

# Tutte, William Thomas [Bill]

(1917–2002)

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Tutte, William Thomas [Bill] (1917–2002), mathematician and codebreaker, was born on 14 May 1917 at Fitzroy House, Newmarket, the only child of William John Tutte (*d.* 1944), gardener, and his wife, Annie, *née* Newell, cook. After moving around for several years his family settled in Cheveley, near Newmarket, where his father obtained the position of gardener at the Rutland Arms Hotel and Bill (as he was always known) attended the village school. At the age of eleven he won a scholarship to the Cambridge and County High School. In the school library he discovered W. W. Rouse Ball's book *Mathematical Recreations and Essays*, in which he read about the five-colour theorem and Petersen's theorem. Both these results were to figure largely in his life's work. In 1935 he went to Trinity College, Cambridge, supported by a state scholarship and a college scholarship. He read natural sciences, specializing in chemistry, in which he obtained a first-class honours degree. He joined the Trinity Mathematical Society, where he met R. L. Brooks, C. A. B. Smith, and A. H. Stone, and together they worked on the problem of dividing a square into squares of different sizes. They reformulated this old problem ('squaring the square' as Tutte called it) in terms of the flow of electricity in a network, and produced a paper that contained several mathematical ideas of fundamental significance.

In 1940 Tutte was called up for national service, and after initial training he arrived at Bletchley Park, the British cryptographic headquarters, in January 1941. There he was asked to work on the cipher system known at Bletchley as Tunny, one of the codes used by the German high command. He copied out some cipher text onto sheets of squared paper, using chunks of various lengths, noticed certain patterns, and was able to infer the structure of the enciphering machine. Indeed, he achieved a virtual reconstruction of an extremely complex machine using only scraps of information—an amazing feat that must rank as one of his greatest intellectual achievements. Throughout 1942 and 1943 many people were assigned to work on the implications of his discovery. Eventually it became necessary to use a form of number-crunching statistical analysis, and Tutte saw how this could be done. In due course the Colossus computer was deployed on these problems.

At the end of the war Tutte returned to Trinity College as a research fellow. His time there was a highly productive one. His PhD thesis, 'An algebraic theory of graphs' (1948), contained many seminal ideas, and these were published in papers that quickly established graph theory as a significant area of mathematics, with Tutte as its master builder. Among the papers he published at that time there were several classics. In a paper published in 1946 he disproved Tait's conjecture by constructing a planar cubic graph that has no Hamilton cycle. His paper on the symmetry of cubic graphs contained a truly unexpected bound on the order of a vertex stabilizer, a fact that was to resurface twenty years later in the work of permutation group theorists. Perhaps his most influential paper from this period was on the factorization of graphs (published in the *Journal of the London Mathematical Society* in 1947), in which he obtained the canonical form of the basic result on this topic, with Petersen's theorem as a simple corollary. The thesis also contained important results about matroids, a subject that had been inaugurated by Hassler Whitney. Many of these results were published about ten years later, but their significance was not fully recognized until they appeared in a series of lectures in 1965.

In 1948 Tutte took up a post at the University of Toronto, where he continued to produce a stream of new ideas. Some of his Toronto papers discussed aspects of the chromatic polynomial and its two-variable generalization, which became known as the Tutte polynomial. Several famous conjectures, such as the conjecture that every bridgeless graph has a 5-flow, also appeared in print at this time. In October 1949 he married Dorothea Geraldine Mitchell, a potter from Oakville, Ontario, whom he had met through the Canadian Youth Hostels Association. She died in 1994; there were no children. In 1962 Tutte was persuaded to move to the newly established University of Waterloo, and he and Dorothea lived in the village of West Montrose, on the banks of the Grand River. By this time he had been appointed a fellow of the Royal Society of Canada (1958), and the importance of his work was being recognized internationally. The university created around him a world-famous department of combinatorics and optimization, and it was instrumental in the foundation of the *Journal of Combinatorial Theory*. The growth of air travel meant that Tutte and his wife were able to travel extensively, and in 1971 he was the principal guest at a small meeting held in Royal Holloway College, London. The success of that meeting led to the establishment of the British Combinatorial Conferences.

Tutte retired formally in 1985, but continued to be active in mathematics. In his quiet way he enjoyed the recognition that accompanied the growth in popularity and status of graph theory, the subject he had built. Outstanding mathematicians were attracted to work in this field, many of them inspired by his earlier results. He became a fellow of the Royal Society in 1987. After Dorothea's death he lived in England for a while, but he did not settle, and eventually returned to his adopted home in Ontario. His eightieth birthday was marked by a celebration in Waterloo, where he talked about his work to an audience that fully appreciated what he had achieved. He was the Rado lecturer at the British Combinatorial Conference in Canterbury in 1999, where he explained how some of his work at Bletchley had helped him to understand the properties of linear dependence, and how this led to some of the fundamental theorems of matroid theory. In 2001 his eminence was recognized by the award of the order of Canada, which he received with characteristic humour and humility. At that time he was in good health, but in March 2002 he was diagnosed with lymphoma of the spleen, and he died on 2 May 2002, in Waterloo, Ontario.

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## Wealth at Death

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