

## Chapter 2

### Early Life 1918–1943

Fred Sanger was born on August 13, 1918, in Rendcomb, Gloucestershire, England, one year after his brother Theodore (Theo). They lived in The Old House down the hill from Rendcomb village (Fig. 2.1). The River Churn, little more than a large creek at this point, flowed by the house. Fred's father, Frederick, was a country medical doctor. He saw patients in an outbuilding behind the house, but mostly he made house calls, traveling around by car, bicycle, two-wheeled horse cart, or on foot. He was also the doctor for the little college at Rendcomb.

Earlier Dr. Sanger had been a medical missionary to China. Never one for high church, he went to China with support of the Church Missionary Society. While there, he also founded a school for the lower classes. Illness forced his return to England. He and his mother moved to Rendcomb, where, unfortunately, she died a few months later. In February 1915, his third year at Rendcomb, he was called to attend Daisy Crewdson at Syde, a village some ten miles from Rendcomb. Daisy had broken her arm.<sup>1</sup> Her husband Dilworth was recovering from an illness, so his sister, Cicely, came to Syde to look after Daisy. The good doctor fell in love. He proposed two months later, on his fortieth birthday. They married in September [1].

Cicely Crewdson was the daughter of a wealthy cotton manufacturer from Styal, Cheshire. Squire Theodore Crewdson had at one time been a Quaker, but he had fallen out with them over biblical interpretations. Nevertheless, he had many Quaker books. Dr. Sanger read through them, found his fit, and became a Quaker. Cicely, however, remained Church of England.

Dr. Sanger kept a diary. He either began or ended each year's diary with a letter to his children. He wrote to the boys in 1921, "I am more than ever a Quaker, the social side of our country seems very terrible. There is a false economy about which takes from the poor before it does from the rich, and cannot see where generosity is needed" [2]. The tone was being set that would influence the boys' development.

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<sup>1</sup>Both Fred and Theo related the story of their parents' meeting when Cicely had a septic finger during a visit to Syde. No doubt that was the family story later told to the boys. Dr. Sanger's diaries, however, told the story related here. The septic finger episode happened over a long period in 1919, after Fred was born.



**Fig. 2.1** The Old House at Rendcomb (Courtesy Fred Sanger, with permission)

Dr. Sanger stressed to his children that he hopes they grow up to treat all persons as equals [3].

Dr. Sanger loved his wife and doted on his children (Fig. 2.2). As a young child, Theodore could not quite say his own name. It came out Ojo, so Ojo became the pet name for Theo. Fred's nickname was Derrick, Der for short. They had these names



**Fig. 2.2** Theo, Fred, and Dr. Sanger with Sammie the donkey (Courtesy Fred Sanger, with permission)



**Fig. 2.3** Far Leys in Tanworth-in-Arden (Courtesy Fred Sanger, with permission)

until they went to boarding school. Dr. Sanger was a keen naturalist and Cicely was a lover of wild flowers, so the boys spent much time outside collecting. Dr. Sanger's relentless schedule took a toll on his health. That, combined with his growing enthusiasm for involvement with the Quakers, led him to sell his practice at Rendcomb.

In late 1922, the family moved to Caudle Green, a village across the valley from Syde. Squire Crewdson owned the house, so they paid only peppercorn rent. They lived there while Dr. Sanger found a new practice to buy. During this time, sister Mary (May) was born. Fred slept in the room with his parents. He was in the room asleep when May arrived. Her crying awoke him [4, 5], an incident that became one of Fred's earliest memories.

Dr. Sanger bought a practice in Tanworth-in-Arden, near Birmingham, ideal for him because Birmingham was a Quaker center. The house, Far Leys (Fig. 2.3), lay at the edge of town. They had a large garden and a pond, a site of many activities for the boys. Theo, an avid collector of birds' nests, was the leader of the two. Theo was quite the extrovert; Fred was more introverted. Theo's enthusiasm for nature and collecting became, as Fred put it, the major influence on Fred's early interest in science [6].

The Sangers engaged a governess, Miss Potter. She was stern and the boys disliked her. According to Dr. Sanger, Miss Potter "told Der that she would put a dunce's cap on him and send him through the village with it on." Der went to lessons weeping, which led to Miss Potter's release [7]. Miss Shewell was the new governess. She used the PNEU system,<sup>2</sup> making lessons fun. The boys loved Miss

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<sup>2</sup>Parents National Education Union, founded by Charlotte Mason, stressed short fun lessons with afternoon walks outside and habit training—attention, truthfulness, neatness, kindness, punctuality, etc. [8].

Shewell. Several other village children came to Far Leys for lessons with Miss Shewell.

In 1926 at age nine, Theo went to The Downs,<sup>3</sup> a Quaker boarding school at Colwall, Herefordshire. Fred followed a year later. Fred did not like The Downs. It was too regimented with much bullying and little privacy. He started fine, but then plummeted and was placed in the lower form. He lived for holidays back at Far Leys [6] but gradually acclimated to The Downs. They had carpentry, metal working, and art, and Fred liked to work with his hands. He performed better than Theo academically, but neither distinguished himself. As headmaster Geoffrey Hoyland wrote in a Christmas note to Dr. Sanger [10],

My Dear Sanger, Here are the boys' reports. They are typically British documents—not too good and not too bad with a strong element of compromises. Neither of the boys finds his chief delight and interest in book work, and you are to blame for that by giving them such a vivid sense of the interest of nature, so it's on your head if we can't make scholars of them.

The Downs did not teach science, but Hoyland regularly addressed the students, highlighting new scientific findings. Hoyland saw his job to create a society where “a normal boy could develop naturally and happily under his own steam” [9].

Back at Far Leys, Dr. Sanger had a hut built for the children (Fig. 2.4). Theo had one corner, where he boiled up heads of dead animals and assembled a skull collection. Fred had another corner. May had a third corner near Theo. Fred liked painting, carpentry, and metal working (Fig. 2.5)—the *doing* of things. As May said, she had two brothers who were absolutely different. If she wanted to go out and collect things, she went with the ebullient Theo; if she wanted to do quieter things, she stayed with Fred [11].

Fred built a mouse house where he kept and bred mice. Dr. Sanger regularly reported selling Fred's mice for him. Dr. Sanger wrote [12],

Fred is coming along with his pictures & carpentry which consists of little original ideas. He has perpetrated a Magnum Opus in the shape of a block of wood carved as a head with open mouth from which is extracted lavatory paper!

The family played many games—Happy Families, Whisk, Charades, Snakes and Ladders, Jacks, and Spillikins.<sup>4</sup> They also donned costumes and did theatricals.

Dr. Sanger flew pigeons, so he and the children would drive to Wales, for example, and let the birds fly. They took many trips pulling a caravan. Dr. Sanger and the children rode in the car. Cicely took the train and met them at the destinations [13]. Family life was busy and fun.

Britain had a vast investment in U.S. stocks, so the crash of 1929 led to hard times. More than 7,000,000 were unemployed [14]. The Sangers were well off because of Cicely's family money, so they did not suffer. Dr. Sanger was too

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<sup>3</sup>Alan Hodgkin, 1963 Nobel laureate in Physiology or Medicine attended The Downs, leaving just as Fred Sanger was beginning. The poet W. H. Auden taught English at The Downs 1932–1935 [9].

<sup>4</sup>Spillikins is pick-up sticks or jackstraws.



**Fig. 2.4** Fred in the hut 1931 (Courtesy Fred Sanger, with permission)



**Fig. 2.5** Fred and May at the forge 1933 (Courtesy Fred Sanger, with permission)



charitable because his patients had so little [5]. Dr. Sanger wrote, “Sad year to most people feeling the economic strain. Country has become so nationalistic with buy British and tariffs. It all seems so selfish and unChrist-like” [15].

Geoffrey Hoyland suggested Bryanston for education after The Downs. Bryanston was a new school in Dorset that followed a modified Dalton Plan,<sup>5</sup> allowing students to take responsibility for their own education, with increasing freedom and responsibility. Classes decreased progressively at each level [17]. Although not a Quaker school, Bryanston focused on promoting peace. Theo went in 1931; Fred followed the next year. The school was perfect for Fred. He had more freedom than at The Downs and much more freedom than other public secondary schools. He liked projects and stuck to them, unlike many of his classmates, who did not do well with all that freedom.

Dr. Sanger liked Bryanston because it had no Officer Training Corps (OTC). In place of OTC, it had Pioneers. One-half day per week, Pioneers worked on building projects around the school—gardening, laying concrete, and building sheds. At holidays, Pioneers worked with the unemployed, helping them dig their allotments<sup>6</sup> and paying them rent to stay with them. Bryanston offered other physical outlets, especially sports. Fred thought The Downs required participation in too many sports. At Bryanston, he was free to choose. He especially liked squash and Fives.<sup>7</sup>

At the end of one summer holiday, Dr. Sanger wrote two mottos on a slip of paper and gave it to Fred: “Success is naught; endeavor’s all.” and “If you have built castles in the air, that is where they should be; now put foundations under them.”<sup>8</sup> Those mottos resonated with Fred because he enjoyed working hard. He also remembered his father saying on many occasions that there are two worthwhile things in life, science and art—science because it means progress; art because it means creating beauty.

Fred liked the biology master, Bill Hoyland, brother of Geoffrey Hoyland from The Downs. One had to pass only five exams to qualify for Cambridge. Fred took School Certificate exams in seven subjects and passed all seven, earning him the moniker of ‘Seven-Credit Fred.’

Fred’s major mentor was chemistry master, H. G. Ordish. Mr. Ordish did research with dyes. Because he had already passed the exams, Fred spent much time with Mr. Ordish in the chemistry lab. Fred loved the beautiful crystals that resulted from their work [19].

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<sup>5</sup>Helen Parkhurst pioneered the Dalton Plan in Dalton, Massachusetts, USA. She believed “The true business of school is not to chain the pupil to preconceived ideas, but to set him free to discover his own ideas and to help him to bring all his powers to bear upon the problem of learning” [16].

<sup>6</sup>A small piece of ground in or near town where one can grow vegetables and flowers.

<sup>7</sup>Fives is a derivative of Eton Fives, a hand ball game played as doubles on a three-sided court, with one wall having a buttress. The game originated outside Eton Chapel, thus the buttress [18].

<sup>8</sup>The first motto is from Robert Browning’s *Red Cotton Night-Cap Country*; the second is from Henry David Thoreau’s *Walden*.

Bryanston had an exchange program with Schule Schloss Salem in Germany. In 1935, Fred and David Forbes were accepted for a half-term at Salem. Salem put so much emphasis on athletics that Fred and David were ahead of their German peers in coursework. They were stunned when the headmaster started each day with readings from either the Bible or Hitler's *Mein Kampf*. The German boys all stood and saluted 'Heil Hitler' after the readings. Being foreigners exempted David and Fred from the requirement. At end of term, David and Fred went on a walking holiday through parts of Germany, Austria, and Italy. They slept in barns or out in the open. They miscalculated the money they needed and ran short, eating only bread and jam the last few days of the journey [6].

Fred was expected to follow in his father's footsteps, attend St. John's College, Cambridge, and study medicine. In fact, Fred was accepted to St. John's to study Medicine Honours Natural Science Tripos<sup>9</sup> Part 1 [20]. Fred decided a country doctor's life was not for him, so he changed to natural science, much to his parents' disappointment. Fred said,

I started to think about what I was going to do. I had seen my father's work, you see, which was very scrappy really. You'd drive around to see one patient, try to cure them, and see another patient, and so forth. It occurred to me I really wouldn't enjoy that very much [6].

Fred planned to study physics, chemistry, maths, and biochemistry. When he approached the physics master at Bryanston about applying for a physics scholarship to Cambridge, the master told Fred he was not up to it. He was going to St. John's a year early and lacked the background. Fortunately, his family had money to pay his way. Theo went to Cambridge the same year, but he entered Trinity Hall with its focus on law.

Fred learned that he was not ready to compete in physics. Most of his peers had three years of secondary school physics; he had only two. After the first year, he changed from physics to physiology. The change cost him a year, so he took three years for Part 1. Biochemistry was a new subject, so Fred was not behind the other students in biochemistry. Theo stayed 'in college' his first year; that is, he had a room in campus housing. Each student at Cambridge was required to stay in college at least one year. Fred could not get in college first year, so he shared lodgings with Geoffrey Udall, a good friend of Theo's from Bryanston. They lived off campus near the Round Church less than a block from St. John's. Fred did not have a room in college until his third year.

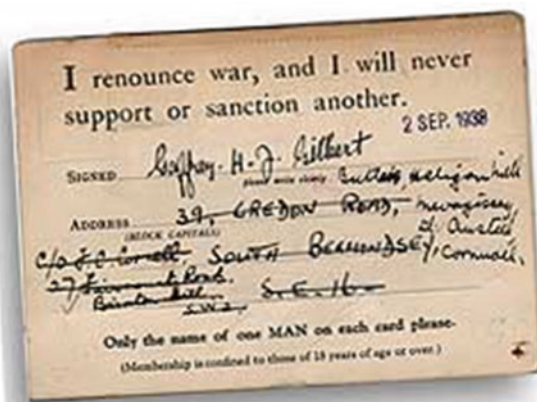
When he came to Cambridge, Fred was political. As a Quaker, he was a pacifist and strongly anti-war. He signed the Peace Pledge Union<sup>10</sup> (Fig. 2.6) and joined the Scientists' Anti-War Group (SAG), which assembled several reports. Fred led a report on the political and economic effects of rearmament. He assembled the

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<sup>9</sup>Tripes is the exam pattern necessary for a B.S. honors degree at Cambridge. Part 1 study normally takes two years, Part 2 a third.

<sup>10</sup>Dick Shepherd, a popular Church of England priest, started the PPU. He asked mostly men to "renounce war and never again to support another" by signing a pledge. In a few months of 1934–35, more than 30,000 signed [21].

**Fig. 2.6** Peace Pledge Union pledge card (Courtesy Peace Pledge Union, with permission)



political parts, but needed help with economics. A friend recruited Joan Howe, an economics student, and they completed the report. The other leaders were not so diligent, so nothing much came of the entire effort. Fred decided he could not make much difference in the peace movement, so he concentrated on his science. Also, his blossoming romance with Joan hastened his drift away from SAG. Joan's father was a Leicester shoe manufacturer. Joan was intelligent and the first in her family to go to college. Her father disapproved of Fred because he did not want her "wasting her time on some good-for-nothing undergraduate" [6].

While Fred was at college, both parents died of cancer. His father opted for surgery and did not survive. His mother moved to Caudle Green and died a year later. Their Uncle Dilworth and Aunt Daisy became de facto parents for Theo, Fred, and May. As a result their holiday home was the house in Caudle Green.

Fred made several trips to Austria, Czechoslovakia, and Germany, usually working in camps sponsored by Quakers to help underprivileged workers. In 1939, he was in Germany for a combined holiday with German students to encourage peace and understanding. Germany invaded Poland, igniting World War II. Fred and the other English students scrambled to catch trains and leave Germany. It was a hectic, fearful time.

Fred took biochemistry for Part 2, requiring a fourth year. He moved out of college to lodgings on Park Parade overlooking Jesus Green. As he began his studies, war broke out. He had already initiated conscientious objector (CO) status following the Military Training Act of 1939, whereby all men aged 20–21 were required to undergo a six-month military training. With the British declaration of war, Parliament passed the National Service Act, imposing conscription [22]. Fred pursued his CO application, going before a Cambridge tribunal, which granted him CO status.

Fred and Joan courted during this trying time. Cambridge did not allow undergraduates to have a car, but Fred bought an old car for £8 and kept it in a



garage out of town. He and Joan bicycled out to the car and then drove around the countryside.

Fred took the exam for Biochemistry Part 2, not expecting to do very well. After all, he did not earn a First on Part 1. Much to his surprise, Fred received a First-Class Honours, the top grade on the exam. He found out from a cousin who read in *The Times* that Fred and one other person had received a First. That result qualified him for graduate school. Fred later reflected that the essay on Comparative Biochemistry at the end of the Part 2 exam probably made the difference. He had some extra time, and he developed the idea of the survival of the fittest molecules [23, 24].

After completing his degree, Fred went to Spiceland [25], a Quaker training center in Devon for war-relief workers. COs had to contribute to the war effort. The three-month training program taught three courses: agriculture, building, and cooking and cleaning. But mostly it was about service. Fred was one of eighteen Spicelanders sent to Winford Hospital near Bristol. As orderlies, they did the drudgework necessary to make the hospital function. Fred wound up cleaning floors and lavatories. He thought this work a waste of his talents, so he wrote to Professor Frederick Gowland Hopkins,<sup>11</sup> chair of biochemistry at Cambridge, about graduate work. His letter went unanswered. During a lull at Winford, Fred went to Cambridge to inquire if anyone needed research help. Discovering that he needed no monetary assistance caught the interest of several researchers. The Ministry of Labour and National Service approved his return to Cambridge to work on his Ph.D.

Fred decided to work with Bill Pirie, who was trying to make edible protein from grass. He gave Fred a bucket of frozen grass and said, “You want to work on this” [23, 24]. Before Fred really got started, Bill left Cambridge for another position. Albert Neuberger, who had recently joined the biochemistry faculty, became Fred’s supervisor. Fred indicated that Neuberger taught him how to research, most importantly not to fear trying something new, not to worry when an experiment did not work, but to get on with it and try something else.

In December 1940, Fred and Joan were married in the old family church at Syde (Fig. 2.7). Gasoline was in such short supply that Joan’s father gave them several gallons as a wedding present. They left Syde for their wedding trip in Wales, but almost had to spend their wedding night in the car. Fred had not booked a hotel, thinking there would be no problem finding a room. Evacuees from London and other parts of Britain occupied hotel rooms all along their route. Rather late, they finally found a room [27].

Fred’s dissertation work was on metabolism of the amino acid lysine. He made acetyl lysines and fed them to rats. In addition to his studies on lysine metabolism, he had war work analyzing nitrogen in potatoes. Fred had fire duty one night a week, where he and a co-worker spent all night watching for fires that might result

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<sup>11</sup>Christiaan Eijkman “for his discovery of the antineuritic vitamin” and Sir Frederick Gowland Hopkins “for his discovery of the growth-stimulating vitamins” shared the 1929 Nobel Prize in Physiology or Medicine [26].

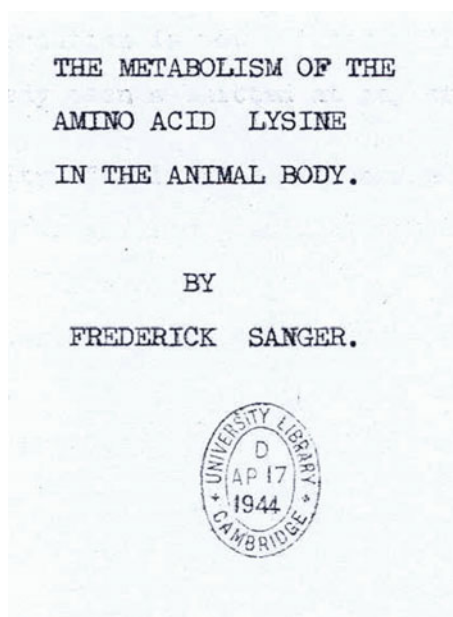
**Fig. 2.7** Fred and Joan Sanger wedding 1940 (Courtesy Fred Sanger, with permission)



from German bombardments. Fortunately, Cambridge escaped major bombing because it had little industry—only 30 persons were killed and 70 injured in all of the war. Most bombing resulted from German's dropping excess bombs on their way home after an attack elsewhere [28].

Cambridge was awash with London evacuees and with Yanks. The Royal Air Force built airfields all over East Anglia in the mid-1930s; Cambridge was the obvious city for military leave. Rationing allowed the typical resident 12 ounces of sugar, four ounces of bacon, four ounces of butter, and six ounces of meat per day in 1940, and even those items became scarce. Yanks came in with all their money and engendered no small amount of resentment [29]. Joan was a master at finding scarce commodities, so the Sangers fared okay. She also worked two jobs. And in 1943, she bore their first son, Robin. He was a difficult baby the first year, crying all the time. Despite this backdrop, Fred managed to submit his Ph.D. dissertation in late 1943 (Fig. 2.8).

**Fig. 2.8** Fred Sanger's dissertation (Courtesy Fred Sanger, with permission)



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Frederick Sanger

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