

News Review



The Nobel Prize Winners in the Natural Sciences for the Year 2019

PHYSICS



James Peebles



Didier Queloz



Michel Mayor

THE NOBEL PRIZE FOR PHYSICS for 2019 was shared by three renowned physicists. According to the Nobel Committee, this year's Prize was awarded "*for contributions to our understanding of the evolution of the universe and earth's place in the cosmos*".

Professor James Peebles, an Emeritus Professor of Physics at the Princeton University won half the Prize for his volume of research that he has carried out since the 1960s. From that time onwards he and a team of physicists at Princeton attempted to detect the remnant radiation of the dense, hot ball of gas at the beginning of the universe: the *Big Bang*.

Professor Peebles has also made decades of pivotal contributions to the study of the matter which pervades the cosmos but are, invisible to telescopes, known as the dark matters. His work on the formation of galaxies is also remarkable. His work on how the *Big Bang* gave rise to the first elements hydrogen, helium and lithium on the periodic table is a foundational discovery.

The other of the Prize went to Professor Michael Mayor, an Emeritus Professor of Physics at the University of Geneva (Switzerland) and Professor Didier Queloz, a Swiss astrophysicist from the University of Geneva and presently working at the University of Cambridge, U. K. Both made breakthroughs with the discovery of the first planet orbiting other stars, also known as exoplanets, beyond our solar system.

Mayor and Queloz carried out survey on nearby stars using a custom-built-instrument. Using this instrument, they were able to detect the wobble of a star ---- which indicates that it is being tugged by the gravity of an orbiting exoplanet.

Briefly it may be said that Professor Peebles was awarded the coveted Nobel Prize for his theoretical discoveries in Physical Cosmology, whereas, Professor Mayor and Professor Queloz won the prestigious Prize for their discovery of an exoplanet orbiting a solar-type star.

CHEMISTRY



John B. Goodenough



M. Stanley Whittingham



Akira Yoshino

Three eminent scientists shared the 2019 NOBEL PRIZE FOR CHEMISTRY. They were awarded the prestigious Prize for their role in developing and refining rechargeable lithium-ion batteries which have made the global information technology, mobile and fossil-fuel free revolutions a possibility. According to the Royal Swedish Academy of Sciences, "*Lithium-ion batteries have revolutionized our lives since they first entered the market in 1991. They have laid the foundation of a wireless fossil-fuel free society, and are of the greatest benefit to humankind.*"

Professor John B. Goodenough, aged 97, a German-born American Professor of Mechanical Engineering and Material Science at the University of Texas, Austin, is the oldest Nobel laureate till date. He was awarded half the Nobel Prize.

Professor Whittingham developed the first functional lithium battery in the early 1970s. Professor Goodenough an intellectual giant of solid state Chemistry and Physics doubled the battery's potential in the following decade. He is widely credited with the identification and development of the lithium-ion-battery, highly acclaimed for developing the Goodenough-Kanamori rules in determining the sign of the magnetic supercharge in materials and for seminal developments in computer random access memory. During the late 1970s and early 1980s Professor Goodenough was the head of the Inorganic Chemistry laboratory at the University of Oxford, U.K. Among his research contributions at Oxford, he is credited with significant research essential for developing commercial lithium-ion-rechargeable batteries. That is how he was successful in expanding upon the previous work

of Professor Stanley Whittingham. He was awarded half the Nobel Prize.

Professor Stanley Whittingham from Britain and Professor Akira Yoshino from Japan shared the other half of the Prize. Professor Whittingham, 77 years old, is a British-American Professor of Chemistry at the State University of New York at Binghamton. As already mentioned above, he was a pioneer researcher in the field of lithium battery. He discovered the intercalation of electrodes in 1970s for the first time and elaborately described the concept of intercalation reaction for rechargeable batteries in the later 1970s. He holds the original patent on the concept of the use of intercalation Chemistry in high-power density, highly-reversible lithium batteries. He is called the '*Founding Father of rechargeable lithium batteries*'.

Professor Yoshino eliminated pure lithium from the battery, making it much safer to use. He has commercialised Goodenough's work through Sony.

The award is a capstone of a truly transformative technology that has permeated billions of lives, including anyone who uses mobiles, computers, pacemakers, electric cars and beyond. The remarkable discoveries and breakthroughs the three were able to make has also made storing energy from renewable sources more feasible, opening up a new front in the war against global warming.

Professor Gregory Offer, an expert in Mechanical Engineering at Imperial College, London, said the scientists' work had led to '*one of the key enabling technologies of the 21st Century*'. He further said: '*They have already underpinned the mobile revolution, and are now essential to help us solve the problem of climate change*'

by electrifying transport and storing renewable electricity generation’.

Professor Somfai, a Professor of Organic Chemistry and a member of the Nobel Committee for Chemistry, said it was clear why the three

should have won it. According to him *‘This is a technology we use every day. Most people have a mobile phone, electric vehicles are getting more popular. So.....it’s pretty straight forward why it’s an important discovery.’*

NOBEL PRIZE FOR PHYSIOLOGY AND MEDICINE



Gregg L. Semenza



Sir Peter J. Ratcliffe



William G. Kaelin Jr.

Three outstanding scientists have shared this year’s Prize for their discoveries of how cells sense and adapt to oxygen availability.

Professor W. G. Kaelin is an American scientist and is a Professor of Medicine. He is known for his studies of tumour suppressor genes and proteins and for his role in identifying the molecular mechanisms that allow cells to sense and adapt to changes in oxygen levels.

Sir Peter J. Ratcliffe is a British physician-scientist, trained in Nephrology. He is a product of the Gonville and Caius College of Medicine in Cambridge. He was a practising clinician at the John Radcliffe Hospital, Oxford. He was also the Director for the Target Discovery Institute within the Nuffield Department of Medicine at the Oxford University from 2004 to 2016. Later in 2016 he took up the Directorship of Clinical Research at the Francis Crick Institute, London. He also retains a position at Oxford University as a member of the Ludwig Institute of Cancer Research. Sir Ratcliffe’s work on cellular reactions to hypoxia is highly acclaimed. He is a Fellow of the Royal Society of London (FRS).

Professor George L. Semenza is an American and did his graduation in medical sciences from the Harvard University. He earned his M. D. and Ph. D. from the University of Pennsylvania. He did his post-doctoral work on Medical-genetics from the Johns Hopkins University. He is a Professor of Paediatrics, radiation, Oncology and molecular radiation sciences, Bio-Chemistry, Medicine

and Oncology at the Johns Hopkins University. He is also the Director, Vascular Programme in the Institute for Cell engineering in the same University. He is also the C. Michael Armstrong Professor of paediatrics.

He is well-known for his path-breaking discovery of HIF-1 which allows cancer cells to adapt to oxygen-poor environments. His work on hypoxia-inducible factors is also highly acclaimed. He has also contributed on areas such as protection of the heart against ischemia-reperfusion injury, role of HIF-1 in cancer, Gene and Stem cell therapy for ischemic cardiovascular diseases, molecular mechanisms of oxygen homeostasis, genetic syndromes due to mutations in genes encoding transcription factors.

According to the Royal Swedish Academy members on this discipline “Their work established the genetic mechanisms that allow cells to respond to changes in oxygen levels. The findings have implications for treating a variety of diseases including cancer, anaemia, heart attacks and strokes. Dr. George Daley, Dean of Harvard Medical School commented: *‘Oxygen is the lifeboat of living organisms. Without oxygen cells can’t survive.’* But too much or too little is deadly. The three researchers tried to answer the question as to how the cells regulate their responses.

**Reported by
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