). *The Mind and the Eye*, which is concerned with the nature of biological research and the bases of biological thinking, may prove the most important of these [books]; she herself modestly described it [Arber, 1954*a* p. vii] as a rushlight seeking to throw a little light upon the biologist's road to reality.

Indeed, Stearn's statement of 'classics within their field' applies to all eight of Arber's books, not just her first four. Arguably, Arber's *The natural philosophy of plant form* is her most important book.

Recognition for Arber's accomplishments culminated with her being elected a Fellow of the Royal Society of London on 21 Mar. 1946, at the age of 67. She was the first woman botanist and only the third woman overall to be so honoured, the two previous women being elected in 1945 (Mason, 1995; Sampson and Edwards, 1995; Packer,

FIG. 1. Agnes Arber, née Robertson (1879–1960).
FIG. 2. Edward Alexander Newell Arber (1870–1918). They were married on 5 Aug. 1909. Both pictures are undated, but apparently were 'taken in 1916 or possibly in 1917' and both studio photographs 'may have been taken at the same time' based on their identical mounts (M.A. Arber, 2 Dec. 1999). Their daughter Muriel Arber remarked (15 Nov. 2000): 'This is a good likeness of her as I remember her when I was a child.' (Photographs from M.A. Arber, 1968*a* pl. 2.)

1997)—physical crystallographer Kathleen Lonsdale, née Yardley (1903–71) and microbial biochemist Marjory Stephenson (1885–1948). The citation for Arber's election read (Council of the Royal Society, 1946):

> Dr. Agnes Arber, of Cambridge, distinguished for her outstanding contributions to the elucidation of the morphology of flowering plants, especially the monocotyledons.

On that same day 24 men were elected to the Royal Society. 'The fact that [Arber] worked as an individual at a time when science was rapidly losing any of the nineteenth-century ideas of gentlemanly [*sic*] amateurism and becoming a totally professionalized and institutionalized activity, made it even more surprising that she was the first woman botanist to be elected as a Fellow of such an important institution as the Royal Society' (Packer, 1997 p. 87, who also discusses Arber's nomination on p. 98).

Figure 5 is of the official, 'formal-setting' photograph of Arber taken on 9 May 1946. She was 'uncomfortable' during the session; 'she disliked being photographed' (M. A. Arber, pers. comm. to R. Schmid, 15 Nov. 2000). The photograph also appears in Boney (1995), Corner (1961*b*), and Hamshaw Thomas (1960*b*).

On 24 May 1948, aged 69, Arber was formally awarded the Gold Medal of the Linnean Society of London, the first woman to receive the medal, 'the Society's highest award . . . instituted in May 1888 to mark the centenary of the Society's founding' (Gage and Stearn, 1988 p. 170; the Linnean Medal was actually made of gold until its 1977 demotion to alloy). The award was announced on 12 Feb. 1948 (*Proceedings of the Linnean Society of London* **160:** 47, 1948). At the ceremony on 24 May, President (1946–49) Gavin R. de Beer (1899–1972), a zoologist and erudite linguist (see Gage and Stearn, 1988), presented the medal and declared in part (de Beer, 1949 p. 154):

> In awarding the Linnean Medal to Dr. Agnes Arber, the Society is honouring itself by including among the list of recipients of this Medal one whose tireless researches have adorned the subject of Botany, have advanced its frontiers, and made her the leading authority in the world on several of its aspects.
>
> Dr. Arber's interests are wide, and I must be expected to refer to a few of them only.
>
> . . .[five paragraphs]

FIG. 3. Agnes Arber seated on quarry rocks at Croyde Hoe, Baggy Point, north Devon, UK, with geologists T. Young (left) and A. I. Rogers. Photograph taken in September 1910 by E.A. Newell Arber.

FIG. 4. Agnes Arber seated and holding a newspaper, a 1911 photograph taken by E.A. Newell Arber. Muriel Arber remarked (15 Nov. 2000): Fig. 4 is 'equally good'; 'it does recall to me her face and her whole appearance (particularly her hands)'.

(Photographs from M.A. Arber, 1982: cover and Stearn, 1960*b* p. 262.)

FIG. 5. Agnes Arber, aged 66, posed 'official photograph taken on 9 May 1946 on behalf of the Royal Society on her election [on 21 March] as a Fellow' (M.A. Arber, 2 Dec. 1999). During this formal session, Arber was 'uncomfortable . . . She disliked being photographed'; Muriel Arber 'never liked the' photograph (M.A. Arber, 15 Nov. 2000).

FIG. 6. Ethel Sargant (1863–1918), undated photograph probably 'taken about 1900' (M.A. Arber, 2 Dec. 1999).

FIG. 7. Edith Rebecca ('Becky') Saunders (1865–1945), undated photograph.

(Photographs from, respectively, Boney, 1995 p. 29; M.A. Arber, 1968*a*: pl. 3; and Boney, 1995 p. 28.)

> Not the least attractive and valuable feature of Dr. Arber's numerous works are the beautiful illustrations from her own hand which accompany them [see section 4B].
>
> We are proud that Dr. Arber, a Fellow of our Society, should be the first Lady Botanist to be elected into the Fellowship of the *Royal* Society [emphasis added], and as a token of our esteem for her services to Science I have great pleasure in handing to her the Linnean Medal.

Arber had already written five books, her *Herbals* in two editions, and was yet to write another three (see section 4A and also Table S1, which is supplementary material to this paper, and can be found on http://www.academicpress.com/aob). Arber was one of the early women to be elected to the Linnean Society. On 3 Dec. 1908 she and four other women were the 44th to the 48th women to be elected, nearly 4 years after the first group of 15 women had been elected to the society on 15 Dec. 1904 (Schmid, unpubl. res.).

Finally, at least seven books in ten editions published from 1910 to 1999 were dedicated partly or entirely to Arber, as well as two genera (the bamboo *Arberella*, 1979, and the illegitimate fungus *Arberia*, 1916) and other forms of dedication (see Table 1).

Stearn's (1986 p. xxxii) conclusion about Arber is still apropos: 'Continued esteem and use of her publications remain her best reward.'

NAMES (2)

Agnes Arber was born Agnes Robertson. After her marriage to Edward Alexander Newell Arber on 5 Aug. 1909, she was generally known by her contemporaries as 'Mrs. Arber', or occasionally as 'Dr. Arber'. She appears on the title page of *Herbals* (1912), her first book, as 'Agnes Arber (Mrs E. A. Newell Arber)'. Library catalogues also use this form or 'Agnes Robertson Arber'. (When making bibliographic searches for Arber's early work one must search under both 'Robertson' and 'Arber'.) From this point onward, all mention of 'Arber' will refer to Agnes Robertson Arber; her husband will be referred to as 'E.A. Newell Arber' or just 'Newell Arber' and their daughter as 'M.A. Arber' or 'Muriel Arber'.

I give brief biographical details here to put the principals into perspective (for titular degrees see section 14, note 2, and for biographical references to Agnes Arber, E.A. Newell Arber, and M.A. Arber see, respectively, the works coded '†', '‡', and '§' in the Literature Cited).

Agnes Arber, née Robertson (23 Feb. 1879–22 Mar. 1960), educated at University College London (1897–99, 1903–05; B.Sc. 1899, D.Sc. 1905) and Newnham College, Cambridge University (1899–1902, titular M.A. 1924) (see also Table 1)

Edward Alexander Newell Arber (5 Aug. 1870–14 Jun. 1918), her husband, educated at Trinity College, Cambridge University (1895–99; B.A. 1898, M.A. 1902, Sc.D 1912), a geologist, palaeobotanist, and demonstrator in palaeobotany at Trinity College (1899–1918) (see also section 5A)

Muriel Agnes Arber (born 21 Jul. 1913), their only child, educated at Newnham College (1932–36; titular B.A. 1935, titular M.A. 1938), a secondary school teacher (1942–73) and geologist working on brachiopods and cliffs and coasts (1936–41, 1973–date) (M.A. Arber, 2 Dec. 1999; see also section 5B). [Personal communications to Rudolf Schmid are cited in the form 'Muriel Arber (12 Sep. 1977)' or '(M.A. Arber, 25 Mar. 2001)' and are all letters except for a long interview in person on 27 May 2000.]

METHODS AND FORMAT OF THIS PAPER (3)

(A) Text

There are a number of good to excellent biographical accounts of Arber that range from obituaries written after her death on 22 Mar. 1960 to recent analyses by sympathetic women writers such as Maura C. Flannery (1990, 1995, 1996, 1997, 1998, 2000) and Kathryn Packer (1997). Richard L. Hauke's 1996 excellent paper, 'Vignettes from the history of plant morphology', stemmed from his nearly four-decade fascination with Arber's works. Hauke's presentation is significant in being well written, in giving some novel insights, in including interviews with Arber's daughter Muriel and other persons, and in accessing archival materials at the Hunt Institute for Botanical Documentation, Yale University, Cambridge University, and other places (see section 12).

Of the many works on Arber (see those coded '†' in the Literature Cited), those by Hamshaw Thomas (1960*b*) and Packer (1997) are, at 12 and 18 pages, respectively, the longest published to date. Instead of writing another relatively brief biography of Arber (her fascinating life warrants much longer, even book-length treatment, and indeed I anticipate publishing elsewhere a much lengthier account in another format), I have taken a double tack: (*a*) to give Arber's vital biographical information in the condensed form of a curriculum vitae (CV) (Table 1), and (*b*) to focus on certain important themes or topics, to wit: her publication record; her relationships with her husband, her daughter, and her friend and mentor Ethel Sargant (1863–1918); Arber's home in Cambridge (1909–61); the denial by the 'botanical establishment' of her 1921 presidency of Section K (Botany) of the British Association for the Advancement of Science (BAAS); the establishment of her private laboratory in 1927; her concept of 'quiet and independent research' that fostered the erroneous notion of her being a recluse; her burial site in Girton; and, finally, archives for Arberiana. Beginning and ending this paper are overviews discussing Arber's place in biology and her place in women's studies.

Presenting a CV for Arber (Table 1) in tabular form is not only more valuable but is also more economical of space than the usual written narrative. Such a CV will offer other workers a convenient reference source to launch their own studies of the life and work of Arber and also, I hope, enable them to avoid some of the mistakes perpetuated in previous narrative accounts of Arber. However, the risk of a CV is that it may convey little sense of the quality of her life and work. Moreover, the simplicity of format of a CV belies the amount of work involved in constructing it, as any job seeker knows. In fact, compiling from scratch a CV for another person, and a deceased one at that, proved to be an almost insurmountable task.

I have fleshed out the text with numerous quotations from the literature and from the extensive correspondence that I have had with Arber's daughter, Muriel A. Arber,

TABLE 2. *Bibliographic overview of the books of Agnes Arber (1879–1960), including their reissues and translations*

1912 (published 19 Nov.,[1] hardbound): *Herbals, their origin and evolution: A chapter in the history of botany, 1470–1670.* University Press, Cambridge.

1999 hardbound reissue: *Herbal plants & drugs: Their origin and evolution.* Mangal Deep Publications, Jaipur. [With no new introductory material and only very minor changes—see Schmid (2000).]

1920 (published 15 June,[1] hardbound): *Water plants: A study of aquatic angiosperms.* University Press, Cambridge.

1963/1972 hardbound reissues: *Water plants: A study of aquatic angiosperms.* J. Cramer, Weinheim/Lehre (series: *Historiæ naturalis classica*, vol. 23). [With a new introduction (see Stearn, 1963/1972). Both reissues have the same text.]

1921 (published early spring, hardbound): *Devonian floras: A study of the origin of Cormophyta,* by E.A. Newell Arber.[2] Edited by A. Arber. University Press, Cambridge. [Never reissued.]

1925 (published 30 Apr.,[1] hardbound): *Monocotyledons: A morphological study.* University Press, Cambridge (series: *Cambridge botanical handbooks*, unnum.).

1961 hardbound reissue: *Monocotyledons: A morphological study.* J. Cramer, Weinheim (series: *Historiæ naturalis classica*, vol. 21). [With a new preface (see M.A. Arber, 1961).]

1934 (published 7 Sep.,[1] hardbound): *The Gramineae: A study of cereal, bamboo, and grass.* University Press, Cambridge.

1965/1972 hardbound reissue: *The Gramineae: A study of cereal, bamboo, and grass.* J. Cramer, Weinheim/Lehre (series: *Historiæ naturalis classica*, vol. 41). [With a new introduction (see Clayton, 1965/1972). Both reissues have the same text.]

1938 (published 13 May,[1] hardbound): *Herbals, their origin and evolution: A chapter in the history of botany, 1470–1670.* 2nd ed. University Press, Cambridge.

1953 (published 13 June[1]) hardbound reissue: Information as preceding. [With a few minor corrections.]

1970 hardbound reissue of 1953 corrected reissue: *Herbals, their origin and evolution: A chapter in the history of botany, 1470–1670.* 2nd ed. Hafner Publishing Co., Darien. [With a new preface (see M.A. Arber, 1970a).]

1946 (published summer, paperbound): *Goethe's botany: The Metamorphosis of plants (1790) and Tobler's Ode to nature (1782), with an introduction and translations.* The Chronica Botanica Co., Waltham (series: *Chronica Botanica*, vol. 10, no. 2).

1950 partial paperbound reissue: Not seen (cited from Amrine, 1996, vol. 2, p. 3, vol. 1, p. 426).

1950 (published 28 Apr.,[1] hardbound): *The natural philosophy of plant form.* University Press, Cambridge.

1970 hardbound reissue: *The natural philosophy of plant form.* Hafner Publishing Co., Darien. [With a new preface (see M.A. Arber, 1970b).]

1954 (published 3 Feb.,[1] hardbound): *The mind and the eye: A study of the biologist's standpoint.* University Press, Cambridge.

1964 paperbound reissue: *The mind and the eye: A study of the biologist's standpoint.* University Press, Cambridge. [With no new introductory material.]

1985 paperbound reissue: *The mind and the eye: A study of the biologist's standpoint.* Cambridge University Press, Cambridge (series: *Cambridge science classics*, unnum.). [With a new introduction (see Bell, 1985).]

1960 German paperbound translation: *Sehen und Denken in der biologischen Forschung.* Trans. by Vilma Fritsch. Rowohlt Taschenbuch Verlag, Reinbek bei Hamburg (series: *Rowohlts deutsche Enzyklopädie*, 110). [With a new perspective (see Fritsch, 1960) and various changes in the text.]

1961 Portuguese paperbound translation: *Ver e pensar: Um estudo do ponto de vista do biologista.* Trnas. by Alberto Candeias. Livros do Brasil, Lisboa (series: *LBL enciclopédia*, unnum.). [Additions and changes as preceding translation.]

1991 Italian paperbound translation: *L'occhio e la mente: Studio sulla metadologia della ricerca biologica.* Trans. by Daniele Castelnuovo Tedesco. Vallecchi Editoire, Firenze (series: *Mente e natura*, unnum.). With a new introduction by Fantini (1991) and a translation of Bell (1985).

2002 Spanish translation of chapter 5: El biólogo ante la escritura. *In* Nemesio Chávez Arredondo (ed.), *Todo por saber.* Dirección General de Divulgación de la Ciencia, Universidad Nacional Autónoma de México, Cuidad Universitaria, México, D.F. In press.

1957 (published 2 Nov.,[1] hardbound): *The manifold & the one* [on half-title page and dust jacket as *The manifold and the one*]. John Murray, London.

1967 paperbound reissue: *The manifold and the one.* The Theosophical Publishing House, Wheaton (series: *A Quest book*, unnum.). [With no new introductory material.]

1969 Italian paperbound translation: *Il molteplice e l'uno.* Trans. by Franco Pintore. Casa editrice astrolablo, Roma (series: *Itinerari nell'ignoto*, unnum.). [With no new introductory material plus some deletions.]

1986 (published 11 Dec.,[3] paperbound): *Herbals, their origin and evolution: A chapter in the history of botany, 1470–1670.* 3rd ed., revised by William T. Stearn. Cambridge University Press, Cambridge (series: *Cambridge science classics*, unnum.). [With a new introduction (see Stearn, 1986), new material in appendices (including a reprinting of Arber, 1940, 1953), but the main text unchanged from the 1953 corrected reissue.]

[1]Publication date from Arber's inscription on her personal copy that I examined on 27 May 2000 courtesy of her daughter Muriel Arber. This is the likely date of publication, or slightly after it.

[2]For completeness Newell Arber's 1921 book. *Devonian floras*, which Arber edited, is included. The reissue of this mentioned by M.A. Arber (1968a:383) never materialized (see Schmid & M.A. Arber 1977).

[3]Publication date from the publisher's U.K. website.

dating back to 24 Oct. 1974. Adding such flesh to the bare bones of history will, I hope, add personality to the text and make Arber and her relatives and colleagues come alive.

For ease of cross-referencing, sections of the paper are numbered sequentially while subsections are lettered sequentially.

(B) Literature citations

Because the Literature Cited includes many of Arber's works, some years have multiple entries, including for some of her books. When citing her books, the '*a*' or '*b*' is not indicated except where it is needed for clarity, for instance: 'Arber's *The natural philosophy of plant form* (1950)' *vs.* ' "morphological and philosophical thought" (Arber, 1950*a* p. vii)' quoted from that book.

The Literature Cited also gives codings ('†', '‡', '§', '‖', and '¶', respectively) for works emphasizing or discussing Agnes Arber, Edward A. Newell Arber, Muriel A. Arber, Ethel Sargant, and/or Edith Rebecca Saunders.

AGNES ARBER'S PUBLICATION RECORD (4)

(A) Books and articles

Arber is best known for her books, of which there are eight (see Tables 2 and S1): *Herbals* (1912, 1938, 1986 editions), *Water plants* (1920), *Monocotyledons* (1925), *The Gramineae* (1934), *Goethe's botany* (1946), *The natural philosophy of plant form* (1950), *The mind and the eye* (1954), and *The manifold & the one* (1957). Her *Herbals, their origin and evolution: A chapter in the history of botany, 1470–1670* ran in three editions and is undoubtedly Arber's most widely known book, certainly to persons outside the areas of botanical philosophy, morphology and anatomy. Seven books have been reissued (1953–99) a total of 13 times, mostly with new prefaces or introductions that discuss Arber's life or work. Most recently, the first edition of *Herbals* was reissued in India under the new title *Herbal plants & drugs* (1999), which is incongruous in view of the actual lengthy title of the original editions (Schmid, 2000). Only two books have been translated: *The mind and the eye* into German in 1960, into Portuguese in 1961, into Italian in 1991, and into Spanish (chapter 5 only) in 2002, and *The manifold & the one* into Italian in 1969.

Goethe's botany (1946) deserves to be reissued. This little book contains Arber's translations of Goethe's *Versuch die Metamorphose der Pflanzen zu erklären* (1790) and Georg Christoph Tobler's (1757–1812) *Die Natur* (1782), as well as her 24 pages of scholarly introductions to these. Amrine *et al.* (1987 p. 405) regarded Arber's translation as 'especially fine'.

Arber's groundwork for these books was some 218 other publications that appeared between 1892 (at the age of 13) and 1961 (a year after she died at the age of 81). These publications (see Table S1) include:

> Ninety-three papers (a 'paper' is defined as an item ⩾ four pages long), including six major review papers on plant morphology (1918–41), 11 research papers in two numbered series on floral structure (1931–32, 1932–42) and ten research papers in a numbered series on grasses (1926–31), with only four papers being coauthored (Sargant and Arber, 1905, 1915; Beer and Arber, 1919, 1920);
>
> Forty-five notes (a 'note' is defined as an item ⩽ three pages long), only one of which was coauthored (Beer and Arber, 1915);
>
> Twenty obituaries, including three obituary memoirs (memorials) written years after the person died;
>
> Three obituary bibliographies in palaeobotanist D. H. Scott's (1918*c*, 1918*e*, 1919) obituaries of Arber's friend, Ethel Sargant (1863–1918; Fig. 6) and Arber's husband Newell Arber (1870–1918; Fig. 2);
>
> Twenty-four book reviews, including six essay-length book reviews;
>
> Sixteen letters;
>
> Thirteen poems; and
>
> Four abstracts, only one of which was coauthored (Sargant and Arber, 1904).

Of interest in this day of interdisciplinary work is the fact that Arber coauthored only six times, three times each with Ethel Sargant and Rudolf Beer (1873–1940), and always as the junior author early in her career. Finally, the above tally excludes Arber's editing of her husband's *Devonian floras* (1921*a*) and four of his palaeobotanical papers (1919, 1920, 1921*b*, 1922), all of which were published posthumously.

Stearn (1986 p. xxviii–xxix), as usual (see section 1), put Arber's publication record into astute perspective: 'The quality of *Herbals*, as of Agnes Arber's other publications, has its roots in her family background, her upbringing and her interest in literature, history and botany, all reinforced by an innate philosophical and synthesizing cast of mind which saw the wider issues underlying the investigation . . . Her publications manifest how industriously and creatively Agnes Arber spent her life.'

(B) Drawings and poetry

Arber was a superb draughtsperson and generally illustrated her later books and articles herself. Of the figures in her four books involving mainly original research, she drew about a third of the 171 text-figures in *Water plants* (1920) herself; the frontispiece and about 140 of the 160 text-figures in *Monocotyledons* (1925); most of the 212 text-figures in *The Gramineae* (1934); and the frontispiece and apparently all 46 text-figures in *The natural philosophy of plant form* (1950).

D'Arcy Wentworth Thompson (1860–1948), author of *On growth and form* (1917, 1942), 'had praised her drawings as being among the best examples of botanical illustration and very much influenced by the Japanese style, which I [Flannery] think refers to their sparseness and grace' (Flannery, 1998 p. 704, indirectly quoting from his letter to Arber now archived at the Hunt Institute). Arber's 1948 citation for the Linnean Gold Medal mentioned her 'beautiful illustrations' (see section 1). However, while Arber's impressive drawings certainly have a clarity and precision suitable to their purpose, they are not of the artistic quality of the exceptional drawings done by some

other botanists, for instance, those of John Hutchinson (1884–1972) in his *The families of flowering plants*, volume two of which was dedicated to Arber (Hutchinson, 1934).

It is little known that Arber also wrote poetry. According to her daughter Muriel (15 Jan. 2000), Arber 'had written verse from her earliest days; she was rather proud of the fact that she wrote a sonnet at the age of nine, which, whatever its demerits as a poem, fulfilled the rules of sonnet form'. Arber published 13 poems during her lifetime: in 1895 at age 16, in 1896, 1904 (two poems), 1915 (three poems), 1916 (three poems), 1956 (two poems), and finally in 1957 (one poem) at the age of 78. Twelve of the poems appeared in relatively obscure or inaccessible serials: *Our Magazine*, the journal of Arber's primary and secondary school, North London Collegiate School for Girls (four poems 1895–96, 1904); *The Cambridge Magazine* (six poems 1915–16), and *Indian P.E.N.* (two poems in 1956). Only Arber's last-published poem, the 13-line 'At the end', itself modified from a 12-line version in *Indian P.E.N.*, is readily available on page 112 of her book, *The manifold & the one* (1957). Interestingly, the influential and pacifist *The Cambridge Magazine* (11 volumes, 1912–23) edited entirely by Charles Kay Ogden (1889–1957) was also the 'favorite weekly' (Campbell, 1999 p. 168) publication vehicle for Siegfried Sassoon (1886–1967), the famous antiwar poet of World War I. Arber's longest poem, the 79-line 'Sea mist', and Sassoon's three-stanza, 14-line 'The tombstone-maker' both appeared in the magazine on 25 Nov. 1916 [*Ibid* **6(7)** pp. 171, 174, respectively]. Incidentally, in March 1951, aged 37, Muriel Arber published a collection of 25 poems in a little book, *The old mermaid and other poems*, which she dedicated 'To my mother'.

AGNES ARBER'S RELATIONSHIPS WITH HER HUSBAND, DAUGHTER, AND ETHEL SARGANT (5)

(A) Relationship with her husband, Edward Alexander Newell Arber (1870–1918)

Agnes Robertson and Edward Alexander Newell Arber met while she was a student at Newnham College (1899–1902), were engaged in September 1906, and married on 5 Aug. 1909 on his 39th birthday (when she was 30). The couple's engagement and marriage were penurious (M.A. Arber, 1988 p. 5, 2 Dec. 1999).

Arber and her palaeobotanist husband 'had many interests in common and Mrs Arber records how much she was helped by her husband, especially in the criticism and improvement of her papers and in the technique of research and publications' (Hamshaw Thomas, 1960*b* p. 3) (e.g. see Arber, 1912 p. ix, for her *Herbals*). In turn, Arber assisted her husband with his work, especially in fieldwork and by drawing figures for and proofreading two of his books, *Plant life in alpine Switzerland* (Newell Arber, 1910) and *The coast scenery of North Devon* (Newell Arber, 1911). Newell Arber dedicated the 1910 book to his wife.

Arber and Newell Arber never copublished. However, she posthumously presented and edited five of his works: four papers (Newell Arber, 1919, 1920, 1921*b*, 1922, but not Newell Arber and Lawfield, 1920) and *Devonian floras* (Newell Arber, 1921*a*). The book was actually a 'first draft' that Arber revised: 'I must assume the responsibility for its final form' (Arber, 1921 p. v). Besides Arber's introductory 'note' (pp. v–vi), there is a preface (pp. vii–ix; Scott, 1921) by Newell Arber's longtime friend D. H. Scott (1854–1934), who read the manuscript while Newell Arber was alive and who, after his death, read the proofs and also suggested various corrections.

After Newell Arber's death on 14 Jun. 1918, Arber wrote two moving obituaries of her husband (Arber, 1918*d*, 1918*e*). She dedicated her next book, *Water plants*, published on 15 Jun. 1920 (see Table 2), 'to the memory of E. A. N. A.' In her preface, Arber stated:

> To my husband, E. A. Newell Arber, I owed the original impulse to attempt the present study, which arose out of his suggestion that life in Cambridge offered unique opportunities for the observation of river and fenland plants. To his memory I dedicate this book.

(B) Relationship with her daughter, Muriel Agnes Arber (born 1913)

Arber did not remarry after her husband's death in June 1918, raising her daughter Muriel alone. They lived together at 52 Huntingdon Road (see section 6) until Arber's death in 1960, except when Muriel was at boarding school between 1928 and 1930 (M.A. Arber, 1988 p. 9, 26 Mar. 2001) and Arber was in nursing homes in June–July 1942 and from November 1959 onwards (M.A. Arber, 27 May 2000). Thus, as is so often the case where a single parent raises an only child, Arber and her daughter became friends and, indeed, professional colleagues.

Arber and her daughter took many holidays together in southern England between 1919 and spring 1939, when Arber was 60 and Muriel 25 (M.A. Arber, 1988 pp. 7, 9, 12). Muriel Arber also helped her mother with several of her books and is acknowledged in Arber's *The Gramineae* (1934), *Herbals* (1938), *The natural philosophy of plant form* (1950) and *The manifold & the one* (1957). Arber dedicated her 1950 book to Muriel, writing in its preface (the book has no dedication page): 'to my daughter, Muriel, I dedicate this book, in the consciousness of its having come into being on the background of our unending talks about "why things are, and that sort of thing" '. And for the 1957 book, Arber (1957 p. viii) wrote in the acknowledgements: 'I wish to record how much I owe to joint "hammering out" of day-to-day experience and of the ideas that come our way with my daughter Muriel—a process which at its happiest moments yields enkindling sparks'. As already noted (see section 4B), Agnes and Muriel Arber shared a love of poetry, and Muriel dedicated her *The old mermaid and other poems* (1951) 'To my mother'.

(C) Relationship with Ethel Sargant (1863–1918)

Ethel Sargant (see section 14, note 3), 15 years Arber's senior, was to have the greatest influence of any person on Arber as a scientist. Arber (1927 p. 17) wrote that Sargant

'played such a large part in my own life that I can hardly bring myself to look upon her with the detachment which is necessary'. As elaborated in section 9A, Sargant's mode of independent research was the model for both botanist Arber and her geologist daughter Muriel.

It is important to summarize the development of the seminal relationship between Sargant and Arber: Sargant visited Arber's primary and secondary school (North London Collegiate School for Girls—see Arber, 1950*b*) to give talks on botany. Sargant was impressed with Arber, and apparently during Arber's final year at school invited her to visit her private laboratory at Reigate, 'Jodrell Junior' (described fully in section 14, note 3). During the summer after graduation (19 Aug. to 22 Sep. 1897 according to inscriptions in Arber's notebook), Sargant introduced Arber to laboratory work, specifically the microtechnique used to prepare plant materials for microscopic examination. Subsequently, Sargant mentored Arber for a presumably unpaid time during at least one summer vacation while Arber attended University College London (1897–99). At Reigate, Arber met Ethel Thomas (1876–1944), who was Sargant's research assistant (1897–1901). When Thomas left, Sargant employed Arber for a year (1902–03), which represented her universitarian interregnum between Newnham College (1899–1902) and University College London (1903–09, her D.Sc. 1905). Sargant and Arber's work on *Zea* was presented at the BAAS meeting held in September 1903 and was published in January 1905 (Sargant and Arber, 1904, 1905). [This scenario derives from Packer (1997), information from Lisa Ferrugia, archivist at the Hunt Institute (pers. comm. to R. Schmid, 1–2 Aug. 2001), and other sources.]

In August 1909, after their marriage, Arber and Newell Arber moved to 52 Huntingdon Road (see section 6), Cambridge. In 1912, Sargant moved into the Old Rectory by St. Andrew's Parish, Girton, close to the Arber household. This proximity allowed Sargant and Arber new personal and professional interaction. Sargant was godmother at Muriel Arber's christening in October 1913 (M.A. Arber, 26 Mar. 2001). Moreover, a second and last joint paper resulted in April 1915 (Sargant and Arber, 1915).

Arber published five moving obituaries, which were as much homages, to her mentor, research colleague and friend (Arber, 1918*a–c*, 1919, 1927). Arber also dedicated her 1925 work, *Monocotyledons*, 'to the memory of Ethel Sargant' and in its preface stated:

> As her assistant, and, afterwards, her colleague in joint investigation, I received from her a training for which no expression of gratitude can be adequate . . . To work with Ethel Sargant was to realise the pursuit of science as an unending adventure of the mind; in dedicating this book to her memory, I dedicate it to the very spirit of research.

According to Arber's preface, Sargant, whose research life was devoted to monocotyledons (see section 14, note 3), had, circa 1910, 'accepted the invitation of the Editors to write a book on Monocotyledons' but 'shortly before her death in 1918', when it was obvious that ill health would make this impossible, had 'suggested that [Arber] should undertake the task in her stead'.

THE ARBER HOME AT 52 HUNTINGDON ROAD, CAMBRIDGE (1909–61) (6)

After their marriage on 5 Aug. 1909, Arber and Newell Arber moved into a rented house at 52 Huntingdon Road, Cambridge (Figs 8 and 9). Their previous addresses, as given in the 'list of members' in the annual reports of the BAAS, were 9 Elsworthy Terrace, Primrose Hill, N.W., for Arber (her parent's home) and Trinity College, Cambridge, for Newell Arber. He actually lived in lodgings at 36 Sidney Street, Cambridge (*The naturalist's directory*, 19th edn, 1904). 'His post was a University one, not a college one, and he was not entitled to rooms in Trinity' (M.A. Arber, 25 Mar. 2001).

The rented house at 52 Huntingdon Road, is located between Benson Street and Priory Street, was (and is) about 1·3 km north-west of the centre of Cambridge and about 3·5 km south-east of St. Andrew's Parish Church, Girton (Figs 10–12), where the couple are buried (see section 10). The Arbers occupied this house for 52 years until August 1961. Arber lived there continuously until November 1959, when she entered the Hope Nursing Home in Cambridge, where she died on 22 Mar. 1960; Newell Arber lived at 52 Huntingdon Road until his death there on 14 Jun. 1918. Their daughter Muriel was born there on 21 Jul. 1913 and lived there almost continuously (except for boarding school, 1928–30) until August 1961, when she moved to a nearby flat.

According to Flannery (1996 p. 54), 'Muriel said that the rent for this house was very reasonable, but that the landlord never made any improvements. They never had electricity, so all Agnes' writing and research [at no. 52] were done by gaslight', certainly 'under less than ideal conditions' (Flannery, 1998 p. 705). However, Muriel Arber (26 Mar. 2001) remarked: 'We did not suffer under gaslight but actively liked it—incredible as this must seem to you!' (See also section 8B.) 'The house was [only] wired for electricity by the people who bought it in 1961 from our landlord after my mother's death and my move' (M.A. Arber, 15 Nov. 2000).

AGNES ARBER'S 1921 PRESIDENCY OF BAAS'S SECTION K (BOTANY) DENIED BY THE 'BOTANICAL ESTABLISHMENT' (7)

(A) Events in January 1921

During 16–30 Jan. 1921, when she was nearly 42, the 'botanical establishment' closed ranks to deny Arber the 1921 presidency of Section K (Botany) of the BAAS, its meeting to be held in Edinburgh. Arber would have been the third woman president of Section K after Ethel Sargant (1863–1918; Fig. 6; section 14, note 3) for the 1913 Birmingham meeting and Edith Saunders (1865–1945; Fig. 7; section 14, note 4) for the 1920 Cardiff meeting. For details see Boney (1995), to whom the following page citations refer.

Eight prominent botanists (all Fellows of the Royal Society of London) were involved: Sir I. B. Balfour (1853–1922) of Edinburgh, F. O. Bower (1855–1948) of Glasgow, J. B. Farmer (1865–1944) of London, W. H. Lang

(1874–1960) of Manchester, F. W. Oliver (1864–1951; see Arber, 1951) of London, D. H. Scott (1854–1934; see Arber, 1949, 1954*b*) of East Oakley, (later Sir) A. C. Seward (1863–1941) of Cambridge, and F. E. Weiss (1865–1953) of Manchester (for Scott and Seward see also section 14, note 6). Bower, who had been president of Section K (Botany) for 1914 (see Boney, 1998), initiated the debate with three letters dated 16 Jan. 1921 that he sent to Lang, Seward, and Ethel Thomas (1876–1944), the Recorder of Section K.

Various factors were involved: (*a*) Bower was upset because a second woman, Arber, was to follow Edith Saunders as president, because both women were from Cambridge, because more senior male botanists had priority for the presidency, and because Edinburgh, where the 1921 meeting was to be held, 'has the right to expect better than this . . . [ellipsis Boney's] To ask Balfour [of Edinburgh] to sit under the Presidency of Mrs. Arber is ridiculous!' (p. 27). (*b*) Bower also maintained that (p. 33) 'Mrs. Arber is not a botanist of such weight or position as would make her appointment suitable for Edinburgh.' Flying against this biased statement is Arber's publication record from 1892 through 1920 of two books and 94 other publications (see Table S1). (*c*) Saunders had not followed proper procedures (which were vague) in designating Arber as her successor. (*d*) Finally, there was anti-feminism and general antipathy toward 'Cambridge botany' and 'Cambridge [botanical] politics'. For instance, Farmer complained that 'the feminists on the Committee are running their show to death' while Seward opined 'that a "botanical gynocracy is unacceptable" ' (pp. 29, 30).

Just a day after Bower's missive, in a letter dated 17 January [the mail was efficient in those days, including transatlantic mail (Schmid, 1986)], Seward could inform Bower that he had met with Arber, who 'had taken the remarks in good spirit, had considered the matter, and had then sent in her resignation to the Secretary of the BAAS' (p. 29).

> Mrs. Arber wrote to Bower on 17 January stating that Seward had just been to see her, and had said that a woman President of Section K would not be agreeable to botanists after a woman President the previous year at Cardiff—". . . [ellipsis Boney's] I am not aware of this feeling but as Professor Seward is no doubt able to gauge the feelings of botanists on this question I at once sent in my resignation" (p. 30).

In a letter to Seward dated 19 January, Bower was relieved, 'paid tribute to the good sense' of Arber in resigning, 'the only dignified way of escape' and blamed Edith Saunders and Ethel Thomas, the sectional recorder, who 'should have guided Miss Saunders', 'but perhaps she is unguidable', she being a strong-willed woman 'who neither knows nor cares nor ascertains general botanical opinion' (pp. 29, 32).

After further fulminations, recriminations, and imbroglios, and some attempts to get Arber to reconsider her resignation, D. H. Scott was chosen as the 1921 president of Section K (Botany) even though he had presided at the 1896 meeting in Liverpool. In a 7 Feb. 1921 letter to Bower, Scott said that 'his sympathies lay entirely with Mrs. Arber, who had been placed in a very trying position and had throughout behaved with admirable discretion and generosity . . . she would have made an excellent President. He had, however, been assured that his appointment was not unwelcome to Mrs. Arber' (p. 34).

Boney (1995 pp. 36–37) concluded that 'the unfortunate Mrs. Arber was the target for the resentment against Miss Saunders . . . Her experience must have been a classic example of being in the wrong place at the wrong time . . . Undoubtedly from the Scottish standpoint it was a factor of scientific standing. Despite her undoubted scientific prowess, Mrs. Arber did not occupy a scientific position of note, and hence was not of sufficient eminence to grace the Presidential Chair in a major centre of botanical excellence in the capital of Scotland.'

In this affair Scotswoman 'Dame Helen [Charlotte Isabella] Gwynne-Vaughan [née Fraser (1879–1967), who in 1911 had married palaeobotanist and morphologist D. T. Gwynne-Vaughan (1871–1915)—see Boney, 1994] had [tried] to tread a careful path between respect for Scottish feelings over the affair, and the wish to see a woman President installed . . . Whilst agreeing with the general sentiment of the unsuitability of Mrs. Arber's appointment for Edinburgh, Dame Helen had nevertheless proposed that Mrs. Arber would be a suitable candidate for the next occasion when a woman President was under consideration' (Boney, 1997 p. 18).

(B) Events in later years

In late 1926, nearly 6 years later, a time period during which she had published her *Monocotyledons* (1925) and 20 additional articles (Table S1), Arber (age 47) was again nominated for the presidency of Section K (Botany) of the BAAS, 'in order of preference' (Packer, 1997 p. 103): Arber, J. H. Priestley (1883–1944), and F. E. Fritsch (1879–1954). Phycologist Fritsch got the presidency for the meeting to be held in Leeds in summer 1927 because Arber declined the nomination. In a footnote to his letter of 13 Nov. 1926, Bower informed Scott: 'I am sorry to say that Mrs. Arber [emphasis in original] resolutely refuses to accept the Presidency of Section K, in spite of my special efforts to induce her to reconsider the matter. One can't altogether wonder!' (Boney, 1997 p. 18).

As a coda, because Boney (1995, 1997) did not mention it, it seems worth noting that Scotswoman Gwynne-Vaughan had played her cards right to be 'a suitable [woman] candidate'. She became the third woman president of Section K, for its 1928 Glasgow meeting.

AGNES ARBER'S PRIVATE LABORATORY AT 52 HUNTINGDON ROAD AND ITS ESTABLISHMENT IN NOVEMBER 1927 (8)

(A) Reasons for the move

In November 1927, at the age of 48, Arber was forced to vacate her laboratory space in the Balfour Biological Laboratory for Women, which led her to set up a laboratory in her home. Packer (1997) and especially Richmond (1997) describe the history of the Balfour Laboratory, which had been established by Newnham College in spring 1884 for the science training of women of

Newnham and Girton, the two women's colleges of Cambridge University. Packer details Arber's move from the laboratory.

Arber was a Demonstrator in Systematic Botany and researcher in the laboratory from autumn 1911 to June 1914, and a researcher thereafter until late 1927 (Table 1). In fact, Arber used the byline 'Balfour Laboratory' on her publications from 1912 to April 1928. Even after Newnham College officially closed the laboratory as a teaching unit in summer 1914 and leased the building to the newly formed Department of Biochemistry in 1919 (Richmond, 1997), there was an 'understanding with Mrs Arber, an ex-Fellow [i.e. 1912–13, 1918–20; Table 1] of the College, that she shall be allowed to carry on her research work', the working space to be made available without charge (Packer, 1997 p. 95). Joan Pernel Strachey (1876–1951), Principal of Newnham College (1923–41) and the sister of biographer Lytton Strachey (1880–1932), had written thus on 31 Oct. 1927 to the University Treasurer, G. H. A. Wilson.

When the financially strapped Newnham College decided to dispose of the building in October 1927, attempts were made to find other facilities for Arber. In a letter dated 3 November, Wilson informed Strachey that A. C. Seward, who was then simultaneously Professor, Chair of the Botany School, and Master of Downing College, and who had just concluded a term as Vice Chancellor of the University (1924–26; see section 14, note 6), would try to find space somewhere for Arber. Strachey had already informed Wilson in her 31 October letter to him that Seward 'is most sympathetic and he promises to see Mrs Arber and to do all he can to meet her wishes'. Strachey wrote to Arber on 5 November requesting that she be contacted after Arber had talked to Seward but before Arber made any final decision. On 8 November, Arber replied to Strachey thus (Packer, 1997 p. 95):

> Professor Seward has no room for me in The Botany School, but is so kind as to suggest that I might be accommodated at the Botanical Gardens. This is not a proposition which I can see my way to accepting [see section 9B], but in accordance with your wish I am deferring my answer—though (to be quite frank) I do not see what is to be gained by this, as the matter is so *entirely personal to me* [emphasis added].

On 9 November, Arber wrote to Seward of her decision and also apologized for its delay, 'but the whole thing has taken some thinking out'. In letters to both Seward and Strachey (Packer, 1997 p. 95)

> [Arber] outlined her intention of setting up some space in her own home in which to continue her work, after having worked in the Balfour Laboratory for the past 17 years [actually 16 years, 1911–27; see Table 1]. She also informed Strachey that she would move out of the Balfour as soon as possible, but this would be held up by a decision as to what would happen to the laboratory equipment . . . Seward wrote back to Arber, and offered his help if she did not find working at home satisfactory . . . In the meantime, Strachey offered Arber the laboratory equipment she had used in the Balfour to use in her home. Arber thanked her for the 'opportunity of *quiet and independent research* [emphasis added; see section 9A for an elaboration] this afforded [her].'

Later in her book *The Gramineae*, Arber (1934 p. viii) would acknowledge both Girton and Newnham Colleges 'for the loan of apparatus, equipment and books which has made [her research on grasses] possible'.

(B) The private laboratory and working at home

Thus Arber, 'looking for [new] research facilities, remodeled a [rear] room in her house at 52 Huntingdon Road into a lab [see Figs 8 and 9]. It had been a servant's room over the kitchen but was vacant because the live-in maid had married [after which she came in daily until summer 1938]. This was advantageous, for Arber could go there and work at any time. It also enabled her to have "a room of her own" [see section 14, note 7]. She had shared space in the Balfour Laboratory with Edith R. Saunders' (Hauke, 1996).

The laboratory at 52 Huntingdon Road (Fig. 9) 'was fitted out with a microscope and microtome, and shelves lined with jars of specimens waiting to be examined. Conditions here were less than ideal; Muriel [M.A. Arber, in a summer-1995 interview] said that the room was so small that there was no space to spread out books and papers. Agnes did her writing in the ground-floor front [living] room[,] which also doubled as a dining room . . . They never had electricity, so all Agnes' writing and research were done by gaslight' (Flannery, 1996 p. 54).

Early during World War II, her increasingly poor health and the difficulty of maintaining the small laboratory in her house forced Arber to give up laboratory work and led her to increased philosophical contemplation. According to Hamshaw Thomas (1960*b* p. 7), 'she found it impossible to maintain the small laboratory in her house and her active mind turned more and more to philosophy [and to the history of botany] and to the quiet contemplation of the facts which she had observed during the work of the previous twenty-five years'. Due to the war, laboratory supplies were increasingly difficult to obtain. Furthermore, according to Muriel Arber (27 May 2000), 'early during the war' Arber gave up laboratory work because she did not think it 'fair to her neighbours' to have flammable laboratory chemicals around due to the danger of wartime bombing.

Dorothea Singer (1960 p. 118) in her obituary of Arber wrote: 'In later years [i.e. after 1953] failing eyesight withdrew her from microscopical study and she became increasingly absorbed in mystical philosophy.' Muriel Arber (15 Nov. 2000) disputed the 'failing eyesight' remark:

> It [Arber's eyesight] didn't deteriorate more than most people's in old age. And I don't think our gas lighting had any deleterious effect; it really worked quite well! In any case, as far as I remember, she did all her microscope work by daylight, with her microscope on a table [at] the window of her lab [see Fig. 9]. Certainly her sight in no way restricted her reading; she read prodigiously right up to her last illness.
>
> It is impossible to say how long my mother would have continued to do lab work if it had not been for the effect of World War II. Her health was poor by the early 1940s, but that too was partly an effect of the war. Had it not been for the war she would probably have continued lab work for at least a few more years, but that is speculation and I simply cannot tell.

In January 1942, at the age of 62, Arber published her last article involving original scientific research, a paper entitled 'Studies in flower structure. VII. On the gynaeceum

of *Reseda*, with a consideration of paracarpy' (Arber, 1942). Her subsequent writings were entirely on historical and philosophical subjects.

In a letter sent to Dame Myra Curtis (1886–1971), Principal of Newnham College (1942–54), in June 1952, Arber, then aged 73, announced her decision 'to discontinue most of her laboratory work "in favour of writing of which I have much more than enough on hand to fill such working years as are likely to be ahead of me" ' (Packer, 1997 p. 96, who does not give a precise date for Arber's letter). Arber wanted to return the laboratory equipment she had received following the closure of the Balfour Laboratory. Eventually, the microtome went to Newnham College while the other items such as furniture, glassware and slide boxes went to Cambridge Technical College (Packer, 1997).

(C) Conclusions

Several conclusions can be drawn about Arber setting up her own private laboratory:

After 1927 the relationship between Arber and Seward was different, but I would not call it estranged because Arber later enthusiastically reviewed two of his books (Arber, 1931, 1932) and acknowledged him in two of her books (Arber, 1934, 1938). In contrast, Packer concluded more strongly (1997 pp. 96–97, emphases added):

> Given Arber's background, dedication to her work, and the circumstances of her move from the Balfour, *Seward seems ungenerous* in not offering Arber space in the Botany School. In contrast, Newnham had been generous in giving space to the Botany School in the past. The Botany School was in a period of expansion [but then space would have been very tight!], and Seward was certainly a prominent figure in the University [see section 8A] . . . It may be that Arber did not want to work in the Botany School. However, Seward had the opportunity to help Arber but instead *he snubbed her*.

Finally, because it was the decision of Newnham College to close down the Balfour Laboratory facilities, one cannot give credence to C. D. K. Cook's conclusion (pers. comm. to R. Schmid, 6 Aug. 1999) that Arber 'fell out with A. C. Seward in the 1920s and was ousted from the lab'.

Packer (1997) also concluded the following, and I would not dispute this: With Arber's earlier failure to obtain the presidency of the BAAS (see section 7) and 'with the failure of the Botany School to provide her with laboratory space, it seems that Arber was drawn into the centre of the debate over women's involvement in botany, but without a real desire for the "rewards" that victory might bring to her personally' (p. 98). Finally, 'Arber's way of coping with [the] opposition ["posed by patricidal institutions"] was not to take on the familiar role of crusader against sexism, but to adopt a more personal separation from the professional scientific world'; this 'fact' 'does not diminish the contribution she made to science and to women in science' (p. 100). (See also the end of section 11.)

'QUIET AND INDEPENDENT RESEARCH' (AGNES ARBER) AND 'INDEPENDENCE IS THE ESSENCE OF RESEARCH' (ETHEL SARGANT) (9)

A) Agnes Arber was not a 'recluse'

There is one matter now that I wish to discuss (and dispel), namely that Arber was a reclusive scientist. On 5 Nov. 1926, in addressing women students of the Girton Natural Science Club at Girton College, Cambridge, about her mentor, research colleague, and friend Ethel Sargant (1863–1918; Fig. 6), Arber had said (Arber, 1927 pp. 18–19, also cited in Stearn, 1960*b* p. 263):

> The concentration of mind necessary for independent thought is far more easily achieved in a place where one can get a generous measure of solitude than in a populous laboratory where people are incessantly running in and out, and in Ethel Sargant's words—'*Independence is the essence of research*' [emphasis added; a similar quote appears in Arber, 1918*a* p. 361]. Moreover, if you are all by yourself in a laboratory where you start everything from scratch, and have no convenient laboratory man to pull you out of practical difficulties, you find yourself, willy-nilly, putting more brain-work into your technique, and hence into your job as a whole; and you are less liable to turn out the dreary, mechanicalised, standardised results which are the curse of certain big laboratories where research has almost become a form of routine work.

Thus, Sargant's mode of independent research (see also section 14, note 3) was the model not only for Arber but also for her geologist daughter Muriel (section 2), who has 'continued to the present day, following [her] mother's [and Sargant's] practice of working independently at home' (M.A. Arber, 2 Dec. 1999).

Two points seem worth emphasizing in passing: Sargant's attitude toward independent research was partly necessitated by her obligation to care for her mother and invalid sister (see section 14, note 3). Secondly, D. H. Scott (1918*a–d*), Sargant's mentor, research colleague and friend (also a friend of Arber), was also an independent researcher at home after 1906, when he left Kew, and until his death in 1934. Scott's wealth, however, facilitated his move into independence (Arber, 1949; see also section 14, note 6).

Muriel Arber remarked about her mother: 'What bothered her most was wasting time'. She 'was passionate about her work, and regretted time she had to be away from it' (indirect quote of Muriel Arber in Flannery, 1996 p. 54). 'She wanted to do [her own research] more than anything' (M.A. Arber, pers. comm. in Hauke, 1996). As elaborated in section 8, this passion could be indulged by Arber moving her laboratory work to her home because this afforded her, in her own words, an 'opportunity of *quiet and independent research*' (emphasis added, Arber, in a November 1927 letter to Pernel Strachey cited in Packer, 1997 p. 95). Thus, according to Stearn (1960*a* p. 920, 1960*b* pp. 262–263):

> Working there in solitude, with her mind free to brood and to search for meaning and the right words to communicate it, she learnt from her own experience, no less than from the examples of Descartes and Spinoza, Darwin and D. H. Scott, that the uninterrupted periods of still meditation are essential if deeper insight is to be won, and she deplored the tragic loss to our culture likely to come as contemplative leisure fades irrevocably from

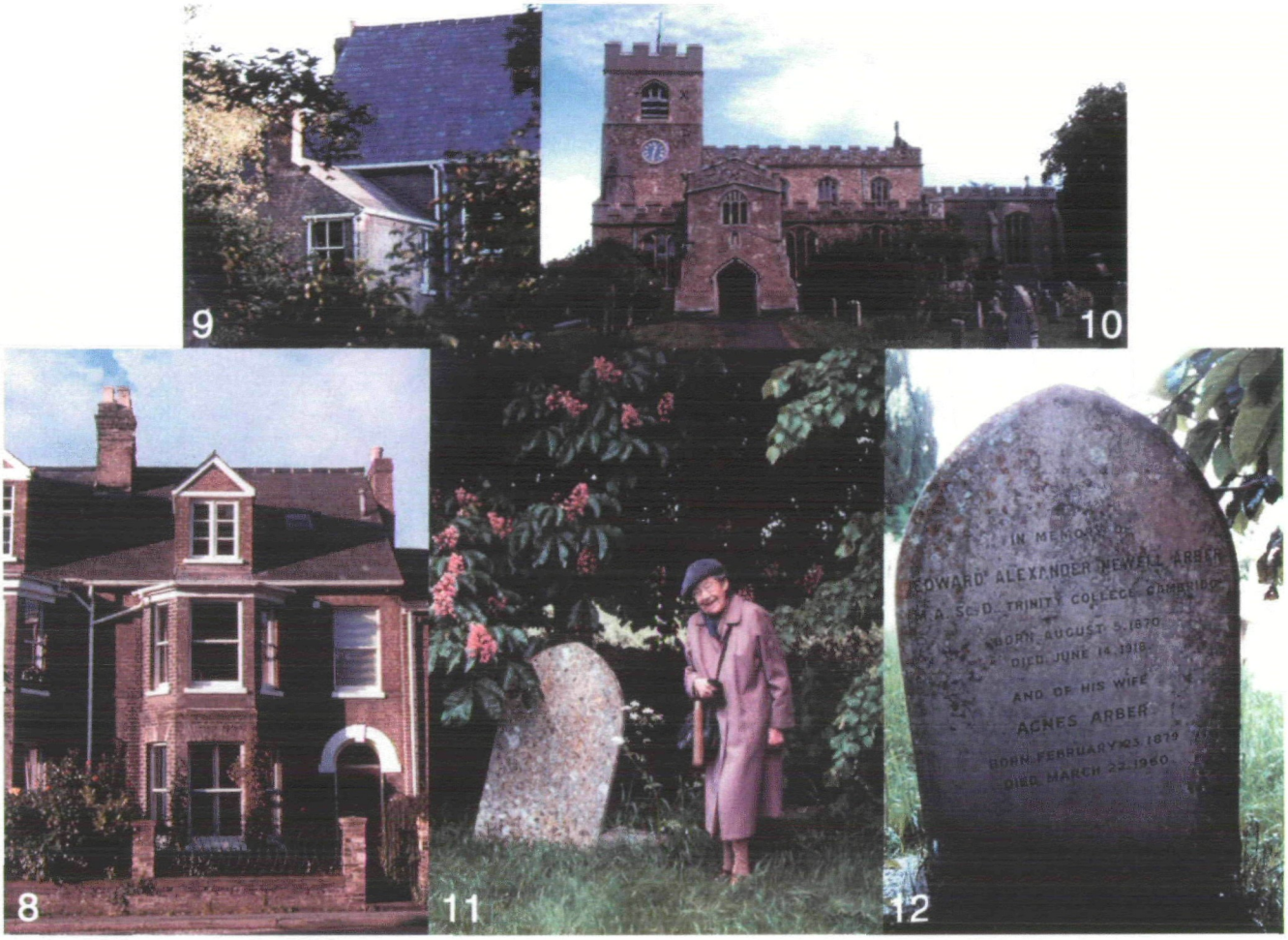

FIG. 8. Looking east at 52 Huntingdon Road, Cambridge, the home of Agnes Arber from 1909 to 1960 and E.A. Newell Arber from 1909 to 1918. The living room has the bay window to the left of the front door and entry. Above the living room is the main bedroom, where their daughter Muriel Arber was born in July 1913. To the right is Newell Arber's dressing room which, after his death, became a storeroom (the brightly coloured window-covering is recent). The attic room was the nursery, then a bedroom, and finally another storeroom. Newell Arber installed the large letter slot (not visible) on the front door; the letter slot was reinstalled on a new door after Arber's death in 1960. Early during World War II the original cast-iron fence was removed by the authorities for scrap for the war effort. The house was not wired for electricity until 1961.

FIG. 9. View of the rear of 52 Huntingdon Road showing Arber's laboratory (see also the main text, section 8B), which until 1927 was a servant's room and which is positioned over the kitchen (not visible in photograph). [A TV antenna and satellite uplink and two rear skylights were digitally removed from Figs 8 and 9.]

FIG. 10. Looking north at St. Andrew's Parish Church (parts date to the 11th century) in Girton, Cambridgeshire, the burial site of Agnes Arber and her husband Edward Alexander Newell Arber (her funeral was here whereas his was at the chapel of Trinity College, Cambridge). According to the church's website (www.girtonweb.dabsol.co.uk/rel), 'this view has remained virtually unchanged from 500 years when the last major rebuilding was completed'; the church is in 'Perpendicular Gothic style'. The Arber gravesite is in the northeastern part of the churchyard at the rear of the church. Inside the church on the north wall is a plaque commemorating Ethel Sargant (published reports—see the main text, section 10—that she is buried at St. Andrew's are erroneous).

FIG. 11. Looking east at Muriel Agnes Arber (born 21 Jul. 1913) standing by the grave of her parents and a tree of *Aesculus* × *carnea* (red horse chestnut, Hippocastanaceae). The engraved part of the tombstone faces east toward a playing field (the Recreation Ground Pavilion).

FIG. 12. The Arber tombstone, which was refurbished in 1960. The inscription reads: In memory of/Edward Alexander Newell Arber/M.A. Sc.D. Trinity College, Cambridge/Born August 5, 1870/Died June 14, 1918/and of his wife/Agnes Arber/Born February 23, 1879/Died March 22, 1960. (All photographs taken 27 May 2000 by Rudolf Schmid.)

scientific life through emphasis on team-work research in university, state and industrial laboratories. For her this fruitful exemption from 'the daily grind of academic duties', 'enforced day-to-day contacts' [quotes unattributed, presumably Arber's in a letter to Stearn, but source unknown], was made possible by private means and grants in aid from the Royal Society and a Leverhulme Research Fellowship [see Table 1].

Stearn's statement, which was published on 24 Mar. 1960 in *The Times* 2 d after Arber had died and again in December 1960 in *Taxon* (respectively, Stearn, 1960*a*, *b*), has fostered the concept of Arber as a solitary worker or reclusive scientist; it was the first such statement to appear in print. Corner was even more explicit: 'She was a *recluse*

[emphasis added], . . . and much was it regretted that she could not enter more into the life of the nearby Botany School' (Corner, 1961*a* p. 128). 'It is a pity that she chose to become a *recluse* [emphasis added], to set aside academic vocation, and to work privately in her home on Huntingdon Road' (Corner, 1961*b* p. 197). 'She worked in isolation' in her 'little laboratory' (Stearn, 1986 p. xxxi). 'Arber was a loner' (Isely, 1994 p. 332). Finally, 'in order to devote her life to a seeking for truth and understanding, she kept domestic and social involvement to a minimum' (Hauke, 1996).

However, Stearn (1960*b* p. 263) himself ended his earlier account quoted just above with this qualification: 'Mrs. Arber never sought publicity and was *reputed a recluse; in fact* [emphasis added] she was a genial and gracious person whose kindness and friendship will be gratefully remembered by the students of botany she helped and encouraged.' For example, palaeobotanist Henry N. Andrews (born 1910) remarked (1980 p. 126): 'Agnes Arber was one of the kindest people I have ever met and one of Britain's great botanists . . . She served a special cake with tea that I particularly enjoyed; she remembered this and some years later after the war when I returned to Cambridge she had the closest item of pastry that was then available!' And ecologist Sir Harry Godwin (1901–85) wrote (1985 p. 167) that although Arber 'pursued her work at home', 'she was always available to help colleagues'.

(B) The perspective from women's studies

Indeed, Arber liked working at home and, as we see in her address about Ethel Sargant to the Girton Natural Science Club (see section 9A), she certainly preferred a working space where there was solitude. Nevertheless, even if her laboratory at home afforded her this private space, she had few options but to move there due to the closure of the Balfour Laboratory. As Packer (1997 p. 96) concluded:

> It has been stressed by several people, including her daughter [Muriel Arber], and implied [see the 'quiet . . .' italicized quote in sections 8A and 9A] by Agnes Arber herself, that she enjoyed the quiet and intense atmosphere of working alone at home. However, the archiv[al] material has shown that, whatever the problems or benefits of this move in the long run, it was not a choice Arber made herself[;] it was a position forced onto her in a matter of two or three weeks. The negotiations involved the insulting offer of working space at the Botanical Gardens [see below and section 8A], which was not then a site for research but for the production of plant material. It appears that from the time she returned to Newnham to start work in the Balfour [Laboratory, 1911–14 as demonstrator and researcher, 1914–27 as researcher], *Arber tended to take the path of least political and administrative resistance* [emphasis added]. She worked in the Balfour on the good graces of Newnham College, but was unfortunate that her benefactors were themselves short of resources. If she had been a man with a similar background she might well have been able to drift into an academic position. As a woman it was more difficult for her to negotiate such a path without actively working towards it or making concessions in terms of her style of work. Her research background in Sargant's private laboratory, and the fact that the family had enough financial resources to support her move to a home laboratory, meant that she need not confront such problems.

I mostly agree with Packer's conclusions but would give it less of a feminist slant. Despite the very substantial accomplishments Arber had already achieved by November 1927 at the age of 48, namely, three books, 118 publications (59 papers, 29 notes, nine obituaries, three obituary bibliographies, four book reviews, two letters, ten poems and two abstracts), and one edited book and four edited papers for her husband (see Table S1), at this date she had had (*a*) only very limited teaching positions and no directorships, and (*b*) only limited memberships and officerial positions in professional societies and rather limited honours and fellowships (see Table 1). Arber's non-publication accomplishments prior to 1928 invite comparison with the numerous ones of Edith Saunders (1865–1945), who had also published many papers, although no books (compare Table 1 and section 14, note 4; neither woman ever held editorships of serials). As demonstrator (1889–92), lecturer (1892–1925), and director in various capacities (1899–1914, 1918–25) at Girton and especially Newnham Colleges (see section 14, note 4) until her retirement in 1925, Saunders played an important role in training several generations of science students at these two women's colleges of Cambridge University. Godwin (1985 p. 165), recalling his student days in the early 1920s, remembered: concerning 'the supreme value to the biological student of examining fresh material for himself at every opportunity, . . . no one more convincingly proved this than the formidable "Becky" Saunders, who gathered all the Newnham and Girton students into her care and made certain that they saw for themselves every last bit of evidence the fresh material might yield: the rest of my demonstrators toiled far behind her in assiduity and skill'. Arber had no such educational role.

In other words, unlike Saunders, Arber was plugged neither into the 'old boy's school' nor into the 'new girl's school'. Thus, she played only a very minor role in the botany of Cambridge, where she lived for nearly 54 years, including the last 51 years of her life. Tellingly, modern histories of Cambridge botany either completely neglect to mention Arber (Brooke, 1993), refer to her only in passing (Walters, 1981), or, at best, give her limited attention (Godwin, 1985), despite Arber's current botanical stature as well as her being the first woman botanist (and the third woman ever) to be elected to the Royal Society and the first woman Gold Medalist of the Linnean Society (see section 1). [Godwin (1985) and Walters (1981) give more attention to Saunders than to Arber, whereas old histories of Newnham College (Gardner, 1921; Hamilton, 1936), of course, mention Saunders but not Arber.] Godwin (1985 p. 167) remarked insightfully about Arber: 'She took little direct part in the work of college and university, but remained in closest touch with botanical thought, and pursued her work at home in a modest terrace house where she was always available to help colleagues.'

Packer's statement about 'financial resources' is misconstrued. My analysis (unpublished, but see section 5A) of the evidence shows that the Arber family had limited financial resources, that Arber did not have a permanently salaried position after June 1914, and that her research depended on shoestring funding. The finances needed for Arber's move from the Balfour Laboratory to her home were, in fact, minimal because Arber could use at home the university equipment that she had used at the Balfour Laboratory. In

addition, space was available at home for a laboratory because the live-in maid had left to get married. Finally, had there been ample finances, Arber might well have moved to a better house or requested her rented house (see Figs 8 and 9) be wired for electricity, though at the risk of an increase in rent (see section 6).

There are several further considerations: (*a*) Arber was 'passionate' about her research (see sections 9A and 11) and apparently never displayed much interest in teaching. It is extremely likely that she shared Sargant's view of 'teaching as a dangerous occupation for the investigator: in her [Sargant's] own words—"In most cases teaching seems to me fatal to research" ' (Arber, 1918*a* p. 361). Or: Sargant 'felt that . . . any large amount of teaching or organising work [i.e. academic committee work] would stifle the power of original thought' (Arber, 1927 p. 23). Such views would certainly prevent any 'drift into an academic position' (Packer's quote just above) that would entail distractions from research such as teaching and committee work (see also section 9A for Arber's words quoted by Stearn). (*b*) Being a single mother with a child to raise (Muriel Arber was 14 in November 1927 during the home–laboratory controversy), Arber might have seen advantages to spending more time at home (I risk here a modernist interpretation). (*c*) Finally, Seward's suggestion that Arber move to the undeveloped facilities at the Botanical Gardens might indeed be interpreted as 'insulting' (Packer's quote just above). However, an additional deterrent would have been the extra commute time for Arber. The Gardens at Bateman Street are about 1.2 km south of the Balfour Laboratory at Downing Street, i.e. further from Arber's home. Expediency thus dictated the home–laboratory solution.

THE FINAL RESTING PLACE OF AGNES ARBER (1879–1960) AND EDWARD ALEXANDER NEWELL ARBER (1870–1918) (10)

Agnes Arber, née Robertson, died on 22 Mar. 1960 in the Hope Nursing Home, Cambridge, aged 81, on the same death day as one of her great inspirations, Johann Wolfgang von Goethe (1749–1832), aged 82. She and her husband Newell Arber are buried at St. Andrew's Parish Church (Figs 10–12) in Girton, about 4·8 km north-west of the centre of Cambridge and about 3·5 km north-west of Arber's long-term home at 52 Huntingdon Road. The captions to Figs 10–12 provide details about the church and the Arber gravesite. Literature reports (Creese, 1998, but not 1993*a*; Hamshaw Thomas, 1960*b*, but not 1960*a*, 1971) about Ethel Sargant's Girton internment close to Arber are erroneous; Sargant is buried at Sidmouth, south Devon (M.A. Arber, 3 Dec. 1999, 27 May 2000).

AGNES ARBER'S PLACE IN WOMEN'S STUDIES (11)

Previous sections have treated some aspects of the feminist movement in botany (see sections 7A, 8C, 9B). Importantly, Arber 'was in the vanguard of the movement of women into scientific research' (Godwin, 1970 p. 205). She was the first woman botanist, and the third woman overall, to be elected to the Royal Society in 1946 (Fig. 5). In 1948, Arber became the first woman to receive the Gold Medal of the Linnean Society of London. (For details see section 1.) As a consequence, especially in recent decades, Arber has received increased biographical attention, particularly by women writers outside of botany and in the fields of history, women's studies and literature.

There is actually some evidence that Arber (as Agnes Robertson) was involved with the woman's movement early in her life, albeit peripherally and, from the perspective of an activist suffragist, even negatively so. Three early articles published in obscure journals under Arber's maiden name Robertson are suggestive (the 1968 bibliography of Arber by her daughter Muriel does not cite these works): (*a*) In August 1899, aged 20, after graduating with a B.Sc. from University College London, Arber published an article entitled 'The comparative accuracy of men and women', in *The educational review (London)* (Arber, 1899). (*b*) In July 1903, at the age of 24, having just spent a year in Ethel Sargant's laboratory (described in section 14, note 3), Arber saw published in *Biennial leaflet*, the organ of the Women's Agricultural and Horticultural International Union, London, her essay called 'The work of women in botanical research' (Arber, 1903). The opening and closing paragraphs of this essay are revealing:

> To make a distinction between the work of women in botanical research and that of men, is to draw a line of cleavage [one presumes no pun intended] which is entirely artificial. 'Science,' in the words of Mr. Francis Darwin, 'recognises no country and should recognise no sex.' There is no question here of women banding themselves together to force an entry into a reluctant profession; there is *no necessity* [emphasis added] for the work of zealous pioneers who are burning to sacrifice themselves for the good of their sisters. The whole wide field of research lies waiting to be explored, and no other 'open sesame' is needed but the single-minded desire to discover truth for its own sake.
>
> The members of the Women's [Agricultural and Horticultural] International Union are in the main concerned with the *practical* [Arber's emphasis] study of plants, and it is this fact which perhaps justifies the short sketch which I am about to attempt of the work of those women who deal with the same subject, but from a totally different standpoint. By far the greater part of the botanical research carried on at the present day has no utilitarian purpose whatever...the aim of pure research is to discover truth, and not to increase the comfort or prosperity of the human race.
>
> Very few women appear to have made their mark in botany in early times, but one or two deserve mention . . .
>
> Women took a fair share in the revival of interest in the collection and study of plants which followed the publication of Linnæus' great System in the latter half of the eighteenth century; in fact, 'the loveliest of the sciences' was 'recommended especially to ladies as a harmless pastime not overtaxing to the mind.'
>
> . . . [Nine, mostly very long paragraphs on 'the work of women in botanical research'.]
>
> It has been asserted and reasserted with wearisome iteration that our powers as women lie only in the direction of hunting old trails, and that we fail conspicuously in anything requiring initiative and original thinking. To indulge in a wordy denial of this charge would be worse than useless; if it is ever to be answered in the sense which we must all ardently desire, it will be by the *quiet and unobtrusive labours* of the women who are devoting themselves to *original work* [emphasis added] in art, literature, or science. It beho[o]ves us to do all in our power to promote the growth of the spirit of research, and for this end it is of the utmost importance that in the education of girls the habit of *independent*

> *thought* [emphasis added] should be fostered, instead of the merely receptive attitude of mind induced by the present deplorable examination system . . .
>
> The Universities, the intellectual armouries of our land, have opened their doors to us, and there is a very real danger that in complacently congratulating ourselves on our shining panoply of examination successes and class-list triumphs, we may lose sight of the fact that sword and buckler are for use and not for show, and that the only way in which we can justify the concessions which have been made for us, is by doing our share of *original work*, and helping, as far as in us lies, to enlarge the boundaries of human thought.

This statement certainly seems to reflect the strong views of Ethel Sargant (1863–1918; Fig. 6; section 14, note 3) on the value of 'independent research' and 'original thought' (respectively, see section 9A and B). Sargant also wrote an article entitled 'Women and original research' (Sargant, 1900). Perhaps significantly, Arber also knew Ethel Thomas, Sargant's prior research assistant (1897–1901) and 'a strong supporter of the feminist movement' (Delf, 1945 p. 236). (*c*) One of Arber's obituaries of Sargant was republished in full in the suffragist journal, *The common cause of humanity* (see Arber, 1918*a*).

Arber's sex and her undeniable achievements as a scientist are susceptible to being viewed through an overly modern prism at best and from a deconstructionist and feminist viewpoint at worst. [This is not uncommon nowadays. There is, for instance, a long account about the famous botanical artist Marianne North (1930–99) in which deconstructionism ran amuck over many pages on the basis of some rather incidentally patronizing (from a modern perspective) remarks that North had made about Brazilian black natives (see Schmid, 1996).] I will let Muriel Arber (Fig. 11) put her mother into perspective regarding feminism (M.A. Arber, 15 Nov. 2000):

> Kathryn's [Packer, 1997] own primary interest is in my mother as a woman scientist; my mother was passionately interested in her work, but she regarded the fact that she happened to be a woman as incidental. Even if women [of Cambridge University] only had the title of a degree [i.e. a titular degree, not the degree itself—see section 14, note 2] until 1948, I don't think this troubled her any more than it did me! Having the title of a degree [i.e. Arber's 1924 M.A.] meant that she was able to use the University library, and borrow books, and this was what really mattered to her and what she really cared about.

Until 1923, Arber and other women could not take books from the Cambridge University library unless a man signed for them—obviously not only an inconvenience but also a demeaning experience. A passage in Stephen (1933 p. 118; a similar passage appears in Stephen, 1927 p. 358) puts Muriel Arber's remark into historical perspective:

> [In March 1923] besides opening titular degrees to women, these Ordinances gave to women students the [unrevocable] right of admission to University lectures and laboratories, thus regularizing the usual (though not unbroken) practice of over forty years . . . Further Ordinances admitted such students to the University Library on conditions similar to those applying to [male] undergraduates; and women lecturers and holders of the titular M.A. degree were given the same facilities in the use of the library as those enjoyed by [male] graduates.

Therefore, to focus, as some are apt to, on what Arber did not accomplish—an active striving for women's rights—is to miss the great significance of what she did accomplish scientifically, and as a woman (see also section 8C for the similar statement by Packer, 1997 p. 100).

These tantalizing facts and thoughts about Arber's role in the woman's movement require further analysis. Suffice it to say here, Arber's vanguard role in the woman's movement was almost entirely as an exemplar and minimally as an activist leader.

ARCHIVES FOR ARBERIANA (12)

Arber's papers and other materials, including pictures and personal letters, are (and will be) archived at the Hunt Institute for Botanical Documentation, Carnegie Mellon University, Pittsburgh, Pennsylvania. Richard L. Hauke's materials on Arber and for his Internet work on her (Hauke, 1996) are archived at the University of Rhode Island Library, Special Collections, Kingston, Rhode Island (www.uri.edu/library/special_collections/registers/hauke/title.html). According to Desmond (1994), some of Arber's manuscripts and drawings are also at the Natural History Museum, London. I have no knowledge of the whereabouts of her extensive microscope slide collection, but generally such collections are heedlessly discarded after a person's death (see Schmid, 1976).

For details about the Hunt materials on Arber see Van Trump (1964); Stieber and Karg (1981); Stieber *et al.* (1987–88); Packer (1997); and Flannery (1998)—Karg, Stieber and Van Trump are, or were, affiliated with the Hunt.

In February 1961, Muriel Arber donated various surviving materials of her mother to the Hunt Institute. These include letters, manuscripts, notebooks, including notes and proofs for Arber's *Herbals* (1912, 1938), *The Gramineae* (1934) and *The natural philosophy of plant form* (1950). Among other things, there are: '7 boxes of [3 × 5″] index cards for *Herbals*; 16 loose-leaf binders of notes on Goethe, *Herbals*, and morphology'; and 'Arber's first notebooks on botany' (Stieber and Karg, 1981 p. 25). Muriel Arber still has many other botanical materials of her mother; these are also destined to go to the Hunt (M.A. Arber, 3 Dec. 1999, 27 May 2000).

Van Trump (1964 pp. 169–170) noted that 'this collection of Arber material reflects all the facets of Mrs. Arber's intellectual life, but there is little here that is purely personal, and only through some of the letters is one afforded glimpses of her personality or private life . . . The entire collection is largely concerned with Mrs. Arber's bibliographical, historical, and philosophical work in connection with botany rather than with records of her scientific observations.' Packer (1997 pp. 91–92) amplified that these contain 'little correspondence' from 1909 to the early 1930s, except for an 'extensive correspondence' with D'Arcy Wentworth Thompson (1860–1948) spanning 1917–47. Her letters contain 'little personal detail and were mainly concerned with . . . [her] publications'. There are very few letters 'that deal with administrative matters or that are to or from the leading names in botany'. Flannery (1998 p. 706) also lamented the dearth of personal letters.

When I interviewed Muriel Arber on 27 May 2000, I examined various of Arber's materials still in her daughter's

possession. I have had indirect access to other archival materials but have yet to consult directly materials in the aforenoted archives. I will eventually donate to the Hunt Institute my extensive correspondence with Muriel Arber and other materials related to her mother.

ACKNOWLEDGEMENTS (13)

I am greatly indebted to Muriel Agnes Arber for an extensive correspondence, dating from 24 Oct. 1974, that indulged my many queries and that offered numerous valuable comments on herself and her family; I also appreciate spending a delightful and informative day with her on 27 May 2000. I am grateful to the following persons for reading parts or various iterations of this paper: Bruce Kirchoff, Chris A. Stray, and particularly Muriel Arber, Peter Stevens, and Ian Jackson, who also provided invaluable biographical assistance. Steve Ruzin, director, Biological Imaging Facility, University of California, Berkeley (http://plantbio.berkeley.edu/cbi), scanned in the pictures and prepared the final plates. Finally, I thank my daughter Mena for many comments on this project and especially for preparing the Agnes Arber part of my website (http://socrates.berkeley.edu/~schmid/arber).

NOTES (14)

Note 1 (E. J. H. Corner): For more on Cambridge morphologist and mycologist Edred John Henry Corner (1906–96) see Mabberley (1999).

Note 2 (Cambridge degrees for women): By 1895 all universities in Britain other than Oxford University and Cambridge University had been awarding degrees to women; only in 1920 and 1948, respectively, did Oxbridge grant full membership and actual degrees to women (Richmond, 1997; McWilliams Tullberg, 1998). The Cambridge Honours (Tripos) course was opened to women in 1881. A man who passed his tripos received the B.A. ('there are not now and never have been Cambridge B.Scs.'—C. A. Stray, pers. comm. to R. Schmid, 27 Aug. 2001), but a woman who passed her tripos received only a certificate until 1923, or from 1923 until 1948 only the title of the degree (i.e. titular degree), not the actual degree or degree proper, which in effect resulted in a pseudo-degree (Newnham College, 1979 p. iii). In other words, 'women who had taken the [Honours] degree examination in exactly the same way as men were [initially] not awarded a degree [until 1948] or even a degree title [until 1923]' (McWilliams Tullberg, 1998 p. 1). Between 1881 and 1926, women at Cambridge University gradually obtained limited rights in other areas, such as full access to lectures, laboratories and the library [the last in 1923—see the quote from Stephen (1933), in section 11] and, finally, full eligibility as University Professors, Readers and Lecturers (in 1926). However, 'by 1947 it seemed a painful scandal that Cambridge still excluded women from degrees, even though in every other way—as students, examinees, examiners, members of faculties and so forth—[women] acted as if they were on the same footing as the men' (Brooke, 1993 p. 327). Full membership of women in Cambridge University and, consequently, full equality with men, came in 1948.

Note 3 (Ethel Sargant): Ethel Sargant (28 Oct. 1863–16 Jan. 1918; Fig. 6; sections 5C, 9, 11), who was 15 years Arber's senior, was an independent researcher on the embryology, morphology and anatomy of monocotyledons (for biographical references see Girton College, 1948, and other works coded '‖' in the Literature Cited, especially Creese, 1993*a*, 1998). From 1881 to 1885, Sargant attended Girton College, Cambridge University (see note 5 for other details on Sargant's education). From 1885 to 1892, she stayed at the family home at Quarry Hill, Reigate, south-west of London, taking care of her mentally handicapped sister and their mother, 'to both of whom she had been devoted to a degree to which only the richest natures can rise' (Arber, 1918*a* p. 361). From October 1892 to 1893, Sargant worked at the Jodrell Laboratory, Kew, where she studied under D. H. Scott (1854–1934), Honorary Keeper of the Jodrell Laboratory, Kew (1892–1906), who retired in 1906 to become a writer and private researcher in his home.

To quote Arber (1918*a* p. 361): 'From 1893 until the end of her life [in 1918, all] her botanical research was all carried out at home', (*a*) first (1893–1912) at her mother's home, from 1897 onward actually 'in a delightful little laboratory, opened in 1897, which was built [on] the grounds of her mother's house' at Reigate, (*b*) then (1912–18), after the deaths of her sister and mother in 1912, in an 18th-century (Georgian) house that she had purchased in Girton about 3·5 km north-west of the Arber home at 52 Huntingdon Road, Cambridge. Arber (1927) described these laboratories in a talk she gave to women students of the Girton Natural Science Club, on 5 Nov. 1926, in the Sargant Library of Girton College. This talk was published in *Girton Review*, a serial that is not readily accessible—thus extensive quotations follow (from Arber, 1927):

> [After her stay at Kew] she never again carried out research in any public institution. She built herself a small but perfect laboratory, familiarly called 'Jodrell Junior', [on] the grounds of her mother's house (Quarry Hill, Reigate), and it was here that all her best work was done. She regularly employed an assistant, . . . especially as her home duties [caring for her mother and sister] never allowed her to give her full time to botany . . . Sargant took great pains to see that the two women whom she successively employed as research assistants [Ethel Thomas between 1897 and 1901, Arber between 1902 and 1903], received precisely the same treatment, as regards payment, and hours, and holidays, as men doing work of the same type in public institutions. (p. 18)
>
> The laboratory [which 'was admirably equipped with all the appliances for advanced histological research'—Scott, 1918*d* p. 115] was rather a puzzle to the neighbourhood—thirty years ago [i.e. 1897] the serious pursuit of science was regarded as an eccentric occupation for a lady living in a comfortable, semi-suburban district; the local excise officer, in particular, was greatly worried in his mind, and used to pay surprise visits at short intervals, because he had a theory that as soon as his back was turned, the little still (with which the supply of distilled water was made) was used for the manufacture of illicit spirit! (p. 18)
>
> . . . Her first love was cytology . . . I believe, but I have never been able to make sure that I am right, that she was the first person in this country to apply microtome methods to botanical problems, though zoologists had used them previously. She certainly taught herself embedding and the use of the Cambridge rocking microtome with no help from anyone, and she evolved an admirable technique, which was largely her own. (p. 19)

> For many years . . . home claims [on Sargant] had become more and more pressing, and illness and death in her family compelled a very long break in her work [there was a 1909–13 hiatus in her publication record—see M.A. Arber, 1968*a*]. When she was eventually left alone by the loss of her invalid sister and her mother [both in 1912], she had to construct her life anew. She had long wished to live in the neighbourhood of this college [Girton], and by a great piece of good fortune her dream materialised, as she was able at the right moment to buy the old Rectory in Girton Village—now the Littleton House School [currently the Cambridge Academy of English, founded in 1975; the building dates to 1730]. The largest room on the ground floor made her a delightful study, and she fitted up a small room opening out of it as a laboratory. (p. 22)

Ethel Sargant died aged 54 in Sidmouth, south Devon, on 16 Jan. 1918, exhausted by her participation in the war effort. She is buried there and not in Girton, Cambridgeshire (see section 10).

Sargant bequeathed her botanical library, bookcases, papers, microscope slides and specimens to Girton College (Arber, 1925 p. vii, but p. xv of reissue; Stephen, 1927 p. 369, 1933 pp. 139–140, 189). In 1926 the college had a meeting room called the Sargant Library, which held her books (Arber, 1927). Dugald Wilson informed me (2 Sep. 2001) that 'there is now a well respected scientific student scholarship at Girton College in the memory of Ethel Sargant, and she is still held in high esteem within the College'. Sargant's other honours and memberships included: BAAS (admitted 1896, life member); Fellow, Linnean Society of London (elected 1904), in the first group of 15 women to be elected to the society and the first woman to serve on its Council (1906–10) (also service on its Library Committee, 1913–15); Honorary Life Fellow, Girton College (elected 1913); President, Section K (Botany), BAAS, 1913 Birmingham meeting, the first occasion on which a women had presided over a section; President, Federation of University Women (1913–18).

Note 4 (Edith Rebecca Saunders): Edith Rebecca Saunders (14 Oct. 1865–6 Jun. 1945; Fig. 7; sections 7A, 9B), nicknamed Becky and 13 years Arber's senior, was an enthusiastic and dedicated college teacher and also a researcher, initially in genetics and then extensively on the morphology and anatomy of flowers (for biographical references see Newnham College, 1979 and other works coded '¶' in the Literature Cited, especially Creese, 1993*b*, 1998). Saunders 'was one of the pre-eminent women botanists of the first half of this century. Her long life [she died at the age of 79 from the complications of a bicycling accident] was devoted entirely to teaching and research and her contributions in both of these spheres of activity were of outstanding importance' (Hamshaw Thomas, 1947 p. 75).

Saunders published on plant genetics and floral anatomy between 1890 and 1941 (Schmid, 1977, for a detailed bibliography of her anatomical work; Richmond, 2001). Together with other women of Newnham College, and in association with geneticist William Bateson (1861–1926) during his years at Cambridge University (1900–10), Saunders helped establish the new discipline of genetics (Richmond, 2001). In collaboration with Bateson as senior author, Saunders 'had independently rediscovered some[,] at least[,] of [Gregor] Mendel's laws before his work was known to them. She must in fact be regarded as the "mother" of British plant genetics' (Haldane, 1945 p. 385).

Saunders published many papers on floral morphology and anatomy in 1890 and between 1913 and 1941 (Schmid, 1977). Her first paper was on the septal nectaries of *Kniphofia* (Liliaceae) and is noteworthy in being not only one of the first detailed anatomical papers on nectaries in English but also the first report of transfer cells in nectaries (Schmid, unpublished literature survey), as evidenced by her statement of a 'thickening' of the cell wall that 'has the appearance of having undergone corrosion' (Saunders, 1890 p. 15).

From 1884 to 1888, Saunders attended Newnham College, Cambridge University (see note 5 for other details on Saunders' education) and then had a scholarship for a year. From 1889 onwards, Saunders held (*a*) significant teaching positions and directorships (she retired in 1925) and (*b*) many memberships and officerial positions in professional societies and many honours and fellowships, to wit: (*a*) demonstrator in botany at (1889–92) and director (1899–1914) of the Balfour Biological Laboratory for Women, Newnham College; lecturer at Newnham College (1892–1925); Director of Studies in Natural Sciences at Girton (1904–14) and Newnham (1918–25) Colleges; (*b1*) 13 items through 1927: Associate, Newnham College (1893–1918); Council, Newnham College (1903–07, 1915–19); BAAS (admitted 1903, life member); Fellow, Linnean Society of London (elected 1905), the 23rd female Fellow; Banksian Medalist (1906), Royal Horticultural Society; Associates' Research Fellow, Newnham College (1906–09); Council, Linnean Society of London (1910–15); Vice President (one of four), Linnean Society (1912–13), their first female vice president; Council, BAAS (1914); member of the first governing body, Newnham College (1917); President, Associates of Newnham College (1917–18); President, Section K (Botany), BAAS (1920); Fellow, Royal Horticultural Society (elected 1925); (*b2*) three items from 1928 on: Vice President (one of six), Section K (Botany), BAAS, 1929 South Africa meeting; Vice President (one of eight), Section G (Genetics and Cytology), Fifth International Botanical Congress, Cambridge (1930); President, Genetical Society (1936).

Note 5 (Ethel Sargant vs. Edith Rebecca Saunders): It is interesting to compare Ethel Sargant (see also note 3 and sections 5C, 9, 11) and Edith Rebecca Saunders (see also note 4 and sections 7A, 9B), respectively: (*a*) born 28 Oct. 1863 *vs.* 14 Oct. 1865 (died 16 Jan. 1918 *vs.* 6 Jun. 1945); (*b*) attended Cambridge University: Girton College 1881–85 *vs.* Newnham College 1884–88; (*c*) Natural Sciences Tripos (the exams for the Cambridge University Honours course) 1884/class II, 1885/class III *vs.* 1887/class II, 1888/class I; (*d*) no scholarship *vs.* Birmingham Scholarship 1884–88 and Bathurst Studentship (i.e. scholarship) 1888–89; and (*e*) both had no further college or university education. Both women had a certificate but not a degree (B.A.) from Cambridge, which did not award degrees to women until 1948 (see note 2). Neither woman received an advanced degree, which makes their accomplishments even more remarkable. Contemporaries referred to these women, who never married, professionally as 'Miss Sargant' and

'Miss Saunders', respectively. According to Creese (1998 p. 43), 'Saunders and Sargant . . . were without doubt among the most notable women botanists of their time'; 'time' here apparently referring to the time period in the title of her book, *Ladies in the laboratory?: American and British women in science, 1800–1900: A survey of their contributions to research.*

Note 6 (Dukinfield Henry Scott and Sir Albert Charles Seward): Scott (1854–1934) and Seward (1863–1941) were the two preeminent palaeobotanists in Britain in the decades around 1900. Scott was Honorary Keeper (the only one ever) of the Jodrell Laboratory (founded in 1876—see Metcalfe, 1976), the Royal Botanic Gardens, Kew from 1892 until 1906, when 'he retired to East Oakley House, near Basingstoke' (Arber, 1949 p. 796), Hampshire, some 65 km south-west of Kew, to continue to do research and write until his death in 1934. Seward taught botany at Cambridge for 46 years, first as lecturer (1890–?), finally as professor (1906–36). He was also Chair of the Botany School (1906–36), Master of Downing College (1915–36), and Vice Chancellor of Cambridge University (1924–26). Seward was knighted in 1936 for his services to science and to Cambridge University.

For other information see: (*a*) for Scott and Seward: section 7A; Andrews (1980); Cleevely (1983); Stafleu and Cowan (1985); Desmond (1994); and Boney (1995); (*b*) for Scott: sections 5A, 9A, 14, note 3; Seward (1934); Oliver (1935); Arber (1949, 1954*b*); Wardlaw (1975); Metcalfe (1976); and Isely (1994); (*c*) for Seward: sections 8A, C, 9B; Hamshaw Thomas (1941); Harris (1941, 1975); Edwards (1943); Walters (1981); Godwin (1985); and Packer (1997).

Note 7 (Virginia Woolf): The expression 'a room of her own' derives from Virginia Woolf's (1882–1941) famous essay, *A room of one's own* (Woolf, 1929, and later reissues) that was published in October 1929. This was based on two papers she read to women students of Newnham and Girton Colleges on, respectively, 20 and 26 Oct. 1928. Woolf opined that 'a woman must have money and a room of her own if she is to write fiction' (Woolf, 1929 p. 2).

The title of Woolf's essay, 'A room of one's own', has been taken up as a metaphor by writers in feminist and women's studies. For instance, variants of the phrase appear in the titles of two important papers on Arber and the Balfour Laboratory, respectively: Kathryn Packer's (1997) 'A laboratory of one's own: . . .' and Marsha L. Richmond's (1997) 'A lab of one's own: . . .'

Obviously, feminists in particular would argue that the subject and title of Woolf's essay would not be unfamiliar to Arber (see also section 9 on 'Quiet and independent research'). Packer (1997 p. 100) in discussing Arber being forced to vacate the Balfour Laboratory in November 1927 (see section 8) 'wonders whether [Woolf's Oct. 1928 talks] had a particular resonance with some members of the audience who had only recently lost their own research space' at the Balfour. However, according to Muriel Arber (26 Mar. 2001), Arber 'did not hear either of Woolf's talks but she did read her influential [October 1929] essay'.

For other information on Virginia Woolf and Cambridge University see Brooke (1993 pp. 328–330, Packer (1997 p. 100), and Rosenbaum (in Woolf, 1992).

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General organization. Because feminine authorship of works is important from the perspective and sensibilities of women's studies, I give full names (if known) of women authors other than Agnes Arber and Muriel Agnes Arber. Arber's books (1912, 1920, 1925, 1934, 1938, 1946, 1950*a*, 1954*a*, 1957, 1986) receive only abbreviated citations below because they are cited in detail in Table 2, which includes details of many reissues and translations. I have not listed below the brief entries in compilatory works such as general histories of biology, biographical dictionaries (e.g. *Who was who*), encyclopaedias, perhaps the first encyclopaedia account being in 1950 (Anonymous, 1950), or online accounts such as in *Encyclopaedia Britannica online* (Anonymous, 2000). Some publications are cited in passing in the main text. For Arber's poetry see the main text, section 4B.

Coding before references. Coding is used before references to indicate works on: Agnes Arber (†; often also on E.A. Newell Arber); E.A. Newell Arber (‡); M.A. Arber (§); Ethel Sargant (‖) and Edith Rebecca Saunders (¶).

Authorship of Arber's works. Before 1908 as Agnes Robertson, from 1910 on as Agnes Arber. She married E. A. Newell Arber on 5 Aug. 1909, and did not publish in 1908 and 1909.

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†**Amrine F, Zucker FJ & Wheeler H (ed.). 1987.** *Goethe and the sciences: a reappraisal.* Dordrecht: D. Reidel Publishing Co. (series: *Boston studies in the philosophy of science*, vol. 97). [Pp. 134, 136, 268–269, 271, 290, 405–406, 417, 429, 435 on Arber.]

†‡**Andrews HN. 1980.** *The fossil hunters. In search of ancient plants.* Ithaca: Cornell University Press. [Pp. 126–131, 169 (1 fig.) on Arber and especially E.A. Newell Arber.]

†**Anonymous. 1950.** Arber, Agnes (1879–). *Chamber's Encyclopædia* (New edition) **1(A–autotomy)**: 519. New York: Oxford University Press. [W. T. Stearn perhaps authored this, as he did the later account (Stearn, 1966).]

†**Anonymous. 2000.** *Encyclopaedia Britannica online.* (accessed 17 Aug. 2000). http://search.eb.com/bol/topic?eu=9335&sctn=1

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‖**Arber A. 1918*a*.** In memorium—Ethel Sargant *Cambridge Magazine* **7**: 361. [Republished in full as 'The work of Miss Ethel Sargant', *Common Cause of Humanity* **9**: 567–568, 1918.]

‖**Arber A (unsigned). 1918*b*.** Miss Ethel Sargant. *Nature* **100**: 428–429. [Arber undoubtedly authored this; various details and phraseology are common with her other obituaries of Sargant (Arber, 1918*a*, 1919*a*, 1927).]

‖**Arber A. 1918*c*.** Miss Ethel Sargant. *Girton Review* [Lent Term], pp. 11–12. [Not seen—cited from Girton College (1948), Stephen (1927–1933).]

‡**Arber A. 1918*d*.** E. A. Newell Arber, M.A., Sc.D., F.G.S., F.L.S. *Geological Magazine*, series 6, **5**: 426–431, 1 pl. [Bibliography pp. 428–431. Partly republished in *Cambridge Magazine* **8**: 6, 1918.]

‡**Arber A. 1918*e*.** Edward Alexander Newell Arber (1870–1918). *Journal of Botany* **56**: 305–308, 1 pl.

‡‖**Arber A. 1918–19.** See also Scott (1918*c*, 1918*e*, 1919).

‖**Arber A. 1919.** Ethel Sargant. October 28, 1863–January 16, 1918 *New Phytologist* **18**: 120–128. [Bibliography p. 128.]

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‡**Arber A. 1921.** Note. In: Newell Arber, EA. *Devonian floras: A study of the origin of Cormophyta*. Ed. by A. Arber. Cambridge: University Press, v–vi. [Frontispiece of book is a portrait of E.A. Newell Arber.]

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