Academic Reading Practice (science based)

Academic Reading – Effective Reading

This document is a practice document for academic reading. The more practice you have, the better your efficiency will be. Academic reading is long, if anything, and you need practice in reading for extending periods. These tasks will help you stay focused.

Task 1

What are your experiences of reading longer texts in English? Answer these questions:

1. What are the challenges of reading longer texts in English?
2. How can these challenges be overcome?
3. What strategies can you recommend for successful reading in a university context?

Task 2 Dorothy Hodgkin

1. Why has this woman featured twice on British stamps?

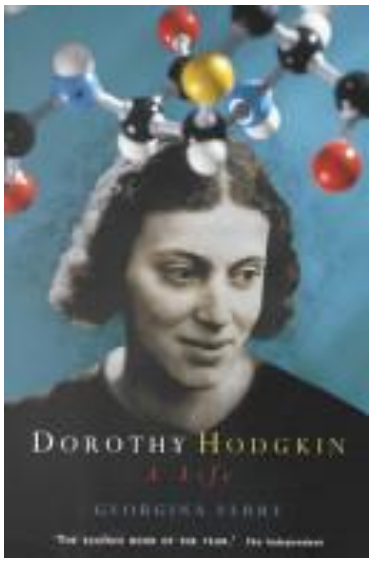
2. Why do you think this headline from the *Daily Mail*, published in 1964, has prompted discussion?

Oxford housewife wins Nobel

Dorothy Hodgkin: Dorothy Mary Hodgkin, OM, FRS (12 May 1910 – 29 July 1994), *née* Crowfoot, was a British chemist, credited with the development of protein crystallography

Task 3

Georgina Ferry is author of Dororthy Hodgkin: A Life (1999).



- What purposes do biographies of distinguished scientists serve?

Pre-reading

1. How many words do you think there are in this article?
2. What do the pictures say about Dorothty Hodgkin?

http://www.nature.com/nature/journal/v464/n7293/pdf/4641268a.pdf

The making of an exceptional scientist

Georgiana Ferry

Dorothy Hodgkin was born 100 years ago next month. Her biographer, Georgina Ferry, reflects on the factors that propelled the Nobel-prizewinning crystallographer to greatness.

When Dorothy Hodgkin won the Nobel Prize in Chemistry in 1964, much was made of her gender. She was only the fifth woman to become a laureate in science, and the first from Britain. Marie Curie had won for both physics and chemistry; the others were Curie's daughter Irène, the biochemist Gerty Cori and the physicist Maria Goeppert-Mayer (all four of whom were married to scientists). The *Observer* newspaper was astonished that the 'affable-looking housewife' Hodgkin had won the prize 'for a thoroughly un-housewifely skill: the structures of crystals of great chemical interest'. Hodgkin was at the time the Royal Society's Wolfson Research Professor at the University of Oxford, UK.

By tradition, the students of Stockholm sing to welcome the prizewinners before the Nobel ball, and one of the laureates responds. Hodgkin said: “I was chosen to reply to the students here this evening as the one woman of our group, a position which I hope very much will not be so very uncommon in future that it will call for any comment or distinction of this kind.” Since she expressed that hope, and despite the intervening revolution in women's rights and

expectations, only ten further women have won science Nobels. In total, women make up 2.8% of the 537 laureates in science since 1901, and 1.5% of those in physics or chemistry.

OXFORD MAIL; OXFORD TIMES

Hodgkin was therefore by definition exceptional. When I began to write her biography soon after her death in 1994, one of my principal motives was to try to understand what it was that had enabled her to transcend the conventions of her time. She never acknowledged that she faced barriers on the grounds of her gender, and her story largely bears this out.

It could be argued that Hodgkin's intellectual qualities alone made her **exceptional**. She possessed outstanding intelligence, insight, perseverance and concentration even as a schoolgirl. She had the chemist's equivalent of green fingers when it came to growing the fragile crystals she needed for her experiments. She had a remarkable ability to visualize atomic arrangements in three dimensions from the two-dimensional projections generated by her calculations. If she had a weakness it was in mathematics, as she readily **acknowledged**; but her skill as a team-builder ensured that she could make use of advances in crystallographic mathematics and computing as they came along.

But look again at the highly **skewed** distribution of men and women among Nobel laureates. Must we accept that the gifts that make great scientists are handed out so unequally? There is a vast and conflicting literature on gender differences in performance on science subjects, but even where such differences are found they are insufficient to account for the gender **disparity** among science Nobel laureates. I believe that Hodgkin's social and scientific circumstances were also exceptional, and provided the environment in which it was possible for her to fulfil her promise and achieve science's highest honour.

Becoming Dorothy

Born in Cairo in 1910, Hodgkin was the eldest of four daughters of John Winter Crowfoot and his wife Molly. John Crowfoot was in the colonial education service in Egypt and Sudan, promoting the education of girls among his other duties. Molly Crowfoot established a midwifery school for traditional birth attendants in Khartoum, hoping through education to end the practice of female circumcision. From 1926 John Crowfoot was able to pursue his passion for archaeology as director of the British School of Archaeology in Jerusalem; Molly

Crowfoot excavated alongside him, and gained international recognition for her own expertise in ancient textiles.

As children, the Crowfoot girls were left in England in the care of friends and relatives for much of each year. Yet Hodgkin developed a close bond with her mother, sharing passions from archaeology and the League of Nations to amateur dramatics. When a school experiment in crystal growing 'captured her for life', her mother allowed Hodgkin to set up a laboratory in the attic, and buy strong acids and other reagents for unsupervised experiments. Molly Crowfoot later bought books to expand her daughter's horizons, including a collection of William Bragg's lectures for children at the Royal Institution in which the 16-year old read that through X-ray crystallography “we can now 'see' atoms”. Her father assumed without question that, like him, she would go to the University of Oxford.

She arrived at Oxford in 1928: it had awarded degrees to women only since 1920. Of the 27 self-governing, single-sex colleges that admitted students, only five were for women. A year before Hodgkin arrived, the university had placed a quota on the numbers of female students, ensuring there would be no more than one woman to every four men. This situation remained more or less unchanged until the 1970s. From her home base in Somerville College, established by pioneers of women's education in 1879, Hodgkin set out to lectures and practicals in the university chemistry department as one of three or four women among 60 students in her year.

“She would never have to compete for one postdoctoral position after another, as most young researchers do today.”

Luck plays a part in every successful career. Hodgkin's stroke of good fortune came when Oxford's Department of Mineralogy set up an X-ray crystallography laboratory just as she was deciding what to do for her one-year research dissertation. Since reading Bragg, Hodgkin had been captivated by the idea of 'seeing' atoms in crystals. So she became the first (and in 1931, the only) student in Oxford to undertake a project on crystal structure, publishing a paper in *Nature* with her supervisor on a group of thallium salts.

Family connections helped her to find the ideal environment for her PhD research. A friend of her father's arranged an introduction to John Desmond Bernal, who was using crystallography at the University of Cambridge to establish the structure of biological molecules such as sterols. Charismatic and a political radical, Bernal ran a lab that employed men and women as equals; he was only too happy to take Hodgkin on as a PhD student already well trained in crystallography and funded by a scholarship from Somerville. With Bernal, she confirmed the **proposition** that biological molecules — including the protein pepsin on which they wrote a classic *Nature* paper — were potentially **susceptible** to X-ray analysis.

PETER LOFTS PHOTOGRAPHY/NATIONAL PORTRAIT GALLERY

Crystallography was a new, interdisciplinary field, led by egalitarians such as John Desmond Bernal.

Somerville sent her the offer of a research fellowship for two years, with the clear understanding that she would subsequently become a fellow — the college's first in science — and tutor in chemistry. It was a job for life, and Hodgkin had not even applied for it. She would never have to compete for one postdoctoral position after another, as most young researchers do today. She was reluctant to leave Cambridge, but Bernal told her that she would be mad to turn down the offer. So she returned to Oxford in 1934 to begin work in her own laboratory, a converted basement in the university's natural history museum.

She was the only person at the University of Oxford doing X-ray work on organic compounds, which made her an immediate focus of attention for others interested in such natural products. The professor of organic chemistry, Robert Robinson, arranged a grant from the British chemical company ICI to equip her lab with the latest X-ray tubes and cameras. No sooner had she got it all working than he gave her crystals of the protein insulin. Her first paper as sole author — again in *Nature* — showed that like pepsin it gave diffraction patterns and so could in theory be solved. When, a few years later, Howard Florey and Ernst Chain of Oxford's Sir William Dunn School of Pathology demonstrated the antibacterial properties of penicillin in mice and human patients, they turned to Hodgkin to analyse the structure of the molecule. By 1945 she had shown that X-ray crystallography could elucidate the structure of such a complex molecule even when its formula was unknown. Backed by her powerful mentor Bernal, in 1947 she was elected a Fellow of the Royal Society, only two years after the first two female Fellows.

Balancing act

The photograph taken by the *Oxford Times* to mark the occasion (pictured) shows her sitting on the steps of her house, a baby on her knee and her two other children under ten alongside. Hodgkin married soon after her return to Oxford and embarked on motherhood almost without breaking her scientific stride. Again, exceptional circumstances enabled her to do this. Her husband Thomas Hodgkin was another left-wing idealist, who found his vocation in adult education. His wife's modest college fellowship provided a more secure income than his, and the families agreed that on no account should she stop working if she wanted to

continue. At this period in history it was compulsory for women in certain professions, such as teaching and the civil service, to resign on marriage, and social convention that middle-class married women would find fulfilment caring for their husbands and children.

Hodgkin was the first fellow of Somerville to become pregnant. No formal arrangements existed for dealing with the situation, but without hesitation the college gave her paid maternity leave for a term after the birth. Hodgkin always had some paid help with childcare, cooking and cleaning; in those days it was affordable even on her meagre funds, and she had relations nearby who often helped out in emergencies. **Nevertheless**, one should not underestimate her capacity to switch focus from a child's chatter to an electron-density map, or the iron will that kept her going through limited sleep and physical ill-health. The two younger children have vivid memories of being left to amuse themselves for hours in the museum after school each day while she finished up her day's research.

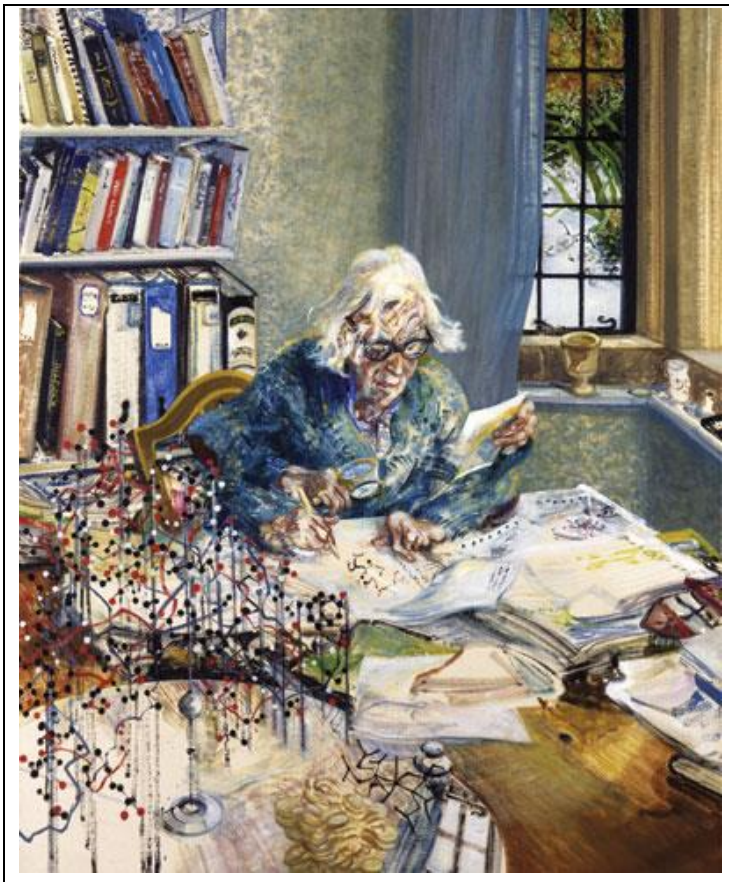
“Because there were more than enough interesting molecules to go round, there was little rivalry between labs.”

Hodgkin's rare experience with chemicals derived from living organisms meant that new and important scientific problems continued to fall into her lap. The penicillin work brought her into contact with industry scientists, and Lester Smith at pharmaceutical company Glaxo Laboratories wrote in 1948 to ask if she would be interested in looking at the red needle crystals he had managed to grow of the 'anti-pernicious anaemia factor' extracted from liver. Vitamin B12, as it became known, had four times as many atoms as penicillin and an unusual ring structure at its core that could not have been predicted from its chemistry. A five-year grant from the Nuffield Foundation enabled her to recruit a small team of able assistants who helped her make her first venture into computer analysis, and she solved the structure in 1955. With the memory of Chuck Yeager's 1947 supersonic flight still in the air, Sir Lawrence Bragg, who had succeeded his father William as the elder statesman of X-ray crystallography, hailed her achievement as 'breaking the sound barrier' in crystallographic terms.

Lessons from a life

Because there were more than enough interesting molecules to go round, there was little rivalry between crystallography labs, and Hodgkin fostered active collaboration with other groups in solving the technical difficulties of protein structure analysis. Her gift for sharing was rewarded as colleagues, mostly male, backed her for honours such as the Royal Society's Royal Medal and Wolfson Research Professorship. The Cambridge team of Max Perutz and John Kendrew won the Nobel Prize in Chemistry 1962 for solving the first protein structures, of myoglobin and haemoglobin. Perutz declared himself embarrassed to receive the honour before his old friend; she had been put forward for the prize on at least two previous occasions. He nominated her again, and saw her declared the sole winner in chemistry in 1964.

Hodgkin continued with research for the rest of her life: insulin finally revealed itself, 34 years after her first X-ray photograph, in 1969. She used her Nobel distinction to campaign actively for causes such as nuclear disarmament, understanding between East and West, peace in Vietnam and education funding. Her transparent goodness (some would call it naivety) opened doors from Westminster to Beijing, and if she did not always succeed in her attempts at persuasion, she never doubted the importance of dialogue.



NATIONAL PORTRAIT GALLERY

The painting of Hodgkin that hangs in the National Portrait Gallery: an inexorable inner drive kept her going through all difficulties.

Hodgkin hated the term 'role model', and indeed for many her story might provoke as much despair as inspiration. Was she just lucky, or can her experience offer any guidance to those encouraging women scientists to greater heights of ambition?

The merits of single-sex institutions are hotly debated, but for Hodgkin a women-only college was the launchpad of her education and employment. Somerville saw her merit and gave her a job, then made sure that motherhood did not arrest her career. Most of her male colleagues held paid lectureships in the departments of the University of Oxford as well as their college fellowships. But it was not until 1945, 12 years after Hodgkin became a research fellow and then a tutor at Somerville, that the university grudgingly appointed her to a junior teaching post in crystallography. And in contrast to Somerville's pragmatic action, the university did not introduce paid maternity leave until the 1970s.

Scientifically, the opportunities Hodgkin enjoyed emerged from her far-sighted (but potentially risky) choice of a very new, **interdisciplinary** field led by flexible thinkers who were also social liberals. It enabled her to move far and fast, attracting the notice and support of powerful figures such as Bernal, Lawrence Bragg and Robinson.

It took a special courage, however, to make this choice, and here I believe that her parents played a key part. They gave her a powerful sense of agency: that her choices would be respected, that she could and should make a difference in the world. A diffident exterior —

Hodgkin never raised her voice or spoke ill of anyone — masked an inexorable inner drive that kept her going through all difficulties. Even marriage and children could not deflect her. Hodgkin used to contrast her situation with that of her school friend Norah, who achieved a higher mark in school certificate chemistry than she did. Norah conformed to her hard-working parents' modest expectations by training to teach domestic science in elementary schools, although she would have loved to do a degree.

Women's opportunities and expectations have been transformed since Hodgkin embarked on her studies. Yet the number of women at the very top has failed to keep pace. Focusing on the exceptional few might help us understand how to endow girls with both the opportunity and the will to make science central to their lives. Hodgkin's example shows that it can be done, without sacrificing family life. However, the high cost of childcare, relentless competition for jobs and funding and the disappearance of all-female institutions may mean that it is now even harder to achieve science's glittering prizes than it was when she started out.

FURTHER READING

Powell, H. M. & Crowfoot, D. M. *Nature* **130**, 131–132 (1932).

Bernal, J. D. & Crowfoot, D. *Nature* **133**, 794–795 (1934).

Crowfoot, D. *Nature* **135**, 591–592 (1935)

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http://www.nature.com/nature/journal/v464/n7293/full/4641268a.html

Task 4

Overview questions (check your answers with your ASK Tutor).

1. Why were Hodgkin's achievements so remarkable?
2. What, in Ferry's view, where the factors that contributed to Hodgkin's success as a scientist?
3. What role did gender play in Hodgkin's career?
4. What obstacles did she have to overcome?

Task 5

Work out the meaning from the context of the following words found in bold in the text. Then write your own example sentence that shows the meaning. Check your answers and sentences with your ASK Tutor.

1. exceptional
2. acknowledged
3. skewed
4. disparity
5. proposition
6. susceptible
7. nevertheless
8. interdisciplinary