Obituary

Melvin Calvin (1911–97)

Chemist who elucidated the biochemical basis of photosynthesis

To achieve great things, being a great man is not enough: you also need to be in the right place at the right time. Melvin Calvin was lucky — although he was certainly an outstanding scientist, he had the good fortune to be in Berkeley at the end of the Second World War and to be a colleague of Ernest Lawrence.

As a boy helping in the family grocery store in Minnesota, he became fascinated with chemistry while musing on the variety of substances in the ingredients of the goods on the shelves. After a BS in chemistry at the Michigan College of Science and Technology, a PhD at the University of Minnesota and a postdoctoral period in Manchester, in 1937 he found himself in the chemistry department at the University of California in Berkeley. He was never to leave.

Several significant events in Berkeley were to have a profound effect on Calvin's future activities. It was in the Radiation Laboratory, which was founded in 1931 by Ernest Lawrence, that Sam Ruben and Martin Kamen discovered ^{14}C in 1940. Together with Andy Benson, they began to use the minute quantities then available to study the path of carbon in photosynthesis. The war put a stop to photosynthesis research; by the time it was over, Ruben had died in a laboratory accident, Kamen had left Berkeley for political reasons, and the availability of ^{14}C had grown enormously as the result of its production in nuclear reactors. Late in 1945, Lawrence, who then in effect controlled access to ^{14}C , suggested to Calvin that he make use of it, both to synthesize labelled compounds for medical research and to resume the photosynthesis exploration. In the heady post-war days of 'big' science in the style of the Manhattan project (in which the University of California had been involved), Lawrence made available to Calvin the funding and laboratory space that he needed.

Calvin never looked back. He was a man remarkable for a comprehensive knowledge of chemistry, unfailing originality and an ability to integrate information from a range of sources. Equally important was his talent for picking the right collaborators. The photosynthesis group was established in the Old Radiation Laboratory (ORL), an old wooden building that is affectionately remembered by the many graduate students and postdoctoral associates who worked there before its demolition in 1959.

Together with Benson, who was back in Berkeley after the war, Calvin set out to map the path of carbon.

In the basic experiments, $^{14}\text{CO}_2$ was fed in short bursts to illuminated green plants which were then studied for the progressive incorporation of radioactivity into product molecules. Initially, products were analysed by ion-exchange chromatography, but in 1949 the group was introduced to paper chromatography and progress then became very rapid. By the end of the 1950s — a few minor uncertainties aside — the carbon pathway lay revealed. The superb quality of the work was recognized in 1961 by the award to Calvin of the Nobel prize for chemistry.

Following the redevelopment of the ORL site, Calvin looked for funds to build a new laboratory. The former residents of ORL had no doubt that it must be a modern version of ORL, embodying its open and intimate quality. The nerve centre of ORL had been a large, white, Formica-topped table on which chromatograms and autoradiograms were laid out for contemplation; it is shown in the picture here. Despite the strong social cohesion of the group, with frequent parties and skiing or walking trips in the Sierras, the conversation round the big white table was almost always about research. (Calvin worried about those ski parties: would the guys be back in the lab on Monday morning?)

The new, three-storey, circular building was finished in 1963. Half of each of the upper two floors was a large semi-circular open laboratory. The big white table was installed at the centre of the third floor where it resumed its function as the group's meeting point; it was in exactly the same place when I last saw it in July 1996.

Resolution of the central biochemical question of photosynthesis, together with the space and facilities of the new building, opened new doors for Calvin. Retaining his earlier interests in chelates and other problems in physical organic chemistry, he

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branched out into the biochemistry of learning, for a short while using the flatworm *Planaria*. After they had been taught to solve simple maze problems, it was claimed the animals could be chopped in half, whereupon the head portion grew a new tail, the tail end a new head with both reconstructed animals remembering their erstwhile 'parent's' training. Feeding trained *Planaria* to their naive cannibalistic relatives was said to confer new skills. (There was talk of feeding minced professors to the students!)

Deeply involved with origin-of-life questions even before probes were sent to the Moon and Mars, there seemed to be no limit to the breadth of Calvin's scientific curiosity. Early in the 1970s he established a group to work on cancer, and even after he relinquished the directorship of the group his ideas kept flowing. In the 1980s he seriously considered the use of certain plant oils as substitute diesel fuels should the world experience a severe petroleum shortage.

Calvin was overwhelmingly an experimental scientist. A consultant to chemical companies, until his Nobel prize and subsequent appointment to President Kennedy's Science Advisory Committee he had little interest in, or familiarity with, public affairs and politics. His many subsequent visits to Washington on public business broadened his understanding, yet he never thought of himself as, or wished to be, anything other than a scientist.

People sometimes talk of the great men and the great scientists they have known. For me and the many colleagues who worked with him, Melvin was *the* great man and *the* great scientist in our lives. Never hesitating to criticize in a scientific context, on a personal level he was always warm and caring. Those who knew him will never forget.

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