



Information and Announcements

The Breakthrough Prize

The Inaugural Prize in Mathematics

The Breakthrough Prize in Mathematics was launched by Mark Zuckerberg and Yuri Milner in December 2013. The prize is in recognition of major advances in mathematics. The Prize Foundation announced five winners of the inaugural Breakthrough Prize. Each of the five Laureates will be presented with a trophy and three million dollars at a ceremony in November 2014. The award aims to support their future endeavours and to help communicate the excitement of mathematics to the public at large.

Mark Zuckerberg said: “Mathematics is essential for driving human progress and innovation in this century. This year’s Breakthrough Prize winners have made huge contributions to the field and we’re excited to celebrate their efforts.”

Yuri Milner commented: “Mathematics is the most fundamental of the sciences – the language they are all written in. The best mathematical minds benefit us all by expanding the sphere of human knowledge.”

From 2015 onwards, one Breakthrough Prize in Mathematics will be awarded each year. All five recipients of the inaugural prize have agreed to serve on the selection committee to choose subsequent winners of the prize from the pool of contenders nominated by the mathematics community.

The five inaugural “Breakthrough Prize in Mathematics” winners are Simon Donaldson, Maxim Kontsevich, Jacob Lurie, Terence Tao, and Richard Taylor.

Simon Donaldson is from the Stony Brook University, USA and Imperial College, London, UK. He has been awarded the Prize for the new revolutionary invariants of 4-dimensional manifolds and for the study of the relation between stability in algebraic geometry and in global differential geometry, both for bundles and for Fano varieties.

Maxim Kontsevich is from the Institut des Hautes Etudes Scientifiques, Paris, France and the University of Miami, USA. He has been awarded the Prize for work making a deep impact in a vast variety of mathematical disciplines, including algebraic geometry, deformation theory, symplectic topology, homological algebra and dynamical systems.



Jacob Lurie is from Harvard University, USA. He has been awarded the Prize for his work on the foundations of higher category theory and derived algebraic geometry; for the classification of fully extended topological quantum field theories; and for providing a moduli-theoretic interpretation of elliptic cohomology.

Terence Tao is from the University of California, Los Angeles, USA. He has been awarded the Prize for numerous breakthrough contributions to harmonic analysis, combinatorics, partial differential equations and analytic number theory.

Richard Taylor is from the Institute for Advanced Study, Princeton, USA. He has been awarded the Prize for numerous breakthrough results in the theory of automorphic forms, including the Taniyama–Weil conjecture, the local Langlands conjecture for general linear groups, and the Sato–Tate conjecture.

Since the announcement of these prizes, the awardees have been thinking of how to use some of the funds to help the field of mathematics.

“The five of us felt we would have more impact if we acted in unison,” said Richard Taylor, who joined Simon Donaldson, Maxim Kontsevich, Jacob Lurie and Terence Tao as the first winners of the Breakthrough Prize in Mathematics. “There were many very exciting mathematical projects that we considered supporting, and we had quite extended discussions.”

Ultimately they were swayed by Ingrid Daubechies, the President of the International Mathematical Union (IMU), who had written to them emphasizing the importance of supporting graduate students studying in the developing world.

“In the end, this was an area we were all enthusiastic about,” said Taylor, a professor at the Institute for Advance Study. Each of them decided to give one hundred thousand dollars to fund the “Breakout Graduate Fellowships” at the IMU, which were announced by the IMU on August 12 in Seoul, Korea, during ICM 2014.

Taylor said he hoped this initiative results in extended benefits to the home countries of those chosen for the fellowships.

“Traditionally, support for mathematics in the developing world has consisted mainly of scholarships for highly talented students to study in Europe or North America,” Taylor said. “Such students rarely return to their home countries, so the impact of the scholarship ends with one student. The hope of the IMU and our fellowship is that if these students study in centers of excellence in the developing world, then they are more likely to return to their home countries and help educate the next generation of mathematicians. We felt that here, relatively little money had the potential to have a big impact.”

B Sury
Editor, *Resonance*



Fundamental Physics Prize, 2014

The award of the Fundamental Physics Prize for 2014 to John Schwarz (California Institute of Technology) and Michael Green (University of Cambridge) recognises their 1984 work. Till then, the quantum theory of strings – meaning one-dimensional objects as opposed to point particles – had been thought of as an interesting but not very successful theory of strongly interacting entities such as protons and neutrons.

The world of theoretical high energy physics underwent a ‘revolution’ when Green and Schwarz were able to show that a generalised version of this theory called ten-dimensional superstring theory with very specific symmetries, had some remarkable properties. It was free of problems which had plagued earlier versions, and was instantly regarded as a strong candidate for unification of fundamental forces including gravity, pursued by hundreds of theorists ever since. Many earlier winners of the Fundamental Physics Prize such as Edward Witten (who co-authored an early book on *Superstring Theory* with Green and Schwarz), Joseph Polchinski, and Asoke Sen stood on the shoulders of this early pioneering work, which has now found fitting recognition.

Rajaram Nityananda
Editor, *Resonance*

Prize in Life Sciences, 2014

The Breakthrough Prize in Life Sciences honors transformative advances toward understanding living systems and extending human life. The Prize was founded in 2013 by Sergey Brin and Anne Wojcicki, Mark Zuckerberg and Priscilla Chan, Yuri and Julia Milner, and Jack Ma and Cathy Zhang.

The Inaugural Breakthrough Prize in Life Sciences has 6 winners.

The Breakthrough Prize in Life Sciences recognizes excellence in research aimed at curing intractable diseases and extending human life. The 2014 recipients are:

James Allison, MD Anderson Cancer Center, for the discovery of T-cell checkpoint blockade as effective cancer therapy.

Mahlon DeLong, Emory University, for defining the interlocking circuits in the brain that malfunction in Parkinson’s disease. This scientific foundation underlies the circuit-based treatment of Parkinson’s disease by deep brain stimulation.



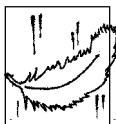
Michael Hall, University of Basel, for the discovery of Target of Rapamycin (TOR) and its role in cell growth control.

Robert Langer, David H. Koch Institute Professor at the Massachusetts Institute of Technology, for discoveries leading to the development of controlled drug-release systems and new biomaterials.

Richard Lifton, Yale University; Howard Hughes Medical Institute, for the discovery of genes and biochemical mechanisms that cause hypertension.

Alexander Varshavsky, California Institute of Technology, for discovering critical molecular determinants and biological functions of intracellular protein degradation.

Dipshikha Chakravorty
Editor, *Resonance*



The Breakthrough Prize trophy was created by Olafur Eliasson.

“The whole idea for me started out with, ‘Where do these great ideas come from? What type of intuition started the trajectory that eventually becomes what we celebrate today?’”

Like much of Eliasson’s work, the sculpture explores the common ground between art and science. It is molded into the shape of a toroid, recalling natural forms found from black holes and galaxies to seashells and coils of DNA.

