

GRACE CHISHOLM YOUNG & WILLIAM HENRY YOUNG

Grace Chisholm Young (March 15, 1868 – March 29, 1944) and **William Henry Young** (October 20, 1863 – July 7, 1942) formed an exceptional mathematical partnership that produced some 220 mathematical articles, several books and six children. Born in Haslemere, England, Grace Chisholm was taught at home by a governess until age 17. Chisholm's family did not think her wish to study medicine was a suitable choice, but they did approve of her social consciousness in working among the poor of London. She entered Girton College, Cambridge, where her mathematics tutor was William



Young. Although women were not awarded formal degrees from Cambridge at the time, Chisholm



earned the equivalent of a first class degree in mathematics in 1892. Since women were not allowed to attend English graduate schools, she traveled to Germany to study at Göttingen, where she completed a doctorate with a thesis *The algebraic groups of spherical trigonometry*, directed by Felix Klein. Grace was the first woman to receive a formal doctorate in any subject in Germany. Sonya Kovalevskaya was awarded a doctorate in

mathematics in absentia from Göttingen, but she never attended the university, nor did the faculty examine her.

Born in London, William Young attended the City of London School whose headmaster was Edwin A. Abbott, the author of the popular mathematical fantasy *Flatland*. Abbott recognized Young's mathematical ability and encouraged him to study it at university. Will, as he was called, was an outstanding student at Peterhouse, Cambridge, where from 1886 to 1892, he was a Fellow, tutoring students for the mathematical tripos. Although never appointed to prestigious university chairs, he had

the distinction of serving as president of the London Mathematical Society (1922 - 1924) and president of the International Mathematical Union (1929 - 1936). Among his most important mathematical works were his independent discovery of the integral named today for Henri Lebesgue, his work on Fourier series, and his book *The Fundamental Theorems of the Differential Calculus* (1910).

When Will first asked Grace to marry him she declined, but he persisted in his suit, and, in 1896 they wed, beginning a personal and professional partnership that lasted 44 years. In 1906 *The Theory of Set Points* was published under both their names. It was “the first comprehensive textbook on set theory with applications to the general theory of functions.” The Youngs left England for Göttingen where, except for a year in Italy, they lived until 1908 when they moved to Geneva, Switzerland. Then in 1915 they made Lausanne their permanent home. During the years 1913 - 1919, Will held two part-time chairs, one at Calcutta University and one at the University of Liverpool. In 1919, he was appointed to the chair of mathematics at the University of Wales in Aberystwyth, where he remained until 1923. These appointments required him to be separated from Grace and their children for extended periods. But when they were together they merged their individual talents in the creation of important mathematical results.

Prior to their marriage, Will had shown little interest in research, but it meant everything to Grace. He was very creative but not terribly attentive to details. Grace prepared his papers for publication, often filling in gaps in his proofs and correcting his mistakes. It's probable that many of the papers that he published were a collaboration of husband and wife. How much was the work of one or the other likely never will be known. In a letter to Grace, he acknowledged her importance in their partnership, but he also recognized the climate of the time:

“The fact is that our papers ought to be published under our joint names, but if this were done neither of us get the benefit of it. No. Mine the laurels now and the knowledge. Yours the knowledge

only ... at present you cannot undertake a public career. You have the children. I can and do.”

In 1905 Grace Chisholm Young published the *First Book of Geometry*. In it she attacked the problem students have learning solid geometry because of the difficulty in adequately representing three-dimensional figures on a two-dimensional surface. She dealt with the complication by demonstrating how to construct three-dimensional objects by cutting, folding and refolding special patterns that she called “nets.” Students could handle these, and in the process discover the solids’ properties and visualize the theorems of solid geometry. Between 1914 and 1916 she published papers under her own name on the foundations of calculus, which earned her the Gamble Prize from Girton College.

Always eager to extend herself, Grace returned to her early interest in medicine, completing all requirements for a medical degree except the internship. She mastered six languages and found time to teach them to each of her children. She also shared with them her sense of curiosity and the desire to learn. The Young’s eldest son, Frank, an RAF pilot, was killed in WWI. Cecily took a doctorate in mathematics. Janet became a physician. Helen Marion completed an undergraduate degree in mathematics. Laurence, a chess master, taught mathematics for twenty-eight years at the University of Wisconsin. Their youngest, Patrick, trained as a chemist, pursued a career in public finance and diplomacy. Laurence’s daughter, Sylvia Wiegand, is a mathematics professor at the University of Nebraska and past president of the Association for Women in Mathematics.

In 1940, fearing the spread of World War II, Grace left Will in Switzerland to take two of their grandchildren to England. She planned to return immediately, but due to the fall of France to the Germans was unable to do so. Will spent the last two years of his life lonely and depressed, never to see his family again. Two years after his death in 1942, Grace died of a heart attack before she could receive the honorary degree that Girton College planned to award her.

Quotation of the Day: “When all is said, it remains that my father had ideas and a wide grasp of subjects, but was by nature undecided; his mind worked only when stimulated by the reactions of a sympathetic audience. My mother had decisiveness and the stamina to carry an undertaking to its conclusion. Her skill in understanding and in responding, and her pleasure in exercising this skill led her naturally into the position she filled so uniquely. If she had not had that skill, my father’s genius would probably have been abortive, and would not have eclipsed hers and the name she had already made for herself.” – Rosalind Cecily Young Tanner