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Bastian H. Lucy Wills (1888-1964), the life and research of an adventurous independent woman.

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"...(A)n experiment was started at the end of 1943 planned to show the effect on the haemoglobin level and on the general health of the pregnant woman, not only of the improved rations but also of the routine administration of iron... Unfortunately, a flying bomb incident interrupted the work, but, though the actual number of observations were not as large as expected, they were large enough for statistical analysis... Alternate patients were given, from the first attendance, either Blaud's capsules...or similar capsules containing a placebo... The laboratory workers were not told which patients were receiving iron, but after a few visits it did not require a Sherlock Holmes to ascertain the nature of the capsules being taken." ([Wills et al. 1947](#))

The continuation of research despite a bombing "incident" (Wills et al. 1947) and the wry statement about Sherlock Holmes give some insight into the personality of a pioneer in haematology who led a most eventful life. Lucy Wills' claim to international fame had come in 1931, with a paper in which she identified through research in India a substance that was later recognised as folic acid (Wills 1931). It is still sometimes called 'the Wills' factor'. She retired from London's Royal Free Hospital somewhere around the time the article quoted above was published (Roe 1978), but continued to work on nutritional effects on health in South Africa and Fiji (Firkin 2000).

The [portrait of Lucy Wills](#) in the *James Lind Library* apparently shows her in the botanical garden to which she devoted the last quarter of her life, along with a spell of 10 years as a Labour councillor in Chelsea (Firkin 2000). She was an ardent cross-country skier and mountain climber (Firkin 2000). The photo shows a private aspect of a woman who:

"...is remembered as aristocratic, independent and radical in outlook, critical of established conservative medical and scientific committees. She rode to work on a bicycle rather than in a large car as did many of her colleagues." (Hoffbrand 2001)



Financial and intellectual independence shaped Wills' life opportunities and work. She was the third child in her family, born in England on 10 May 1888. She went to a small private school, and then to the Cheltenham College for Young Ladies (Roe 1978). Cheltenham College was in the vanguard of new boarding schools providing a high standard of academic education in formerly male-only topics such as mathematics. Cheltenham also sought to encourage a public-spirited and achievement-oriented life for women in Victorian England. It was Gothic in architecture, but reformist in character (Vicinus 1985). For over 40 years from 1858, the school had been steered by the strong-minded and high-achieving Dorothea Beale. Beale would have been in her last years at the helm of the College when Wills attended. It was a privileged environment, intellectually as well as socially. Beale did not allow students whose parents were 'in trade' to enter Cheltenham (Vicinus 1985).

Beale was an early and long-time supporter of educational reform and suffrage for women, being one of the signatories on John Stuart Mills' 1867 petition to Parliament to give women the vote. She was also the founder of St Hilda's College in Oxford, although she did not live long enough to see women students accepted at Oxford University. An excellent picture gallery [online at the BBC](#) shows the environment around the time Wills was a student at Cheltenham - including the laboratory that must have helped shape her interest in science.

These boarding schools were a particularly Victorian phenomenon, radical and progressive in the later quarter of the 19th century, but already seen as old-fashioned and oppressive by the end of World War I (Vicinus 1985).

Their historical progress provides some measure of the change in women's educational opportunities. The baseline for education for females had been low: consider the shocking fictional depiction of 'Lowood' by Charlotte Bronte in her novel *Jane Eyre*. Beale had briefly taught at the actual school on which Bronte had based Lowood (Wilson 1989). Within decades, though, the reformist educational movement in which Beale was one of the leaders enabled the group of women in Wills' generation to gain entrance into professional and academic life.

From the strong grounding that she received at Beale's Cheltenham College for Young Ladies, Wills went on to Newnham College at Cambridge where she received a double first honours degree in botany and geology in 1911 (Roe 1978). Newnham College was one of the first that was open to women in England (Vicinus 1985). Wills' primary interest at that time was still science, not medicine (Roe 1978).

After Cambridge, Wills travelled to South Africa with Margaret Hume, a fellow student at Cambridge, who remained a lifelong friend (Roe 1978). Hume was a lecturer in botany in Cape Town at that time, and she also had an interest in the work of Sigmund Freud. This became of such interest to Wills that she considered studying psychiatry. However, a stint working as a nurse in South Africa during World War I led her to decide on a career in medicine, which had only recently been an option for women in England. She returned to London and entered the London School of Medicine for Women, England's first medical school for women (Bowden 2001), and gained her medical degree through London University in 1920 (Roe 1978).

Photo: Students at the London School of Medicine for Women



After graduating, Wills began working with another friend from Cambridge in the Department of Chemical Pathology at the Royal Free Hospital, which was not a very busy department at that time (Obituary 1964). As her interest in and knowledge of medical biology was growing, the area of haematology was beginning to make advances. In 1926 Minot and Murphy published their groundbreaking work in Boston on diet to treat pernicious anaemia (Minot and Murphy 1926). In India, Margaret Balfour, working at the Haffkine Institute in Bombay (see Wagle et al. 1941), became aware of a high prevalence of a particularly severe and often fatal form of anaemia in pregnancy (Wadsworth 1988).

It is not clear why Balfour made contact with Wills, but it may have been because the London School of Medicine for Women had a history of student and teaching involvement with India (Bowden 2001), although such links also existed throughout the Victorian feminist movement (Burton 1996). By the late 1920s, Wills had begun a series of trips to India, where she undertook studies to try to isolate whether dietary factors played a part in the so called pernicious anaemia of pregnancy (Wills and Mehta 1930).

Wills has been criticised for taking a narrow biomedical approach, which did not pay sufficient attention to the social conditions limiting women's lives (Lal 2005). However, she undertook an extensive programme of observation, which included possible infective causes and living conditions as well as diet (Wadsworth 1988).

"I spent many hours plating stools and doing Widal tests in an attempt to determine the nature of the diarrhea and the cause of the high temperature that affected so many of my patients with nutritional macrocytic anemia, only to find negative Widal's and non-pathogenic organisms in the majority of patients" (Roe 1978).

Ultimately, though, Wills' studies suggested that some kind of vitamin deficiency was involved.

Wills worked closely with Sakuntala Talpade, Robert McCarrison and Manek Mehta in attempts to find a supplement that might overcome the deficiency they were observing. They tried many substances on rats. Wills was concerned, however, that an infection common in the rats might be playing a role in their anaemia (Wadsworth 1988), so she decided to test some dietary interventions in monkeys. One particular monkey did especially poorly, and for reasons which are not recorded – perhaps in desperation - she tried the cheap yeast extract, Marmite. It had a dramatic effect. Thus, after all the intensive examination of diets and exhaustive testing on rats, it was a chance intervention with a single animal that led to the breakthrough (Wadsworth 1988). Wills had taken the first step to the discovery of folic acid.

Extensive testing of a variety of active and de-activated substances in women was the next step, and marmite proved to be the substance that could help (Wills 1931, 1933a). Wills' conclusion was that: "These findings provide further evidence in support of the opinion, expressed in the previous paper, that the extrinsic factor...is not vitamin B2 but some other factor, as yet undetermined, which is present in both animal protein and marmite" (Wills 1933b). Folic acid was named in 1941 when it was isolated from spinach (Hoffbrand 2001).

Lucy Wills' case notes for responses to Marmite as a treatment for pernicious anaemia in pregnancy

Mr. Gooding. 45 Liverpool St. temp. Post Office. Warrington
 History: always anaemic - no other illness. Into pregnancy. Husband at work + obvious that food has been inadequate.

17.11.31 H: do. of premenstrual - unusual delivery, infant -
 came fast in part: "inverted nipples (had)
 little pain w/ breast temp up to 101° a 2:30 -
 was febrile but very pale!

Marmite 31 + 1/2 oz
 RBC 36,200,000 Hb 72 Cl. 1.0. WBC 15,900
 M 64 Lymphs 32 Hms 3 Strains 1. Punctate
 cells. Platelets few. Ret. 20%

20.11.31 RBC 47,000,000 Hb 74 Cl. 1.0. WBC 15,900
 WBC 5400. M 78 Lymphs 22% [Ret 27%]

27.11.31 RBC 47,000,000 Hb 80 Cl. 1.0. WBC 10,000 per cent.
 M 70 Lymphs 26 Hms 47. Ret 17%
 Under letter directed to CH. in marmite +
 M 1/2 oz

Lucy Wills returned to London at the outbreak of World War II (Firkin 2000), where she continued her work on anaemia, and on the effect of diet on health and illness. In her 1933 paper in *The Lancet*, she had described her systematic experiments as 'clinical trials' (Wills 1933). However, the placebo-controlled test of iron supplementation in pregnancy done with her colleagues at the Royal Free Hospital appears to be the only report of a formal test of a treatment comparing two groups of people (Wills et al. 1947). Wills and an all-woman cast¹ of researchers started their experiment in 1943, to address the question:

"Can it be shown that the pregnant woman whose haemoglobin has been raised by the routine administration of iron is in any way better off than her 'untreated' sister?" (Wills et al. 1947)

And that question, they said, could only be answered by comparing results in comparable women, "some receiving and some not receiving routine iron treatment from the very beginning of pregnancy". We do not know what path led them to conclude that a trial using alternation either to a haematonic preparation or to a placebo was what they needed to do.



Despite the restrictions imposed by flying bombs, Wills and the rest of the team at the Royal Free Hospital, together with close to 500 pregnant women, were among the first to address a question that has remained important for generations of other women (Cuervo and Mahomed 2001).

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- i. An obituary notice in the BMJ (Woodgate-Jones NP. *BMJ* 1998;316:1172) tells us a little about Wills' second co-author - Gladys Hill Hill (1894-1998). She qualified in medicine in 1923, went to Paris to study radium with Marie Curie, and became a consultant obstetrician and gynaecologist at the Royal Free Hospital in 1935. It was she who managed to keep clinical care operating throughout the war, including the bomb "incident" - not surprising, perhaps, for a woman who had worked for MI5 during the First World War. At an age when many people are beginning to retire (56), Hill set off to the United States to learn cervical cytology, and later started one of the earliest 'well woman' clinics. Eventually she retired to Somerset where she "took an interest in many local activities", living to several years past 100. According to her obituary in the BMJ:

"Miss Hill had a flair for teaching, having a horror of slovenly thought and shoddy work, and was examiner to London University and the Royal Colleges of Surgeons and Obstetricians and Gynaecologists."

I could find no further information on their other co-authors and would welcome learning more about any

of them from readers.

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