

2019 King Faisal International Prize for Science and Medicine

The King Faisal Foundation in Riyadh, Saudi Arabia has awarded the 2019 King Faisal International Prize (KFIP) for Medicine (topic: Bone biology and osteoporosis) to Steven L. Teitelbaum and Bjørn Reino Olsen. The Science Prize in the field of chemistry has been awarded to Allen Joseph Bard and Jean M. J. Fréchet. The Prize comprises a 24-carat gold medal weighing 200 g and a cash award of 750 thousand Saudi Riyal (USD 200,000).

Teitelbaum was born in 1938 in New York, USA. He is the Wilma and Roswell Messing Professor of Pathology and Immunology at the Washington University at St Louis, USA. His research focuses on bone cell biology for the purpose of developing new treatments for the prevention and cure of diseases such as osteoporosis. This is a disease characterized by low bone mass and deterioration of bone tissue, which can lead to increased risk of fracture, particularly among the elderly¹. Skeletal mass is the product of activities of two types of cells that work together to continuously remodel the bones, repair damage, balance calcium levels in the body and maintain the integrity of the skeleton. The first type is the 'osteoblast', which synthesizes bone in response to growth factors and mechanical stress on the bone. The second type is the 'osteoclast', which removes the aged or damaged, mineralized and calcified constituents of the bone matrix and this process is known as 'bone resorption'. Teitelbaum's studies include confirming the hematopoietic lineage of the osteoclast and the mechanisms by which the cell resorbs bone². His work has contributed to the effective therapy for joint destructive conditions such as rheumatoid arthritis³.

Olsen was born in 1940 in Skien, Norway. He moved to USA in 1971. Since 1996, he is at the Forsyth Institute and Professor of Developmental Biology at Harvard School of Dental Medicine, Boston, Massachusetts, USA. He is recognized for his outstanding contributions to the field of bone biology. He has made a series of key genetic discoveries which have enhanced the understanding of bone development, and the basis of inherited skeletal disorders, including osteoporosis syndromes⁴. His studies have uncovered fundamental roles of collagens, tran-

scription factors, and receptors that affect not only skeletal development, but also angiogenesis and blood vessel morphogenesis.

Bard was born in 1933 in New York, USA. He is the Hackerman-Welch Regents Chair Professor and Director of the Center for Electrochemistry at the University of Texas at Austin, USA. Bard is recognized for his ground-breaking development of electro-generated chemiluminescence methods. Chemiluminescence is the emission of light as a result of chemical reactions. Exploiting this emitted light, he developed the scanning electrochemical microscope, which allows for high-resolution chemical imaging of surfaces and the study of chemical reactions at the nanoscopic regime. This has numerous biological and medical applications such as diagnosis of AIDS and analysis of DNA⁵. Bard and his team were the first to study the electrochemistry of particle semiconductors for solar energy conversion and environmental remediation.

Fréchet was born in 1944 in Burgundy, France. He completed his Ph D in chemistry from Syracuse University, USA in 1971. He is a Professor Emeritus at the University of California, Berkeley, USA. Fréchet has been awarded the Prize for his pioneering work and seminal contributions in the areas of convergent synthesis of branched molecules (dendrimers) and their applications, chemically amplified photoresists and organic photovoltaics. Dendrimers have a number of therapeutic applications, including targeted drug delivery⁶. Fréchet developed chemical amplification in high-resolution imaging systems, that enabled the production of modern photoresists and integrated circuits, which are the key components in the development of the modern computer and other electronics⁷.

There are 59 KFIP Science Laureates from 13 countries⁸. 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. Sajeev 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 USA, received the Science Prize in the category of biology in 2016. There

are 4 women among the 117 KFIP Science/Medicine Laureates (3.41%). This is marginally higher than that for the Nobel Prize: just 20 women (3.29%) are among the 607 Nobel Prize-winners in the fields of medicine/chemistry/physics¹⁰. Out of 117 KFIP Science/Medicine Laureates, 21 are also Nobel Laureates. The other notable science prizes established in the Middle East are the Mustafa Prize for Science from Iran¹¹ and the UNESCO Sultan Qaboos Prize for Environmental Preservation from Oman¹². For the year 2020, the topic for the Medicine Prize is 'Haemoglobinopathies'¹³ and the Science Prize is in the field of biology (<http://kingfaisalprize.org/>).

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