# Princeton University

### Honors Faculty Members
### Receiving Emeritus Status

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# Contents

# William Browder

William Browder's mathematical work continues Princeton's long tradition of leadership in the field of topology begun by James Alexander and Solomon Lefschetz. His profound influence is measured both by the impact of his work in the areas of homotopy theory, differential topology and the theory of finite group actions, and also through the important work of his many famous students. He and Sergei Novikov pioneered a powerful general theory of "surgery" on manifolds that, together with the important contributions of Bill's student, Dennis Sullivan, and those of C.T.C. Wall, has become a standard part of the topologist's tool kit.

The youngest of three brothers, Bill was born in January 1934 to Earl and Raissa Browder, in a Jewish Hospital in Harlem in New York City. At that time, Earl Browder was leader of the Communist Party of the United States, and ran for president on that ticket in 1936 and 1940. (He lost!)

It was on a family trip to Missouri to visit the boys' grandfather in 1939 that Earl learned, while changing trains in Chicago, that he had been summoned to Washington to testify before the Dies Committee, later known as the House Un-American Activities Committee; he was forced to miss the rest of the trip. It was on this occasion that the word "subpoena" first entered Bill's vocabulary and he began to appreciate the special status of his family.

After early schooling in the Yonkers public schools, Bill entered the Massachusetts Institute of Technology in 1951, following in the footsteps of his two brothers, Felix and Andrew. There, he majored in mathematics after a short flirtation with physics.

On graduating in 1954, he came to graduate school in Princeton where he received his degree in 1958. His thesis was written under the direction of John C. Moore.

Bill was offered an instructorship at the University of Rochester in 1957. This was followed in 1958 by another instructorship at Cornell University, where he remained until 1963, advancing to the rank of associate professor. Bill's appointment to Princeton as full professor came in 1964. At that time — at the age of 28 — he was the youngest person to have achieved this rank in the mathematics department.

Bill's involvement with the American Mathematical Society (AMS) began at Cornell when he was elected to the council for the first time. In later years, he was elected again to the council, to the executive committee of the council, as vice president, and, finally in 1987, president. During Bill's tenure as president, the AMS became more involved in issues of K-12 education. Bill served on numerous AMS committees over a period of many years.

During the late seventies, Bill became chair of the Office of Mathematical Sciences of the National Research Council (NRC). He moved to establish the David Committee, which was charged with investigating the underfunding of mathematical research. This was done with the warm support of many scientists from other disciplines. The committee's report marked a turning point in the funding of mathematics. Later, it was used as a basis for briefings for the White House (which Bill chaired) and for the Pentagon. Over the years, Bill has been a member of many other committees of the NRC and the National Academy of Sciences.

Bill was elected to the National Academy of Sciences in 1980, to the American Academy of Arts and Sciences in 1984, and to the Finnish Academy of Arts and Sciences.

For his Ph.D. thesis, Bill investigated the homology of loop spaces; Moore had given Bill a very beautiful idea. On the eve of Bill's departure to Rochester in August 1957, the thesis collapsed after Moore discovered a flaw in his original idea. Initially, Bill was depressed, but later he realized it was a blessing in disguise, as it led to the writing of a new thesis that Bill completed in a much more independent way. He considered this to be a significant point in his mathematical development.

Among the results of which Bill is most proud is his analysis in 1960 of the homology of H-spaces following the program begun by

Heinz Hopf and Armand Borel. This led to the remarkable extension to H-Spaces of Élie Cartan's famous result that the second homotopy group of a Lie group vanishes. In 1962, building on the work of John Milnor and Michel Kervaire, Bill showed that one could characterize differentiable manifolds in terms of homotopy theory. At roughly the same time, Novikov, in Moscow, obtained similar results independently. The work became known as the Browder-Novikov theory and later, as surgery theory. Bill's famous book on the subject, "Surgery on Simply-Connected Manifolds," appeared in 1968.

In 1963, in collaboration with Jerry Levine and Roger Livsey at the Institute for Advanced Study, Bill developed a new technique for codimension-one surgery, which proved influential for future developments by Laurance Siebenmann, F. Thomas Farrell, Novikov and Wall.

Arising from the work of Kervaire and Milnor was an important "obstruction to surgery" that became known as the Kervaire invariant. Bill showed in 1967 that this invariant vanished in the important case of framed manifolds of dimension not equal to a power of two minus two. He did this by reducing the problem to homotopy theory and relating the invariant to the Adams Spectral Sequence. This led him to discover a new example of a framed manifold in dimension 30 with non-vanishing Kervaire invariant. Forty years after Bill's work, the vanishing of the Kervaire invariant was settled, in all but the single dimension of 1926, by the celebrated work of Michael Hill, Michael Hopkins and Douglas Ravenel.

In his 48 years at Princeton, Bill served in various capacities in the mathematics department: chair, director of graduate studies and undergraduate representative. He also served as chair of the Resources Committee of the University and was a member of the Concerts Committee. For a decade, he was an editor of the Annals of Mathematics.

Bill has advised 30 Ph.D. students and numerous undergraduates who went on to brilliant careers. Among his Ph.D. students is a recipient of the Fields Medal, two recipients of the National Medal of Science and many others who have enjoyed distinguished careers.