

News Review



The Nobel Prize Winners in the Natural Sciences — 2021

Introduction

Nobel prizes are widely regarded as the most prestigious awards in the five fields of Physics, Chemistry, Physiology or Medicine, Literature and Peace. The Nobel Assembly announces the prize at the Royal Swedish Academy of Sciences in Stockholm. The prize money comes from an endowment left behind by the prize's creator, Alfred Nobel, who died in 1895. Alfred Bernhard Nobel, a Swedish chemist, inventor, engineer, businessman, and philanthropist, had 355 different patents, dynamite being the most famous one. He bequeathed his fortune to the Nobel Prize institution. According to his will of 1895, the above mentioned five separate prizes are awarded to those who, during the preceding years have conferred the greatest benefit to humankind. The awarding of the 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.

This year (2021), total thirteen prizes - ten Nobel Prizes and three Nobel Memorial Prizes were awarded to different fields:

- One from Literature - Abdulrazak Gurnah (born 1948 in Zanzibar, first Tanzanian

writer) 'for his uncompromising and compassionate penetration of the effects of colonialism and the fate of the refugee in the gulf between cultures and continents'

- Seven from Natural Sciences - three from Physics, two from Chemistry and two from Physiology or Medicine
- Two for Peace Prize - Dmitry Muratov (born 1961, Russia) & Maria Ressa, (born 1963, Philippines) for their 'Efforts to safeguard freedom of expression, which is a precondition for democracy and lasting peace'
- Three Nobel Memorial Prizes were awarded in the field of Economic Sciences - Guido Imbens (born 1963, Dutch-American economist); David Card (born 1956, Canadian-American labour economist) and Joshua Angrist (born 1960, Israeli-American economist) on 'Research on wages, jobs'.

The seven Nobel laureates in Natural Sciences this year are - Syukuro Manabe, Klaus Hasselmann, & Giorgio Parisi in Physics, Benjamin List & David MacMillan in Chemistry and Ardem Patapoutian & David Julius in Physiology or Medicine.

The Nobel Prize in Physics 2021



Syukuro Manabe



Klaus Hasselmann



Giorgio Parisi

The Royal Swedish Academy of Sciences has decided to award the 2021 Nobel Prize in Physics to three Professors for “Study of Humanity’s Role in Changing Climate”. The half of the prize money was awarded jointly to Syukuro Manabe of Princeton University in New Jersey, USA and Klaus Hasselmann of Max Planck Institute for Meteorology in Hamburg, Germany. The second half of the prize money went to Giorgio Parisi of Sapienza University of Rome, Italy. Manabe and Hasselmann laid the foundation of our knowledge of the Earth’s climate changes and how human behavior is influencing those changes. Parisi was able to discover hidden patterns with theories that could be applied to chaotic forces of nature. The work of all three scientists has gained urgency as forecast models reveal a terrible outlook if rise in global temperature is not arrested.

Scientists for decades had mentioned that carbon dioxide traps heat, but starting in 1960s, Japanese-born American Manabe created the first climate models that specifies and forecast what would happen to the globe with carbon dioxide built up in the atmosphere. About a decade later, Hasselmann from Germany, helped explain why the climate models can be reliable despite the seemingly changing nature of the weather. He also highlighted ways to look for human influence on the climate. On the other hand, Parisi from Italy built a deep physical and mathematical model that made it possible to understand the complex system.

Syukuro “Suki” Manabe is a Japanese-educated American meteorologist and climatologist who pioneered the use of computers to simulate global climate change and natural climate variations. He was born on 21st September 1931 in Shinritsu, Japan and did his education of BA, MA, DSc from University of Tokyo. After

finishing his doctorate, Manabe went to the United States and worked up to 1997 at the General Circulation Research Section of the US Weather Bureau, now the Geophysical Fluid Dynamics Laboratory of NOAA. From 1997 to 2001, he worked as Director of the Global Warming Research Division at the Frontier Research System for Global Change in Japan. In 2002 he returned to the United States as a visiting research collaborator in the Program of Atmospheric and Oceanic Science, Princeton University. He currently serves as senior meteorologist at the same university. He was also engaged as a specially invited professor at Nagoya University from December 2007 to March 2014. He was awarded with AMS Carl-Gustaf Rossby Research Medal (1992), Blue Planet Prize (1992), Asahi Prize (1995), Volvo Environment Prize (1997), William Bowie Medal (2010), Franklin Institute Awards (2015) and Crafoord Prize (2018).

Klaus Ferdinand Hasselmann is a German oceanographer and climate modeler. He is Professor Emeritus at the University of Hamburg and former Director of the Max Planck Institute for Meteorology. He founded the ‘European Climate Forum’ Organization. He mentioned after getting information about his selection as Nobel Prize winner - “I’m very happy that they put the attention on the climate problem”. He was born on October 25, 1931 in Hamburg, Germany and completed his Education, MSc from University of Hamburg and Ph.D from Max Planck Society, University of Gottingen.

Giorgio Parisi is an Italian theoretical physicist, whose research has focused on quantum field theory, statistical mechanics and complex systems. He, born on 4th August, 1948 in Rome, Italy, completed his education BS, MS, PhD

from Sapienza University. His research interests are on the subjects of Theoretical Physics, Statistical Mechanics, Glasses, Mathematical Physics and Quantum Chromodynamics (QCD). Besides Nobel Prize in Physics in 2021, he was awarded with Boltzmann Medal (1992), Dirac Medal (1999), Enrico Fermi Prize (2002), Dannie

Heineman Prize (2005), Nonino Prize (2005), Microsoft Award (2007), Lagrange Prize (2009), Max Planck Medal (2011), EPS HEPP Prize, Lars Onsager Prize, Pomeranchuk Prize, Wolf Prize in Physics (2021) and Clarivate Citation Laureate (2021).

The Nobel Prize in Chemistry 2021



Benjamin List

The Nobel Prize in Chemistry 2021 was awarded jointly to Benjamin List and David W.C. MacMillan for their development of a new tool to build molecules, the work that has spurred advances in pharmaceutical research. In 2000, the two scientists working independently of each other, reported the development of the new type of catalysis that reduced waste and allowed for novel ways to construct molecules. They developed organocatalysis, a method of accelerating chemical reactions and making them more efficient. This method, a greener way to build molecules, has allowed scientists to produce those molecules safely with less environmental impact. The method has already benefitted humankind greatly and can have applications in wide fields from medicines to food flavourings.

Benjamin List is a German chemist who is one of the Directors of the Max Planck Institute for Coal Research, Germany and Professor of organic chemistry at the University of Cologne.



David MacMillan

He was born on 11th January 1968 in Frankfurt, Germany. He had MSc education from Free University of Berlin and did his PhD from Goethe University, Frankfurt. He was awarded with Gottfried Wilhelm Leibniz Prize in 2016.

Dr. David William Cross MacMillan FRS, FRSE is a Scottish chemist and the James S. McDonnell Distinguished University Professor of Chemistry at Princeton University, where he was also the Chair of the Department of Chemistry from 2010 to 2015. He, born on 16th March 1968 in Bellshill, United Kingdom, completed his BSc from University of Glasgow and MSc & PhD from University of California, Irvine. He had his scientific career in Princeton University; California Institute of Technology; University of California, Irvine; University of California, Berkeley and Harvard University. He was also awarded with Corday–Morgan Prize and was a member of the National Academy of Sciences in 2018.

The Nobel Prize in Physiology or Medicine 2021



Ardem Patapoutian

The Nobel Prize in Physiology or Medicine was awarded jointly to David Julius and Ardem



David Julius

Patapoutian, two American scientists “for their discoveries of receptors that allow humans to

feel temperature and touch". The two laureates made breakthrough discoveries that launched intense research activities that in turn led to a rapid increase in our understanding of how our nervous system senses heat, cold, and mechanical stimuli. This really unlocks one of the secrets of nature.

Human body is a wonderful noiseless instrument consisting of so many sensors. All sensors are connected to human brain to perform the specific purposes. The optical sensor, the two eyes, sense the vision through 180 degrees (two phi solid angle); sound sensors, the two ears, sense the sound from four phi solid angles; nose, senses smell; tongue, sense taste; and the whole smart skin senses the temperature and pressure impinges on any part of the body. Besides, lots of sensors inside the body give signals of thirst and hunger for requirements of inputs and output purposes of waste materials and so on.

Thus in our daily lives we take for granted our ability to sense heat, cold and touch, which are essential for our survival. The question is how are nerve impulses initiated so that temperature and pressure can be perceived? This question has been solved by this year's Nobel Prize laureates in Physiology or Medicine. Their work was in the field of somatosensation that is the ability of specialised organs such as eyes, ears and skin.

Dr. Ardem Patapoutian is a molecular biologist and neuroscientist at Scripps Research Institute in La Jolla, California. He has been awarded the Nobel Prize in medicine for his groundbreaking discovery of pressure-sensitive sensors in cells. He used pressure-sensitive cells to discover a novel class of sensors that respond to mechanical stimuli in the skin and internal organs. He is well known for his work in characterizing the PIEZO1, PIEZO2, and TRPM8 receptors that respond to mechanical stimulation. He was born on 2nd October, 1967 in Beirut, Lebanon. In his youth, he moved from a war-torn Beirut to Los Angeles, USA. He received his BS degree from the University of California, Los Angeles in 1990 and PhD from California Institute of Technology, Pasadena, USA in 1996. He was a postdoctoral fellow at the University of California, San Francisco. Since 2000, he is a scientist at Scripps Research, La Jolla, California and now

he is Professor there. He is a Howard Hughes Medical Institute Investigator since 2014.

Dr. Julius is a Professor of physiology at the University of California at San Francisco. David Julius utilised capsaicin, a pungent compound from chilli peppers that induces a burning sensation, to identify a sensor in the nerve endings of the skin that responds to heat. He was born on 4th November, 1955 in New York, United States. He did his BS from Massachusetts Institute of Technology, MS and PhD from University of California, Berkeley in 1984 and was a postdoctoral fellow at Columbia University in New York. His scientific career involves Physiology, Biochemistry and Neuroscience. He was also awarded breakthrough Prize in Life Sciences, Canada Gairdner International Award. He is a professor at the University of California, San Francisco. David Julius was recruited to the University of California, San Francisco in 1989 where he is now Professor.

Conclusion

The prestigious Nobel Prizes are awarded annually. Nobel Prize season begins every October as committees in Sweden and Norway name laureates in variety of fields. The Royal Swedish Academy of Sciences awards the prizes for Chemistry, Physics and Economic Sciences; the Karolinska Institute confers the prize for physiology or medicine; and the Swedish Academy confers the prize for literature. The Nobel Peace Prize is conferred by the Norwegian Nobel Committee based in Oslo.

The Nobel Prizes are presented generally to recipients in Stockholm and Oslo in December every year. Each Nobel Prize winner is awarded with a diploma, a gold medal and prize money of 10 million Swedish krona (or about \$1.14 million). The prize money is divided in case of multiple winners. Usually, the prize ceremony takes place annually, but the Nobel committees have changed their approaches in 2020, because of the coronavirus pandemic. In 2020, "Medals and Diplomas were distributed to the recipients' embassies and subsequently handed over in their home countries". This year also i.e., in 2021, laureates will receive their Nobel Prize medals and diplomas in their home countries in December, 2021. Each Nobel Prize winner is

awarded with a diploma, a gold medal and prize money of 10 million Swedish krona (or about \$1.14 million). The prize money is divided in case of multiple winners.

The work of Nobel Prize winners in Physics 2021 is essential in understanding how the Earth's climate is changing and how human behavior is influencing those changes. As Hasselman, one of the Nobel Prize winner, said “the problem with climate change is that it exists on such a large time scale that people have difficulty comprehending it”. This understanding time should not be too late to implement the remedial measures.

The Nobel Prize winners 2021 in Chemistry, Benjamin List and David MacMillan developed the new method named as ‘asymmetric organocatalysis’. This is used widely today in the fields like drug discovery and fine chemicals production. H.N.Cheng, president of American

Chemical Society, named the work as ‘New Magic Wands’.

The 2021 Nobel Prize laureates in physiology or medicine identified critical missing links in our understanding of the complex interplay between our senses and the environment. Intensive ongoing research originating from this Nobel Prize awarded discoveries are focused to develop treatments for a wide range of disease conditions, including chronic pain.

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

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