Levi L. Conant
LECTURE SERIES

John W. Morgan

Director, Simons Center for Geometry and Physics
Stony Brook University

John Morgan was named director of the Simons Center for Geometry and Physics at Stony Brook University in September 2009. He served as professor at Columbia University (1974–2009), assistant professor at MIT (1972–1974), and instructor at Princeton University (1969–1972). He received his PhD from Rice University in 1969.

He has held visiting positions at the Institut des Hautes Études Scientifiques in Paris, Université de Paris-Sud, MSRI in Berkeley, Harvard University, the Institute for Advanced Study in Princeton, and Stanford University. His area of expertise is topology, especially its connections with geometry, algebraic geometry and mathematical physics.

Morgan is the author of more than 50 journal articles and several books; his latest is *Ricci Flow and the Poincaré Conjecture*. He is a member of the National Academy of Sciences.

Solution of the Poincaré Conjecture

Friday, 11:00 a.m.
March 26, 2010
Higgins House, Great Hall

In 1904 Poincaré published a long exposé on 3-dimensional manifolds. At the end of the exposé he asked if every closed (i.e., compact without boundary) 3-dimensional manifold that is simply connected, meaning that every loop in the space can be continuously contracted within the space to a point, was topologically equivalent to the 3-sphere. The conjecture that this was indeed the case became known as the Poincaré Conjecture. It formed the central motivating problem in the next one hundred years of development in topology. It was generalized to higher dimensions, where it was solved (affirmatively) in 1960 by Smale. It was generalized to a question about all 3-manifolds, not just simply connected ones, and many of these questions were resolved in the 1960s by Waldhausen. In 1982 Thurston proposed a much stronger conjecture called the Geometrization Conjecture, which describes all 3-dimensional manifolds in terms of especially nice geometric pieces and includes as a very special case the Poincaré Conjecture.

In this talk I will begin by sketching some of the history of this problem and describing some of the methods of attempted solution. Then I will explain Thurston's Conjecture and show how it suggests a more differential geometric and analytic approach to the study of the topology of 3-dimensional manifolds. At the end I will introduce Hamilton's Ricci flow equation and indicate how this parabolic, heat-type equation can be used to establish the Geometrization Conjecture and hence the Poincaré Conjecture.

Levi Leonard Conant, 1857–1916

Levi Conant was a mathematician and educator who spent most of his career as a faculty member at Worcester Polytechnic Institute; he served as head of the Mathematics Department and as acting president from 1911 to 1913. Conant was noted as an outstanding teacher, and an active scholar. He published a number of articles in scientific journals and wrote four textbooks: *The Number Concept: Its Origins and Development* (1896), *Original Exercises in Plane and Solid Geometry* (1905), *Five-Place Logarithmic and Trigonometric Tables* (1909), and *Plane and Spherical Trigonometry* (1909). Upon his premature death in 1916 he made a large bequest to The American Mathematical Society, which established the Levi L. Conant Prize, awarded annually to recognize the best expository paper published in either *Notices of the AMS* or *Bulletin of the AMS* in the previous five years.

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Students and faculty are invited to meet the speaker at a reception following the lecture

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