ABEL
PRISEN

The Norwegian Academy of Science and Letters has decided to award the Abel Prize for 2011 to

John Willard Milnor

Institute for Mathematical Sciences, Stony Brook University, New York

«for pioneering discoveries in topology, geometry and algebra».

All of Milnor's works display marks of great research: profound insights, vivid imagination, elements of surprise, and supreme beauty.

Milnor's discovery of exotic smooth spheres in seven dimensions was completely unexpected. It signaled the arrival of *differential topology* and an explosion of work by a generation of brilliant mathematicians; this explosion has lasted for decades and changed the landscape of mathematics. With Michel Kervaire, Milnor went on to give a complete inventory of all the distinct differentiable structures on spheres of all dimensions; in particular they showed that the 7-dimensional sphere carries exactly 28 distinct differentiable structures. They were among the first to identify the special nature of four-dimensional manifolds, foreshadowing fundamental developments in topology.

Milnor's disproof of the long-standing *Hauptvermutung* overturned expectations about combinatorial topology dating back to Poincaré. Milnor also discovered homeomorphic smooth manifolds with nonisomorphic tangent bundles, for which he developed the theory of microbundles. In three-manifold theory, he proved an elegant unique factorization theorem.

Outside topology, Milnor made significant contributions to differential geometry, algebra, and dynamical systems. In each area Milnor touched upon, his insights and approaches have had a profound impact on subsequent developments.

His monograph on isolated hypersurface singularities is considered the single most influential work in singularity theory; it gave us the Milnor number and the Milnor fibration.

Topologists started to actively use Hopf algebras and coalgebras after the definitive work by Milnor and J. C. Moore. Milnor himself came up with new insights into the structure of the Steenrod algebra (of cohomology operations) using the theory of Hopf algebras. In algebraic K-theory, Milnor introduced the degree two functor; his celebrated conjecture about the functor — eventually proved by Voevodsky — spurred new directions in the study of motives in algebraic geometry. Milnor's introduction of the growth invariant of a group linked combinatorial group theory to geometry, prefiguring Gromov's theory of hyperbolic groups.

More recently, John Milnor turned his attention to dynamical systems in low dimensions. With Thurston, he pioneered "kneading theory" for interval maps, laying down the combinatorial foundations of interval dynamics, creating a focus of intense research for three decades. The Milnor–Thurston conjecture on entropy monotonicity prompted efforts to fully understand dynamics in the real quadratic family, bridging real and complex dynamics in a deep way and triggering exciting advances.

Milnor is a wonderfully gifted expositor of sophisticated mathematics. He has often tackled difficult, cutting-edge subjects, where no account in book form existed. Adding novel insights, he produced a stream of timely yet lasting works of masterly lucidity. Like an inspired musical composer who is also a charismatic performer, John Milnor is both a discoverer and an expositor.