

BREAKTHROUGH PRIZE LAUREATE BIOS

Ed Boyden - Life Sciences; MIT Media Lab

Boyden is a professor of biological engineering and brain sciences at MIT. Among other inventions, he is one of the pioneers of optogenetics, the groundbreaking technique for controlling neurons with light, and expansion microscopy, a technique for inflating cellular structures up to 1000 times larger so that they can be studied with ordinary microscopes.

Joanne Chory - Life sciences; Salk Institute for Biological Studies

Chory has done seminal work on the molecular pathways governing plants' response to sunlight, including discovering which genes cause seedlings to grow upwards in soil and sprout leaves upon reaching the surface. In recent years her lab has been working on developing new plants that can store carbon much more permanently in the soil, so mitigating the effects of climate change.

Shep Doeleman and the Event Horizon Telescope Team – Physics

The Event Horizon Telescope Team (“EHT”) is an international collaboration that in 2019 produced the first photograph of the environment of a black hole - specifically the event horizon, the “point of no return” beyond which even light cannot escape. The image - captured using telescopes in Arizona, Sierra Nevada, Chile, Mexico, Hawai'i, and the South Pole - triumphantly confirmed the theoretical predictions made on the basis of Einstein's general relativity. And EHT's observations promise more key tests of fundamental physics in years to come, including strong gravity effects that are expected near a black hole, and dynamics near the black hole as matter orbits at near-light speeds.

Jennifer Doudna - Life sciences; University of California, Berkeley

Doudna is one of the discoverers of CRISPR-Cas 9, a bacterial immune system that she and her colleagues engineered into a near-universal gene-editing tool that allows scientists to hone in on particular genes, cut them out of their strand of DNA, and replace them with another sequence. This technology has enormous potential for medicine, industry and other fields.

Fabiola Gianotti - Fundamental Physics; CERN

Gianotti is an experimental particle physicist who is Director General of CERN, where she has worked as a physicist for over 25 years. Her work has included detector R&D, construction, software development and data analysis from particle physics experiments. From 2009 to 2013, she was project leader for the ATLAS experiment, one of the two experiments that discovered the Higgs boson in 2012.

Svante Pääbo –**Life sciences; Max Planck Institute for Evolutionary Anthropology**

Svante Pääbo founded the field of paleogenetics - the study of ancient DNA found in fossils. He was the first scientist to successfully sequence the genome of Neanderthals, a closely-related species to modern humans that became extinct about 40,000 years ago. In the process, he discovered that some genes of Neanderthal origin are preserved in the genomes of people today. This implies that the two species must have interbred.

Terence Tao - Mathematics; University of California, Los Angeles

Tao is considered one of the greatest living mathematicians. His work spans an extraordinary range of fields, including harmonic analysis, combinatorics, partial differential equations, and analytic number theory. Some of his most famous results have concerned prime numbers. For instance, he proved that every odd number (except 1) is the sum of at most 5 prime numbers.

Kip Thorne, Caltech

Thorne is one of the world's leading theorists in general relativity and gravitational astrophysics. He is a co-founder of the LIGO project which in 2015 detected gravitational waves from colliding black holes, and for which he made many contributions in experimental design, engineering and data analysis techniques. He is also known for his work popularizing science, including as scientific consultant on the movie *Interstellar*.

Cumrun Vafa - Fundamental Physics; Harvard University

Professor Vafa is world-renowned for his groundbreaking work in string theory and the mathematical technology needed to explore this field. He is one of the founders of the duality revolution in string theory which has reshaped our understanding of the fundamental laws of the universe. He has uncovered mysteries of black holes using topological aspects of string theory and is the founder of 'F-theory' which is one of the most promising directions in connecting string theory solutions known as the 'string landscape' to particle physics.

Huda Zoghbi - Life sciences; Baylor College of Medicine

Zoghbi is a neurogeneticist at Baylor College of Medicine, as well as Director of the Jan and Dan Duncan Neurological Research Institute in Texas. She has found genetic mutations responsible for two rare neurodegenerative diseases, which also promises to impact our understanding of more common diseases like Parkinson's and autism.