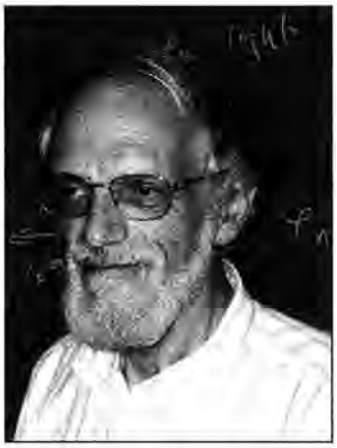
Furstenberg and Smale Receive 2006–2007 Wolf Prize

On January 15, 2007, the Wolf Foundation announced that the 2006–2007 Wolf Prize in Mathematics will be awarded to HARRY FURSTENBERG and STEPHEN J. SMALE. Furstenberg, emeritus professor of mathematics at the Hebrew University of Jerusalem, is honored "for his profound contributions to ergodic theory, probability, topological dynamics, analysis on symmetric spaces and homogenous flows." Smale, emeritus professor at the University of California, Berkeley, and a professor at the Toyota Technological Institute at the University of Chicago, is honored "for groundbreaking contributions that have played a fundamental role in shaping differential topology, dynamical systems, mathematical economics, and other subjects in mathematics." The US$100,000 prize will be presented by the president of the State of Israel in a special ceremony at the Knesset (parliament) in Jerusalem on May 13, 2007.



Harry Furstenberg

Stephen J. Smale

Harry Furstenberg

Harry Furstenberg is one of the great masters of probability theory, ergodic theory, and topological dynamics. Among his contributions: the application of ergodic-theoretic ideas to number theory and combinatorics and the application of probabilistic ideas to the theory of Lie groups and their discrete subgroups.

In probability theory he was a pioneer in studying products of random matrices and showing how their limiting behavior was intimately tied to deep structure theorems in Lie groups. This result has had a major influence on all subsequent work in this area, which has emerged as a major branch not only in probability but also in statistical physics and other fields.

In topological dynamics Furstenberg's proof of the structure theorem for minimal distal flows introduced radically new techniques and revolutionized the field. His theorem that the horocycle flow on surfaces of constant negative curvature is uniquely ergodic has become a major part of the dynamical theory of Lie group actions. In his study of stochastic processes on homogenous spaces, he introduced stationary methods whose study led him to define what is now called the Furstenberg Boundary of a group. His analysis of the asymptotic behavior of random walks on groups has had a lasting influence on subsequent work in this area, including the study of lattices in Lie groups and cocycles of group actions.

In ergodic theory Furstenberg developed the fundamental concept of dynamical embedding. This led him to spectacular applications in combinatorics, including a new proof of the Szemeredi Theorem on arithmetic progressions and far-reaching generalizations thereof.

Born in Germany in 1935, Furstenberg received his Ph.D. from Princeton University in 1958 under the direction of Salomon Bochner. Since 1965 Furstenberg has been a professor of mathematics at the Hebrew University. He is a recipient of the Israel Prize and is a member of the Israel Academy

of Sciences and Humanities and of the U.S. National Academy of Sciences.

Stephen J. Smale

Stephen J. Smale contributed greatly, in the late 1950s and early 1960s, to the development of differential topology, a field then in its infancy. His results on immersions of spheres in Euclidean spaces still intrigue mathematicians, as witnessed by recent films and pictures on his so-called "eversion" of the sphere. His proof of the Poincaré Conjecture for dimensions bigger or equal to 5 is one of the great mathematical achievements of the twentieth century. His *h*-cobordism theorem has become probably the most basic tool in differential geometry.

During the 1960s Smale reshaped the view of the world of dynamical systems. His theory of hyperbolic systems remains one of the main developments on the subject after Poincaré, and the mathematical foundations of the so-called "chaos-theory" are his work as well. In the early 1960s Smale's work dramatically changed the study of the topology and analysis of infinite-dimensional manifolds. This change was achieved through his infinite-dimensional version of Morse's critical point theory (known today as "Palais-Smale Theory") and his infinite-dimensional version of Sard's theorem.

In the 1970s Smale's attention turned to mechanics and economics, to which he applied his ideas on topology and dynamics. For instance, his notion of "amended potential" in mechanics plays a key role in current developments in stability and bifurcation of relative equilibria. In economics Smale applied an abstract theory of optimization for several functions, which he developed, to provide conditions for the existence of Pareto optima and to characterize this set of optima as a submanifold of diffeomorphic states to the set of Pareto equilibria. He also proved the existence of general equilibria under very weak assumptions and contributed to the development of algorithms for the computation of such equilibria.

It is this last activity that led Smale in the early 1980s to the longest segment of his career, his work on the theory of computation and computational mathematics. Against mainstream research on scientific computation, which focused on immediate solutions to concrete problems, Smale developed a theory of continuous computation and complexity (akin to that developed by computer scientists for discrete computations) and designed and analyzed algorithms for a number of specific problems. Some of these analyses constitute models for the use of deep mathematics in the study of numerical algorithms.

Born in 1930 in the United States, Smale received his Ph.D. from the University of Michigan in 1957 under the direction of Raoul Bott. Smale joined the faculty at the University of California, Berkeley, in 1960 and retired in 1994. He was a Distinguished Professor at the City University of Hong Kong from 1995 to 2001, when he joined the Toyota Technological Institute. Smale received the Fields Medal in 1966 and the National Medal of Science in 1996. His other honors include the AMS Veblen Prize (1965) and election to the National Academy of Sciences.

—Based on Wolf Foundation news releases