

Past times

Muriel Wheldale Onslow (1880–1932): pioneer plant biochemist

The British biochemist Muriel Wheldale Onslow was one of only two genetics researchers in the first decade of the 20th century who performed plant breeding experiments and also investigated the corresponding chemistry of flower pigments of the plants (the other being Erwin Bauer in Germany)¹. J.B.S. Haldane used her research to conclude that genes controlled the formation of large molecules, such as pigment molecules².

Muriel was born in Birmingham on 31 March 1880, the only child of John Wheldale, a barrister³. Muriel attended King Edward VI High School, Birmingham, a school that excelled in producing academic women⁴, and then proceeded to Newnham College, Cambridge in 1900, where she took First Class Honours in both parts of the Natural Sciences Tripos (the end of year examinations at Cambridge), specializing in botany. However, she could not receive formal degree status as Cambridge did not grant bachelor's degrees to women until 1948⁵.

In 1903, Muriel joined the research group of William Bateson. With the revival of Mendel's theories at the beginning of the 20th Century, Bateson had become one of Mendel's most ardent champions. It was Bateson who had devised the term 'genetics' to describe the field and he had surrounded himself with a group of enthusiastic research students, many of them women⁶. Muriel's particular niche was the study of the inheritance of flower colour in *Antirrhinum*. Her research proved to

be among the most widely recognized in Bateson's group. She published a full factorial analysis of flower colour inheritance in *Antirrhinum* in 1907. In a reference for Wheldale, Bateson commented⁷: "The problem of colour inheritance in *Antirrhinum*, which she set out to

solve, proved to be far more complex than was expected, and the solution she proposed (Proc. R. Soc. B 79, 1907) is entirely her own work. There is every reason to believe that it is correct and I regard the paper as one of considerable value."

This landmark publication was the first of a flurry of research papers on the linkage between the inheritance of genetic factors and the production of the pigments, the anthocyanins. Her research culminated in the writing of the classic monograph, *The Anthocyanin Pigments of Plants*⁸. In the preface of the monograph, she

by Marelene Rayner-Canham and Geoffrey Rayner-Canham

Newnham College, Cambridge, group photograph from 1903. Muriel Wheldale Onslow is circled. Photograph courtesy of Newnham College Archives.





One of Muriel's early publications in the *Biochemical Journal* (1914) 8, 204

commented⁹: "Herein lies the interest connected with anthocyanin pigments. For we have now, on one hand, satisfactory methods for the isolation, analyses and determination of the constitutional formula of these pigments. On the other hand, we have the Mendelian methods for determining the laws of their inheritance. By a combination of these two methods we are within reasonable distance of being able to express some of the phenomena of inheritance in terms of chemical composition and structure."

By 1913, Muriel's fame was such that she was one of the first three women (the other two being Ida Smedley and Harriet Chick) to be elected to the Biochemical Club¹⁰, the forerunner of the Biochemical Society. She was also awarded a Prize Fellowship in 1915 by the British Federation of University Women for her scientific research.

Muriel became convinced that the future lay not with the genetic aspects of botany, but with the biochemical basis of plant pigment synthesis. To this end, she briefly attended the University of Bristol to strengthen her background in biochemistry. Though Bateson encouraged her to join his new group at the John Innes Horticultural Institution, Merton, South London she decided her future lay elsewhere.

With Muriel's departure, Bateson lost not only one of the most gifted members of his research team, but also his leading artist. In a letter of reference that he wrote for Muriel, together with an acknowledgement of her considerable research talents, he noted¹¹: "As an artist in colour she has extraordinary skill. If she leaves us, her loss will be a serious one, for she is the only person I know who can reproduce the colours of flowers in such a way as to be an exact record. In respect of accuracy and appreciation of what scientific colouring should be, the quality of her painting far exceeds that of any professional whose work I know."

"By 1913, Muriel's fame was such that she was one of the first three women (the other two being Ida Smedley and Harriet Chick) to be elected to the Biochemical Club¹⁰, the forerunner of the Biochemical Society."

In 1914, Muriel was fortunate to be invited to join the research group of Frederick Gowland Hopkins. Though botany had always been an acceptable field for women¹², chemistry and biochemistry were another matter¹³. Hopkins' group¹⁴ was an exception to the male-dominated groups elsewhere. As the science historian Creese has noted¹⁵: "At the time when there were practically no women research workers in any of the other university departments at Cambridge, Hopkins gave them places in his, despite the

criticism which this brought him. Even in the 1920s and 1930s, when, as a Nobel laureate with a worldwide reputation he received hundreds of applications for places in his laboratory, nearly half of the posts in his Department went to women scientists."

The anthocyanin pigments that she had studied genetically with Bateson, she studied chemically with Hopkins. This proved a fruitful line of research that cemented her reputation as a leading chemical geneticist¹⁶.

Her biochemical studies led her to write a second edition of *The Anthocyanin Pigments of Plants*¹⁷. This was no mere reprint of the first edition, but a complete revision in light of the tremendous biochemical advances of the previous decade. As she noted¹⁸: "Since the appearance of the first edition the publications of greatest value on the subject of anthocyanin pigments have been in connection with the chemistry and biochemistry of these substances. This later work has now been included, and the present state of our knowledge of

the significance of the pigments in relation to plant metabolism has, as far as possible, been indicated."

In 1916, she was introduced to Huia Onslow, second son of the 4th Earl of Onslow. Onslow had had a diving accident, which had paralysed him from the waist down. Nevertheless, he began a research program in chemical genetics from a laboratory constructed in his home. At their first meeting together, they had tea followed by a "certain amount of Mendelian discussion"¹⁹. Over the

following years, Muriel spent much of her time helping Onslow with his research, particularly that on the origins of the iridescence of some butterflies, moths, and beetles (though she was never acknowledged in his publications). In 1919, they were married and, until his death in 1922, Wheldale became the conduit between Onslow and the Hopkins group. Hopkins, in an obituary of Onslow, commented²⁰: "He married Muriel Wheldale, one whose scientific work is very familiar to the readers of this [Biochemical] Journal. By a pleasant and acceptable fiction Onslow claimed to be a member of the Biochemical Department at Cambridge. It became less of a fiction after marriage, for his wife brought his thoughts to us, and reported our activities to him. Indeed, after all, it was no fiction. We knew that a short way off a colleague was daily conquering difficulties compared with which our own could be as nothing."

Her devotion to research was balanced by an enthusiasm for teaching. She was a Demonstrator in Physiological Botany in the Balfour Biological Laboratory for Women, in Cambridge, from 1907 until its closure in 1914²¹. From 1915 until 1926, she held the position of Assistant in Plant Biochemistry in the Biochemistry Department under Hopkins, and in 1926 she became University Lecturer in Biochemistry, one of the first women to hold this rank at Cambridge. This pedagogical interest led her to write *Practical Plant Biochemistry*²² in 1920, which was followed by *Principles of Plant Biochemistry*²³, the first volume of which was published in 1931. She wrote the latter book at her house in Norfolk, one of her two favourite places, the other being the Balkans where she spent her holidays. Unfortunately, she died a year later before completing the second volume.

Research into anthocyanin continued at Cambridge with the arrival in 1926 of a new graduate from Imperial College, Rose Scott-Moncrieff (Mrs Meares). Muriel persuaded Scott-Moncrieff to work on the isolation of pigments, particularly the pigment of the magenta *Antirrhinum* that had first fascinated Muriel in 1914²⁴. Scott-Moncrieff worked initially under the direction of Haldane, but she soon became the link to the research on plant pigments being carried out at Oxford under the direction of Sir Robert Robinson. Much of the anthocyanin research at Oxford was performed by Gertrude Walsh (Lady Robinson). But that is another story²⁵.

References

1. Olby, R. (1989) *Ann. Sci.* **46**, 497–510
2. Glass, B. (1965) *Proc. Am. Phil. Soc.* **109**, 227–236
3. Stephenson, M. (1932) *Biochem. J.* **26**, 915–916
4. Vardy, W.I. (1928) King Edward VI High School for Girls Birmingham 1883–1925, Ernest Benn, London.
5. McWilliams-Tullberg, R. (1975) *Women at Cambridge: a Men's University — though of a Mixed Type*. Gollanz, London
6. Richmond, M.L. (2001) *Isis* **92**, 55–90
7. Richmond, M.L. (2001) *Isis* **92**, 83
8. Wheldale, M. (1915) *The Anthocyanin Pigments of Plants*, 1st edn. Cambridge University Press, Cambridge
9. Wheldale, M. (1915) *The Anthocyanin Pigments of Plants*, 1st edn. p. v. Cambridge University Press, Cambridge
10. Goodwin, T.W. (1987) *History of the Biochemical Society 1911–1986*. Biochemical Society, London
11. Richmond, M.L. (2001) *Isis* **92**, 82
12. Alic, M. (1986) *Hypatia's Heritage: a History of Women in Science from Antiquity through the Nineteenth Century*. Beacon Press, Boston, MA
13. Rayner-Canham, M.F. and Rayner-Canham, G.W. (1998) *Women in Chemistry: Their Changing Roles from Alchemical Times to the Mid-Twentieth Century*. Chemical Heritage Foundation, Philadelphia, PA
14. Rayner-Canham, M.F. and Rayner-Canham, G.W. (1999) *Chem. Br.* **35**, 47–49
15. Creese, M.R.S. (1991) *Br. J. Hist. Sci.* **24**, 275–305
16. Lawrence, W.J.C. (1950) *Biochemical Symposia* **4**, 3–9
17. Wheldale Onslow, M. (1925) *The Anthocyanin Pigments of Plants*, 2nd edn. Cambridge University Press, Cambridge
18. Wheldale Onslow, M. (1925) *The Anthocyanin Pigments of Plants*, 2nd edn. p. vii, Cambridge University Press, Cambridge
19. Onslow, M. (1924) *Huia Onslow: A Memoir*. Edward Arnold, London
20. Hopkins, F.G. (1923) *Biochem. J.* **17**, 1–4
21. Richmond, M.L. (1997) *Isis* **88**, 422–455
22. Wheldale Onslow, M. (1920) *Practical Plant Biochemistry*. Cambridge University Press, Cambridge (2nd edn published in 1923)
23. Onslow, M. (1931) *The Principles of Plant Biochemistry, Part I*. Cambridge University Press, Cambridge
24. Scott-Moncrieff, R. (1981) *Notes Rec. R. Soc. London* **36**, 125–154
25. Rayner-Canham, M.F. and Rayner-Canham, G.W. (1999) *Chem. Brit.* **35**, 45–46



Marelene Rayner-Canham is a Laboratory Instructor in Physics at Sir Wilfred Grenfell College, Corner Brook, Newfoundland, Canada. Her major research interest is the history of women in science and is co-author of numerous articles and

three books (a biography of Harriet Brooks, a compilation on women in the early studies of radioactivity, and a history of women in chemistry) on the subject. She is currently undertaking a comprehensive study of women members of the Chemical Society and the Royal Institute of Chemistry up to 1950.

e-mail: mrcanham@swgc.mun.ca



Geoff Rayner-Canham is a Professor of Chemistry at Sir Wilfred Grenfell College. In addition to being co-author of the studies on the history of women chemists with Marelene Rayner-Canham, he has been prominent in chemical education. One

particular interest of his is the relevance of chemistry and he presents an annual Chemistry Show with this theme to high school students. The university-level text he has authored, *Descriptive Inorganic Chemistry*, emphasizes biological, environmental, geological, industrial, medicinal, and consumer applications of inorganic chemistry. He is currently working on the third edition of this widely-used book.

e-mail: grcanham@swgc.mun.ca

The editor of Past times, John Lagnado, would be delighted to hear from readers who think they could write about a historical aspect of biochemistry. So, if you have a story to tell, contact him directly (e-mail: j.lagnado@rhul.ac.uk)