News Review

The Nobel Prize Winners in the Natural Sciences — 2020

Alfred Bernhard Nobel, a Swedish chemist, engineer, inventor, businessman, and philanthropist, who with 355 different patents, dynamite being the most famous one, bequeathed his fortune to the Nobel Prize institution. It was in 1888, the death of his brother Ludvig caused several newspapers to publish obituaries of Alfred in error, even mentioning "The merchant of death is dead" in one French newspaper. The event changed Alfred Nobel's mind and so according to his will of 1895, five separate prizes in the fields of Physics, Chemistry, Physiology or Medicine, Literature, and Peace are awarded to those who, during the preceding years have conferred the greatest benefit to humankind. The awarding of Nobel Prizes began from the year 1901. In 1968, the sixth prize was established in the field of Economic Sciences; however, it is not considered a "Nobel Prize" but a "Nobel Memorial Prize" sponsored by the Sveriges Riksbank in Memory of Alfred Nobel. Nobel prizes are widely regarded as the most prestigious awards available in the respective fields. The Nobel Assembly announces the prize at the Royal Swedish Academy of Sciences in Stockholm. The prize ceremony takes place annually. Each recipient receives a gold medal, a diploma, and a monetary award.

Between 1901 and 2020, the Nobel Prizes and the Nobel Memorial Prize were awarded 603 times to 962 people and organizations. Forty-two laureates have received more than one Nobel Prize. Considering all the fields, twelve laureates were awarded Nobel Prizes and Nobel Memorial Prize in 2020. In natural science, eight laureates were awarded Nobel Prizes in 2020; three from Physics, two from Chemistry and three from Physiology or Medicine.

The Nobel Prize in Physics

Roger Penrose Reinhard Genzel Andrea Ghez

The Nobel Prize in Physics was awarded to three Professors - Roger Penrose, an Englishman, Reinhard Genzel, a German, and Andrea Ghez, an American, for work that was literally out of

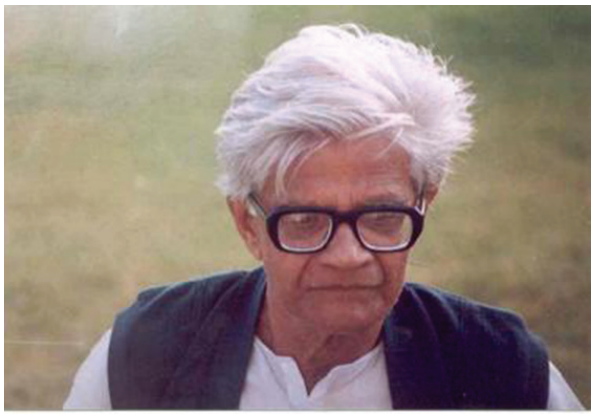
the world, i.e., universe related. Their discoveries are related to one of the most exotic phenomena in the universe, the black holes, the Milky Way's massive objects that swallow light and everything else that enters them, nothing can escape, not even light.

In general, black holes are formed when stars collapse. This collapse results in massive explosions and the formation of a celestial object that has massive gravity and whatever comes within its proximity cannot escape its pull, not even light.

The Royal Swedish Academy of Sciences has decided to award the 2020 Nobel Prize in Physics with one half to Britain's Roger Penrose, emeritus professor as mathematical physicist at the Mathematical Institute, University of Oxford, UK, and Honorary Fellow and alumnus of St John's College, Cambridge for the "discovery of black hole formation, a robust prediction of the general theory of relativity". The other half was awarded jointly to the two astronomers, German Reinhard Genzel of Max Planck Institute for Extra-terrestrial Physics, Garching, Germany and University of California, Berkeley, USA, and Andrea Ghez of University of California, Los Angeles, USA for their "discovery of a supermassive compact object at the centre of our galaxy". Reinhard Genzel and Andrea Ghez led independent teams for verifying the existence of a black hole at the centre of the Milky Way galaxy. Dr. Ghez is the fourth woman to win the Nobel Prize in Physics, following Marie Curie in 1903, Maria Goeppert Mayer in 1963 and Donna Strickland in 2018.

Roger Penrose was born on 8 August, 1931 in Colchester, United Kingdom. Reinhard Genzel was born on 24 March, 1952 in Bad Homburg vor der Höhe, Germany and Andrea Ghez was born on 16 June, 1965, New York, NY, USA.

Einstein was awarded Nobel Prize in 1921 for his discovery of the photoelectric effect, made in 1905, which established "dual properties of light – waves as well as particles". At that time he first spoke of black holes in his General Theory of Relativity but he himself was in grave doubts. After ten years of his death, Penrose's ground breaking paper with his mathematical brilliance was published in 1965, which explained that the general theory of relativity leads to the formation of black holes. His path of research was facilitated by a young Professor of Physics Amal Kumar Raychaudhuri, who was then at Ashutosh College and afterwards at Presidency College under the University of Calcutta. In the early 1950s, Professor Raychaudhuri began examining some of the questions in general theory of relativity. His work known famously as the 'Raychaudhuri Equation' developed the mathematical formulation that helped Penrose to prove that black holes really can form. It is not out of place to mention that Professor Amal Kumar Raychaudhuri was President of Institute of Science, Education and Culture (ISEC), Kolkata.



Amal Kumar Raychaudhuri

Penrose's work laid a firm mathematical basis for black holes. Such a theoretical derivation is not enough for physicists; physics needs experimental evidence to confirm a theory. Science has leaped over a number of barriers since the 1950s and this is what Genzel and Ghez achieved, finding that the Milky Way Galaxy, like most galaxies, hosts a massive black hole at its centre.

Prof. Genze, the Director of Max Planck Institute for Extra terrestrial Physics in Garching, Germany, along with Prof Andrea Ghez, Professor in the University of California, Los Angeles, each lead a group of astronomers since the early 1990s and developed remarkable ways of maneuvering telescopes which could detect a black hole at the centre of our galaxy, the Milky way. Ghez's team used the 10-metre diameter Keck Telescope in Hawaii, and Genzel's group used the 8-metre diameter telescopes at the European Southern Observatory in Chile.

The Nobel Prize in Chemistry

Jennifer A. Doudna

Emmanuelle Charpentier

Chemistry was the most important science for Alfred Nobel's own work and so Chemistry was the second prize area that Nobel mentioned in his will.

The Nobel Prize in Chemistry 2020 was awarded jointly to Emmanuelle Charpentier and Jennifer A. Doudna "for the development of a method for genome editing". This is the first time a Nobel science prize has gone to a women-only team.

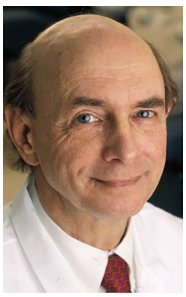
Genome editing is a way of making specific changes to the DNA of a cell or organism. CRISPR gene editing is a genetic engineering technique in molecular biology by which the genomes of living organisms may be modified. The nuclease Cas9, a protein, plays a vital role in the immunological defense. CRISPR-Cas9 works like a pair of scissors capable of cutting the genome precisely.

Using the gene technology's sharpest tools: the CRISPR/Cas9 genetic scissors, researchers can change the DNA of animals, plants and microorganisms with extremely high precision. This technology has had a revolutionary impact on the life sciences contributing to new cancer therapies and may make the dream of curing inherited diseases come true.

Emmanuelle Charpentier was born in 1968 in Juvisy-sur-Orge, France. She did Ph.D. in 1995 from Institut Pasteur, Paris, France. Now, she is the Director of the Max Planck Unit for the Science of Pathogens, Berlin, Germany.

Jennifer A. Doudna, born in 1964 in Washington, D.C, USA, did her Ph.D. in 1989 from Harvard Medical School, Boston, USA and now she is Professor at the University of California, Berkeley, USA and Investigator, Howard Hughes Medical Institute.

The Nobel Prize in Physiology or Medicine



Harvey J. Alter

Michael Houghton

Charles M. Rice

The Nobel Prize in Physiology or Medicine 2020 was awarded jointly to Harvey J. Alter, Michael Houghton and Charles M. Rice "for the discovery of Hepatitis C virus", each sharing 1/3 of the prize money.

Hepatitis refers to an inflammatory condition of the liver. The most common types of hepatitis classified as A, B, and C. Hepatitis A is usually a short-term infection while hepatitis B and C can cause long-term chronic, infections and in many cases leads to liver cancer. Hepatitis A can be spread by fecal-oral transmission or by consuming food or water that has been contaminated. In contrast, the hepatitis B's primary mode of transmission is through direct blood-to-blood contact with an infected person. These infections can be spread in the same ways as HIV (Human Immunodeficiency Virus). Today, most people become infected with the hepatitis C virus by sharing needles or other equipment with an infected person to inject drugs. Combined chronic hepatitis B and C account for approximately 80% of the world's liver cancer cases.

The methodical studies of transfusion-associated hepatitis by Harvey J. Alter demonstrated that hepatitis C virus was a common cause of chronic hepatitis. Michael Houghton used special strategy to isolate the genome of the C virus. This virus was discovered in 1982 by screening millions of DNA samples. Charles M. Rice provided the final evidence showing that Hepatitis C virus alone could cause hepatitis. The discovery by the three Nobel laureates allowed the design of sensitive blood tests that have eliminated the risk of transfusion-transmitted hepatitis in a large part of the world. Also the development of new medicines have saved millions of lives.

Harvey J. Alter was born in 1935 in New York. He received his medical degree at the Medical School of Rochester University, and was trained in internal medicine at Strong Memorial Hospital and Hospitals at the University of Seattle. In 1961, he joined the National Institutes of Health (NIH) as a clinical associate. He spent several years at Georgetown University before returning to NIH in 1969 to join the Clinical Center's Department of Transfusion Medicine as a senior investigator.

Michael Houghton was born in the United Kingdom. He received his PhD degree in 1977 from King's College, London. He joined G. D. Searle & Company before moving to Chiron Corporation, Emeryville, California in 1982. He relocated to University of Alberta in 2010 and is currently in Canada Excellence Research Chair in Virology and the Li Ka Shing Professor of Virology at the University of Alberta and also Director of the Li Ka Shing Applied Virology Institute.

Charles M. Rice was born in 1952 in Sacramento. He received his PhD degree in 1981 from the California Institute of Technology where he also trained as a postdoctoral fellow between1981-1985. He established his research group at Washington University School of Medicine, St Louis in 1986 and became full Professor there in 1995. Since 2001 he has been Professor at the Rockefeller University, New York. During 2001-2018 he was the Scientific and Executive Director, Center for the Study of Hepatitis C at Rockefeller University.

Conclusion

The prestigious Nobel Prizes are awarded annually and Nobel Prize season begins every October as committees in Sweden and Norway name laureates in the variety of fields. The Nobel Prizes are presented generally to recipients in Stockholm and Oslo in December every year. In 2020, because of the coronavirus pandemic, the committees have changed their approaches. Some of the events in Stockholm were cancelled in favor of a digital ceremony for the Nobel Prize winners. Medals and Diplomas are to be distributed to the recipients' embassies and handed over in their home countries. If possible, the recipients may be invited to the award ceremony for 2021. The Nobel committee also announced another change i.e., the each prize will rise to 10 million Swedish Krona, 1 million more than the previous year, so the prize money works out to Rupees 8.3 crores approx.

Nobel Prize winner Penrose's work with innovative mathematical techniques in physics open out possibilities to understand the universe. But there is need of experimental verification, which is a daunting task no doubt. Stretching the limits of technology, Reinhard Genzel and Andrea Ghez with their relentless and decades long investigation, gave the most convincing evidence of a supermassive black hole at the centre of the Milky Way. It is a pleasure to mention that Professor Penrose visited Kolkata number of times, like in 1987 at Jadavpur University, in 1997 at Indian Association for Cultivation of Science, in 2003 at British Council, in 2006 again at Jadavpur University and in 2011 at Indian Institute of Science Education & Research, Kolkata.

Hepatitis is an inflammation of the liver that causes several health problems. According to WHO, around 325 million people are living with viral hepatitis B and C. Although Hepatitis C remains a major global health concern, but with the discovery of Hepatitis C virus by the Nobel Prize winners in Physiology or Medicine 2020, Harvey J. Alter, Michael Houghton and Charles M. Rice, the path has opened for the opportunity to eliminate the disease.

[Information collected from various Internet sites and different news papers]

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