

2022 King Faisal International Prize for Science and Medicine

The King Faisal Foundation in Riyadh, Saudi Arabia has awarded the 2022 King Faisal International Prize for Medicine (topic: Gene Editing Technologies) to David Ruchien Liu. The Science prize in the field of mathematics is awarded to Nader Masmoudi and Martin Hairer. The prize comprises of 24-carat gold medal, weighing 200 grams; and a cash award of 750 thousand Saudi Riyal (USD 200,000).

Genome editing (also called gene editing) comprises a group of technologies that enable the modification of an organism's DNA. The techniques have advanced to a stage that the genetic material can be added, removed or altered at specific locations in the genome. This has enhanced understanding of the gene function and has a potential to treat diseases, which may be genetic or otherwise. Gene editing also provides the scope of growing human organs in animals¹.

Liu was born in 1973 in Riverside, California, USA. He is the Richard Merkin Professor, Director of the Merkin Institute of Transformative Technologies in Healthcare, and Vice-Chair of the Faculty at the Broad Institute of Harvard University and Massachusetts Institute of Technology, Massachusetts, USA. The deoxyribonucleic acid (DNA) is the hereditary material and consists of four bases namely adenine (A), thymine (T), cytosine (C) and guanine (G). They specifically pair as C–G and T–A, which are known as base pairs. The base pairs serve as the building blocks of the double helix structure. The sequence of these bases governs the functioning of the organism. In 2016, Liu and collaborators developed the DNA 'base editor' which made it possible to change the C–G base pairs to T–A base pairs within the DNA without introducing double-stranded breaks^{2,3}. This technique of base editing is advantageous over the other techniques. Liu is awarded the prize in recognition of his 'revolutionary work and development of next generation gene editing technology with powerful translational potential for the treatment of congenital and common disorders.'

Masmoudi was born in 1974 in Sfax, Tunisia. He received diploma in Mathematics from the École Normale Supérieure Paris (1996) and Ph.D. from Paris Dauphine University (1999) under the supervi-

sion of Pierre-Louis Lions (recipient of the Fields Medal in 1994) for the thesis on asymptotic problems in fluid mechanics. Masmoudi's main research areas are non-linear partial differential equations of hydrodynamics. The question of hydrodynamic stability dates back to the late 19th century and some results in the linear approximation have been known since then. Masmoudi and collaborators addressed these problems in the nonlinear regime⁴. Masmoudi is awarded the prize in recognition of his 'outstanding contributions to the mathematical theory of fluid dynamics, in particular for the proof of nonlinear inviscid damping and nonlinear Landau damping for the Euler system.' He is a professor in the Courant Institute of Mathematical Sciences at New York University, New York, USA. Masmoudi also holds the post of a distinguished Professor of Mathematics, at the Center for Stability, Instability, and Turbulence in the New York University's Abu Dhabi campus in UAE.

Born in Geneva, Switzerland in 1975, Hairer received Ph.D. in Physics in 2001 from the University of Geneva. He is a Professor of Pure Mathematics at Imperial College London, UK. He made outstanding contributions to the theory of stochastic partial differential equations (SPDE). He single-handedly created the 'theory of regularity' which provides a flexible framework for tackling a large class of stochastic partial differential equations^{5,6}. Thus, he opened up an entire field covering SPDE from turbulence to quantum field theory. He was awarded the Fields Medal in 2014. Hairer is awarded the prize in recognition of his 'pivotal contributions in transforming the area of stochastic differential equations by introducing fundamental new techniques'. Since his school days, Hairer has a keen interest in software development. He has a software company by name Hairer Soft (<https://www.hairersoft.com/>) specializing in sound editing systems, which are widely used by music professionals.

Among the 13 KFIP mathematics laureates, there are six Fields medalists and two Abel prize laureates. Out of 123 KFIP Science/Medicine, 21 are Nobel laureates^{7,8}. Mudumbai Seshachalu Narasimhan is the only Indian to have received the KFIP science prize (for mathematics in

2006) and the only Asian to have won it for mathematics⁹. Sajeew O. John of Indian origin, now based in Canada received the Science prize in the category of physics in 2001. Vamsi Krishna Mootha of Indian origin, now based in the USA received the Science prize in the category of biology in 2016. The other notable science prizes established in the Middle East are the Mustafa Prize for Science from Iran¹⁰ and the UNESCO Sultan Qaboos Prize for Environmental Preservation from Oman¹¹. For the year 2023, the topic for the Medicine prize is 'Pandemics and Vaccine Development' and the Science prize is in the field of chemistry (see <http://kingfaisalprize.org/>).

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