UC San Diego Computer Theorist And Mathematician Ronald Graham Elected To AAAS Council

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Leading American mathematicians have elected Ronald Graham of the University of California, San Diego (UCSD) to represent them on the Council of the American Association for the Advancement of Science (AAAS). Graham will serve a three-year term beginning in February 2004. "Mathematics is the language of science, and as all disciplines become more advanced, scientists rely increasingly on math to frame new discoveries," said Graham. "Part of my job will be to see that the Association and its members are fully aware of the exciting developments occurring in the mathematics world."

Graham holds the Irwin and Joan Jacobs Endowed Chair in Computer and Information Science in UCSD's Jacobs School of Engineering, and is Chief Scientist of the California Institute for Telecommunications and Information Technology [Cal-(IT)2]. He joined the UCSD faculty in 1999, after a 37-year career with AT&T, ultimately as chief scientist at AT&T Labs. Graham received his Ph.D. in mathematics from U.C. Berkeley in 1962. Currently he is the Treasurer of the National Academy of Sciences, and President of the Mathematical Association of America. He has won numerous awards in the field of mathematics, including the Polya Prize in Combinatorics and the Steele Prize for Lifetime Achievement from the American Mathematical Society in 2003.

Mathematics is one of eight AAAS sections electing Council Delegates to take office in 2004. The other sections electing new delegates to the AAAS Council included Anthropology, Astronomy, Biological Sciences, Chemistry, Geology and Geography, Neuroscience, and Physics. Graham was the only UCSD nominee on the 2003 ballot.

Graham has previously been the Secretary and Chair of the Mathematics Section of the AAAS, and also served on its Program Committee for four years. "Even in the social sciences, math is a powerful way of expressing concepts and finding solutions, especially in disciplines where patterns are involved, because math is basically the science of patterns," said Graham. "As a result, if we can find a new mathematical tool to solve one problem, it can often be used to tackle seemingly very different problems which however share the same mathematical structure. And as these new mathematical tools are created, scientists can use them to revisit existing problems in areas that until now seemed unanswerable."

In looking at breakthroughs in mathematics on the horizon that should be of interest to all AAAS members, Graham notes that a Russian mathematician appears to have solved the first of the seven fundamental questions known as the Millenium Prize Problems. The Clay Mathematics Institute issued the challenge in 2000, focusing on classic problems that have resisted solution over the years, and offering a $1 million prize for each one that is solved. In this case, the Poincare Conjecture - named after the Frenchman who proposed it in 1904 - posits that the three-dimensional sphere is the only bounded three-dimensional space with no holes. The problem is central to the field of topology, which looks at the properties of surfaces that don't change no matter how much you stretch or bend them. Russia's Grigori Perelman recently posted a proof that is based on a method called Ricci flow, which breaks a surface into parts and smoothes these parts out. This particular approach was initially pioneered by former UCSD mathematician Richard Hamilton, now at Columbia University. Perelman's proof joins topology and geometry, by stating that all space-like structures can be divided into parts, each of which can be described by one of three kinds of simple geometric models. His work sent shock waves through the math

community at conferences in December. "Perelman's proof could change our perspective in many branches of mathematics and physics," said Graham.

Graham and his wife, fellow UCSD mathematician Fan Chung Graham, were recently involved in corroborating new insights into an ancient problem posed by Greek mathematician Archimedes over 2,200 years ago. The so-called *Stomachion* involved 14 irregular polygonal shapes. As a simple puzzle, the pieces could be configured into many different shapes. Historians have wondered why Archimedes was taken with the problem. A long-lost copy (circa 975 A.D.) of Archimedes' document dealing with the puzzle surfaced in 1998, and sold at auction for $2 million. Since then, scientists have been able to rescue much of the original writing, and Stanford historian Reviel Netz has championed a new understanding of the Stomachion treatise: that Archimedes was interested *not* in how many shapes could be created, but rather in how many ways the pieces could be combined to form a square. In calculations that took weeks, the Grahams confirmed that there are exactly 17,152 different ways of making a square from the assembled pieces. For Graham, this new insight has special meaning. "My specialty is combinatorial mathematics, which often involves enumerating the number of different ways to solve a problem," he observed. "For most of us, combinatorics didn't come into its own until the advent of computer science, and there was certainly no evidence of scientists looking at math problems in this way in ancient texts. Now it seems clear that Archimedes, already the father of integral calculus among many other things, is also the father of combinatorics." The research was featured in December in the New York Times.

Note to Editors: A high-res photo of Prof. Ronald Graham can be downloaded from the "Faculty & Students" section of the Image Gallery at http://www.jacobsschool.ucsd.edu/news_events/gallery/.

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