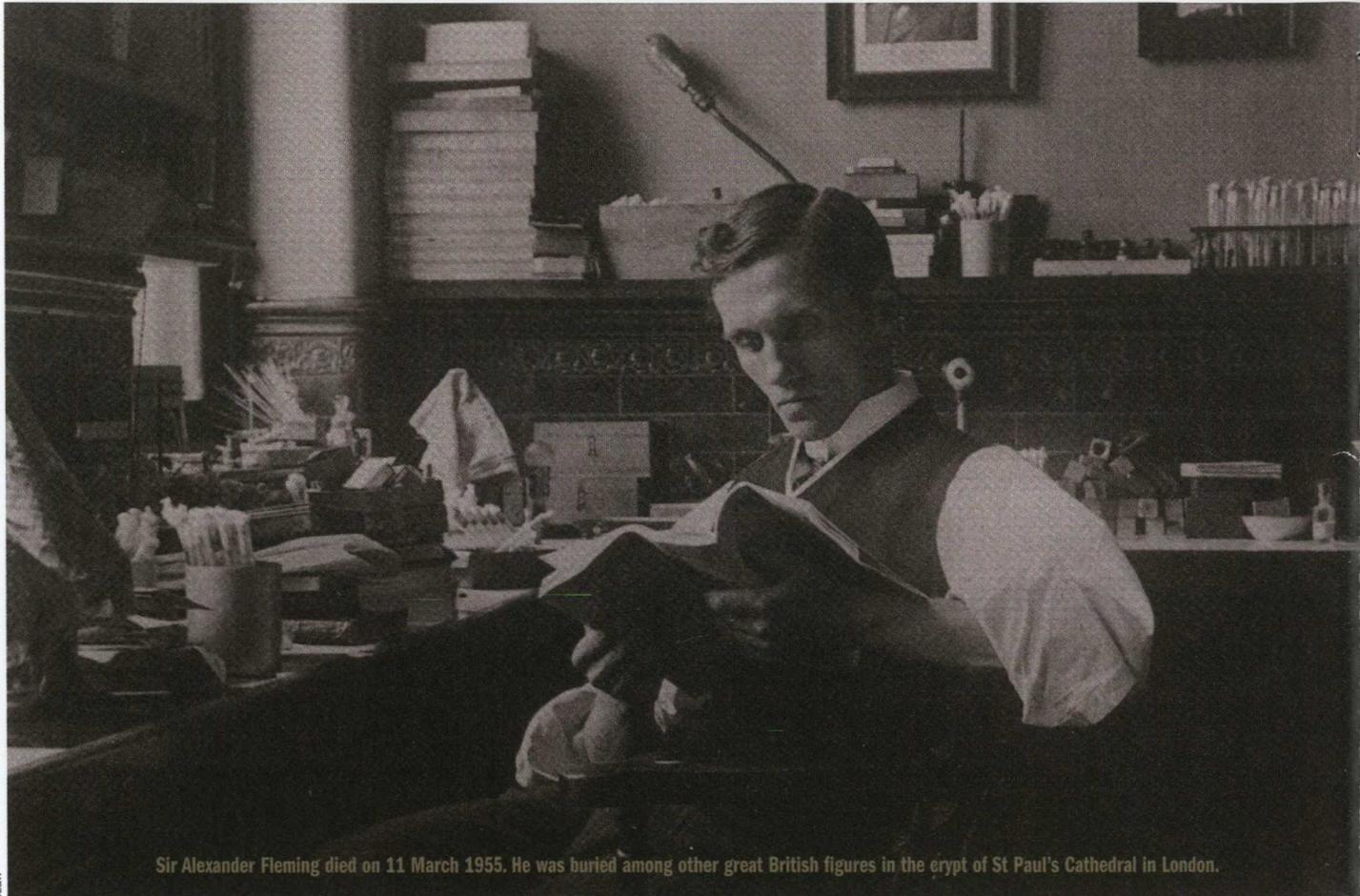


Sir Alexander Fleming

An Accidental Discoverer



Sir Alexander Fleming died on 11 March 1955. He was buried among other great British figures in the crypt of St Paul's Cathedral in London.

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Prof. Kazimierz Kochman is a neuroendocrinologist and an enthusiast of the history of science.

For must there not be some extraordinary circumstances to exalt the name of a professor from the history of Science to the general history of the human race?

Honoré de Balzac

Alexander Fleming – a prominent scientist, the discoverer of penicillin, and a Nobel Prize winner – was born on 6 August 1881 in Ayshire, Scotland. He spent his

childhood in a rural setting at Lochfield, a farm leased by his father, Hugh Fleming. It was owing to such upbringing that he developed observation skills along with a fascination with the natural world.

After completing elementary schooling, the young Fleming was sent to Kilmarnock Academy. At the age of 13, he moved to London, where his elder brother, Tom, had set up as an oculist. After graduating from the Royal Polytechnic Institution, he became a clerk in a shipping company, the American Line. Despite performing his tasks exceptionally well, he took no liking to the job, so he abandoned it without regret after inheriting a small sum of money from his uncle, John. Encouraged by his brother, Fleming decided to use the money to pay for medical school.

Despite winning virtually every prize and distinction available to students, Fleming remained uncertain of the

direction of his career. He decided to qualify as a surgeon only because a friend had encouraged him to do so. He did not want the exam fee of £5 to go to waste, so he continued his education in the field of surgery and consequently earned the prestigious title of a Fellow of the Royal College of Surgeons, an event that demonstrated the meaning of happenstance in Fleming's scientific career. Chance determined even the choice of the specialty that later brought him fame: he was a prominent member of a rifle club and the captain was desperate to keep him in the team, so he recommended him as an intern to Prof. Almroth Wright, head of the department of bacteriology at St Mary's Hospital.

Father Chaos

The series of discoveries that ultimately led to the development of penicillin took place in 1922. The scientist, who was suffering from a cold, accidentally contaminated a Petri dish used for growing bacteria with a drop of nasal mucus. He quickly realized that the mucus contained a substance that killed the surrounding bacteria. He confirmed his observation in a liquid culture, also by using other body fluids such as tears. Fleming concluded that lysozyme, as he named the substance, represented a natural defense mechanism against infections. It was a groundbreaking discovery, as all the substances at that time known to have antibacterial effect, so-called antiseptics, were harmful not only to bacteria but also to human tissue.

Although Fleming earned a reputation as a talented experimenter, his laboratory was not exactly a paragon of tidiness, with stacks of dishes from previous experiments piling up on tables. It was this untidiness that enabled the scientist to make another discovery. Some of the dirty dishes became contaminated with mold. At some point, Fleming noticed that the opaque colonies of staphylococci had become translucent like drops of dew in the proximity of mold. He concluded that mold must contain an antibacterial substance harmless to itself. He soon proved that it was equally harmless to the tissues of other organisms.

After naming the miraculous substance penicillin (after the mold *Penicillium rubrum*), he decided to isolate and purify it. But the task proved a lot more difficult than Fleming had expected, so he ultimately abandoned his plans several years later. Even so, the partial work provided an impulse for other scientists.

In 1932, the German scientist Gerhard Domagk discovered that a red dye he had been using protected mice against streptococci without harming the animals. He named the substance "prontosil" and one of the first people it saved was his daughter, who had contracted a streptococcal infection in a laboratory. Domagk unveiled his findings in a lecture at the Royal Medical Society.

Fleming, who attended the lecture, was fascinated. Even so, he concluded that "penicillin might yield even better results."

Despite its high effectiveness in living organisms, prontosil failed to kill bacteria in vitro. A team led by Prof. Ernest Fourneau from the Pasteur Institute in Paris discovered that the substance underwent transformations in the human body. Their description of the properties of the first sulfonamide allowed the circumvention of Bayer's original patent, so everyone could produce the drug. It proved very popular in the UK, where Leonard Colebrook and Meave Kenny used it to treat puerperal fever. It was soon proved effective in the treatment of meningitis, gonorrhoea, pneumonia, and even certain viral diseases.

Nonetheless, sulfonamides proved ineffective against certain infections and Fleming suspected that bacteria might simply become resistant to the drugs if treated with insufficient doses. He pinned his hopes on penicillin and continued to look for people who could purify the substance. Finally, the task was undertaken by scientists from Oxford: Howard Florey and Ernst B. Chain, who were soon joined by Edward Abraham. They used the technique of freeze-drying (lyophilization) to extract pure penicillin from mold. It proved a thousand times more active than the original penicillin and ten times more active than even the most active sulfonamides. In 1940, they published an article entitled "Penicillin as a Chemotherapeutic Agent" in the prestigious journal *Lancet*. Fleming welcomed the publication with enthusiasm. When he called Chain to congratulate him, the latter cried, "Dear God, I thought you were dead!"

Mother Freedom

After a quiet period of 1940-1942, penicillin started to bring Fleming fame and honors. In 1944, he became a Fellow of the Royal Society and was knighted. In 1954, he received the Nobel Prize in medicine, sharing it with Florey and Chain. During Fleming's triumphant tour of the United States, chemical companies offered him \$100,000 in recognition of his discovery. But Fleming suggested that the money should be donated to the development of research laboratories at St Mary's Hospital.

When accepting a honorary degree from Harvard University, Fleming stressed the role of chance in his career. He also argued that a scientist had to be given the freedom to be able to wait for his work to bear fruit, whereas constant supervision and demands of quick results killed innovation and creative thinking. ■

Further reading:

- Maurois A. (1965), *La vie de sir Alexander Fleming*, Paris: Librairie Hachette, Presse-Avenir.
Fleming A. (1946), *Penicillin*, Butterworth Medical Publications.