Women in Cambridge Biochemistry

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When I look back over my life in science, I recognise how fortunate I was in the intellectual possibilities that opened out before me. Although she had had no university training, one of my aunts, Miss Agnes Daves, established a very successful school (Claremont College, Stockport) of which she was headmistress. I went to this school, and we had very good teaching which included some science, mainly botany. My aunt took a great interest in my future and decided that I could benefit from a university education. She arranged for me to take the entrance examination at Girton College, Cambridge, and actually went with me on my first visit. I duly became a student and lived there from 1915 to 1919.

At Girton we had excellent teaching in chemistry from Miss M. B. Thomas, including rigorous experimental work in the College laboratory. It seems that in the period at the end of the First World War the schemes followed in the Girton laboratory for experimental chemistry were incomparably better planned and organized than those available in the University Chemical Department, which then for the first time had replaced most of the separate College laboratories. This famous laboratory at Girton finally closed in 1935 when Miss Thomas retired, and the building can still be seen, though it is now used for other purposes.

In my time women students attended university lectures, and it was ordained (I do not recall by whom) that we should all sit together in the front row of the lecture halls. Girton being a long way out of town, hansoms or four-wheeled cabs were provided for those students who were not bicycling.

In 1920 I started research, and here again I was very fortunate, because I wanted to do biochemistry, a desire probably the result of attending Professor Hopkins' lectures. Women research workers were very rare in Cambridge at that time – indeed I think they were accepted only in the Department of F. G. Hopkins (later Sir Gowland) who had the Chair of Biochemistry. He welcomed them, and there were perhaps nine of us, about the same number as the men. My first job was a research grant from the Food Investigation Board, then recently founded by Sir William Hardy of Caius College. I took my M.A. in 1923 and my Ph.D. in 1930. This latter degree was then a new introduction, and for some time there was a prejudice against it as a new-fangled German-American invention. In those days women could not take a degree in the Senate House, receiving only the 'title of the degree' and a diploma. I do not remember the date of change, but by the time I got my D.Sc. in 1945 I was able to take it properly in the Senate House.

Professor Hopkins, or Hoppy as we called him affectionately, was a very accessible head of department. At the time when Meyerhof was investigating the origin of the lactic acid found by Fletcher and Hopkins in contracting muscle, he asked my collaborator, Dorothy Foster, and me, to translate the papers, and he would come frequently to our bench to hear the latest state of play. Since there were some differences in the lactic acid results obtained by Meyerhof in Germany and Parnas in Poland respectively, he asked Dorothy and me to repeat Meyerhof's estimations, using the Hopkins gravimetric method which necessitated the use of 5 to 20 frog-limb pairs for each estimation - Meyerhof's micro-method needed only one gastrocnemius. The Professor came often to see how we were getting on, and was delighted to find our results in agreement with Meyerhof's.

Joseph Needham of Caius joined Hopkins' laboratory in 1922 and we were married in 1924. This was also the year of the removal of the Biochemical Department to its own elegant building on Tennis Court Road. During the 10 years from the time when Hopkins had founded it in 1914 it had occupied a former chapel in Downing Place and some rooms adjacent to the Old Anatomy School in Corn Exchange Street. About this time I gained the Gamble Prize of Girton College for work on the physiological and biochemical differences of red and white muscle. From 1925 to 1928 I held a Beit Memorial Research Fellowship. In those years Joseph and I did much collaborative work, often in marine biological stations such as Roscoff in Brittany, Cumbrae on the Clyde, and Monterey and Woods Hole in America.

Growing out of the work under Hopkins' influence, my main interest became in due course the biochemistry of muscle contraction, and I worked in this field in the Department until 1963 with a series of collaborators. There were, for instance, besides a number of English ones, Raman Kochukrishna Pillai from Travancore in South India, Kits van Heyningen from South Africa, David Green from America, Hermann Lehmann from Germany, Arnost Kleinzeller from Czechoslovakia, Jaap Cohen from Holland, and Lu Gwei-Djen and Ch'iu Ch'iung-Yün, both women, from China. Apart from skeletal muscle we worked much on the smooth muscle of the internal organs, especially the uterus. The function of adenosine-triphosphate in muscle, and of the phosphagens creatine-phosphate and arginine-phosphate in energy-provision gave another subject for several papers. I also lectured and conducted practical classes. I wrote two books, a Methuen Monograph on muscle in 1932, and a large work published by the Cambridge University Press in 1971: *Machina Carnis; the Biochemistry of Muscle Contraction in its Historical Development*. In 1948 I had been elected a Fellow of the Royal Society. I worked for the Ministry of Supply (1940-3) and then during the Second World War (1943-5) I was Chemical Advisor on the staff of the Sino-British Science Co-operation Office at the British Embassy in Chungking, and for a time Acting Director. This was the organisation which Joseph headed, designed for liaison in science, technology and medicine, between the beleaguered Chinese and the Western allies.

Returning to Cambridge research, I received research grants from the Medical Research Council, the Agricultural Research Council and the Broodbank Fund of the University, and later on, in 1963, a Leverhulme Award. Since my retirement from experimental work in 1963 I keep in close touch with a former collaborator, Catherine F. Shoenberg, who works on the contraction of vertebrate smooth muscle. In recent years I have been fully occupied with a *Source Book on the History of Biochemistry, 1740-1940*, in collaboration with the Czech historian of science, Mikuláš Teich.

Looking back over my 45 years in research I find it remark able, especially from the point of view of contemporary practice, that although a fully qualified and full-time investigator, I never received, or even applied for, any substantive post. I simply existed on one research grant after another, devoid of position, rank, or assured emolument. In other words I belong to the generation for whom it was calmly assumed that married women would be supported financially by their husbands, and if they chose to work in the laboratory all day and half the night, it was their own concern. Moral support I also received consistently from Joseph, but it was never in his power to give me the self-respect which comes from a recognised and established position. I am glad that the young women in science today are not expected to observe this discouraging system of dependence.

Some of the women of our group became quite famous later. First, there was Marjory Stephenson. She had been at Newnham from 1903 to 1906, a time when women were excluded from university classes in chemistry and zoology; and later in London she worked in the laboratory of Dr R. H. A. Plimmer. In 1913 she was awarded a Beit Memorial Fellow ship for Medical Research but gave it up on the outbreak of the First World War. From 1914 to 1918 she worked with the British Red Cross in France and then in Salonika, where she was mentioned in dispatches, becoming in 1917 an Associate of the Royal Red Cross; she also received the MBE for her war services.

On her return she again took up the Beit Fellowship and joined the Department of Professor Hopkins, here working first on fat-soluble vitamins. By 1922 she was publishing papers on bacterial metabolism, the subject which became her life-work and which she developed fundamentally. It is of interest as regards the position of women that after the Beit Fellowship expired she worked on annual grants from the Medical Research Council for nearly 10 years but in 1929 she was at last appointed to its permanent staff. In 1945 she was elected Fellow of the Royal Society, being the first woman in Division B (Biological Sciences) to receive this honour and recognition; at the same time Dr Kathleen Lonsdale was elected the first woman Fellow in the Physical Sciences (Division A).

In 1930 Marjory Stephenson published her book *Bacterial Metabolism* (Longmans, London) which has gone into three editions and is still a standard work. She warmly supported the Society of General Microbiology founded in 1944, with Sir Alexander Fleming as its first President; she herself was President in 1948 at the time of her death.

The other most distinguished woman in our group was Dorothy Jordan Lloyd. She took first class honours in Zoology at Cambridge (1910 to 1912) but about 1913, influenced by Sir William Hardy and F. G. Hopkins, in whose laboratory she came to work on biochemistry, she was attracted to the physico-chemical study of the proteins. By 1921 her distinguished work in this field led to an invitation to join the Leather Research Association Laboratory where Dr Pickard was Director. She thus became diverted to problems of industry, and pursued them so successfully that in 1927 she succeeded him. By 1946 this Association served practically all the British tanneries, and gave valuable help to the government during the war years.

Her success in the fields of pure and applied science resulted in her election to the Council of the Institute of Chemistry in 1936, and to the Chairmanship of the Hides and Skins Committee and the Tanning Materials Committee. She travelled on scientific missions abroad, and in 1939 was awarded the Fraser Muir Moffat Medal for 'distinguished contributions to leather chemistry'. Besides her many papers she wrote a first-class textbook, *Chemistry of Proteins* (D. Jordan Lloyd and A. Shore, 2nd ed. 1938, Churchill, London).

I have looked through the Royal Society list of Fellows for 1978 and I find some 28 women included out of about 750 Fellows. Of these women many are Professors, Directors of Research Units, Senior Scientific Officers, and so on. Women sometimes serve on the Royal Society Council and on Committees, but this seems to be rare. They have, however, organized a few successful Meetings for Discussion (as I did once myself with Professor Edith Bülbring, FRS). Among the honours accorded to them by the Society should be mentioned the Royal Medal (1956) and the Copley Medal (1976) won by Professor Dorothy Crowfoot Hodgkin, FRS, and the Darwin Medal (1976) by Professor Charlotte Auerbach, FRS. Finally, Dorothy Hodgkin received the Nobel Prize for chemistry in 1964.

All this goes to show two things, first the uphill struggle which women have had in the modern scientific world ever since the days of Mme Lavoisier and Mme Curie; and secondly that there is no reason whatever to believe their intellectual powers inferior to those of men. May the day soon come when prejudice and obstacles will be removed, and women be free to make the fine contributions of which they are assuredly capable.

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Contents