



## UNDERSTANDING THE NOBEL PRIZE. THE WINNERS OF THE NOBEL PRIZE IN CHEMISTRY.

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The Nobel Prizes are an international award given annually for great work. A medal awarded to a Nobel laureate based on the legacy of the founder A. B. Nobel's will.

Award field Physics, chemistry, literature, peace, physiology or medicine and economy in the fields huge contribution and scientific discoveries for Organizer Sweden Academy, Sweden Kingdom Sciences Academy, Karolinska Institute, Norwegian Nobel Committee Country Sweden and Norway. The first Nobel prize was given in 1901. Official Foundation website was organized. (<http://www.nobelprize.org/>). The annual income of this fund is divided into 5 equal parts and is given for discoveries in the fields of physics, chemistry, physiology or medicine, works of art, friendship and peace between peoples, regardless of race, nationality, gender or religion. (In 1968, on the occasion of its 300th anniversary, the State Bank of Sweden established an additional Nobel Prize for achievements in the field of economics). The Nobel Prize consists of a gold medal with an image of Alfred Nobel, a diploma, and an amount depending on the income of the Nobel Foundation (usually between 30,000 and 70,000 dollars).

According to Alfred Nobel's will, the task of awarding the Nobel Prize was entrusted to the Royal FA in Stockholm (for physics, chemistry, economics), the Royal Institute of Medicine and Surgery in Stockholm (for physiology or medicine) and the Swedish Academy in Stockholm (for works of art). The 1st Nobel Prize is awarded by members of the Nobel Committee of the Norwegian Parliament for the activities shown in the 4 Ways of Peacebuilding. All awards except the Peace Prize are awarded on an individual basis. Nobel Prizes are not awarded to died persons. The Nobel Prize ceremony will be held in Stockholm and Oslo on the day of Alfred Nobel's death (December 10). The first prize was awarded in 1901. 565 people received the Nobel Prize in 1901-2003.

Among the winners of the Nobel Prize there are such people who received this unique prize twice for the achievements they made during their life and scientific activity through inventions and discoveries, among them:

During the preparation of information about the Nobel Prize, prize-winning scientists who grew up from the same family attracted our attention. The following scientists from representatives of the same family or dynasty received this high award:

Pierre and Marie Curie, their daughter and son-in-law Irene and Frederic Joliot-Curie, father and son Nils Bohr and Oge Bohr, father and son William Henry Bregt and William Laurence Bregt, father and son Mann Sigban and Kay Sigban, Maria Sklodowska-Curie Warsaw Linus Pauling John Bardin Fredric Sanger Albert Einstein USA (Oregon) USA (Wisconsin) Anguilla (Randcombe) Germany (Ulma) Family Award Winners. The names of scientists found worthy of the 2017 Nobel Prize in Chemistry have been announced. This year's prizes will be awarded to Swiss Jacques Debusch, American Joachim Frank and British Richard Henderson, reports the Royal Swedish Academy of Sciences.

According to RIA news, scientists have created a cryo-electron microscope that allows to determine the structure of molecules in liquid with high accuracy. It is noted that the method of cryo-electron microscopy opened a new era in biochemistry. Scientists will now be able to freeze biomolecules in motion and observe processes that were previously impossible to see. Discovery plays an important role in the development of biochemistry and pharmaceuticals. The 2021 Nobel Prize in Chemistry will be awarded to German Benjamin List and American David McMillan "for the development of asymmetric organocatalysis". A press release about the scientists' research was also published on the website of the Nobel Committee, which broadcasts the ceremony of announcing the winners.

The prize of 10 million Swedish kroner (over 1.14 million dollars) will be divided equally between the two laureates.

It was believed that there were only two types of catalysts: metals and enzymes. List and McMillan independently developed a new method of creating molecules- asymmetric organic-catalysis based on small organic molecules. According to the press release of the Nobel committee, it will serve as a basis for the research of new pharmaceutical products, and will also help to make chemistry more sustainable.

"Organic-catalysis" is developing incredibly fast. "With these reactions, researchers can now more efficiently create everything from new pharmaceuticals to molecules that can absorb light in solar panels," the report said.

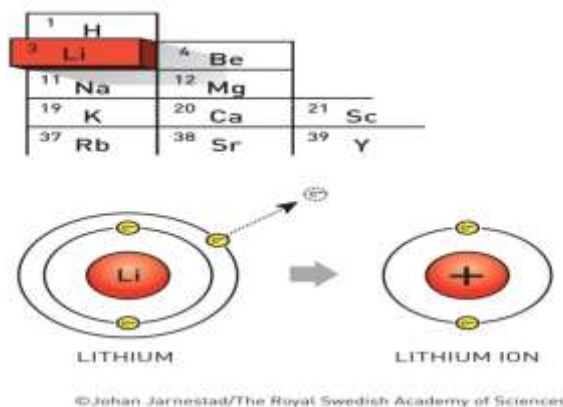
Liszt was born in 1968 in Frankfurt-Main, Germany, and received his doctorate in 1997 from Goethe University in Frankfurt. Currently, he is the head of one of the research institutes of the Max Planck Society for Scientific Research in Mülheim an Ruhr, Germany.

McMillan was born in Bellshill, Scotland in 1968. Later, he moved to the United States. In 1996, he received his doctorate from the University of California, Irvine. He is now a professor at Princeton University.

The 2020 Nobel Prize in Chemistry was awarded to Emmanuel Charpentier and Jennifer Dudne for the development of genome editing methods.

So, this year's winners of the Nobel Prize in Chemistry "for the invention of lithium-ion batteries" were considered worthy of this most prestigious scientific award. Two of the laureates are John Goodenough and Stanley Whittingham from the USA, and the third laureate - Akira Yoshino - is a Japanese chemist. So to speak, they won the Nobel Prize for providing humanity with a rechargeable, lightweight, compact and safe source of electricity - lithium-ion batteries.





In fact, if you look at the battery that powers any modern portable electronic device, it's almost certainly a lithium-ion battery. Such a battery is used in fields ranging from mobile phones, laptops and other household electronics to electric cars, which are considered the most promising and environmentally friendly means of transport. Also, the importance of such batteries is incomparable in the collection and processing of energy generated by renewable energy sources - solar and wind energy, which is one of the most pressing problems of our time. Lithium-ion batteries can serve as an important bridge in the transition of humanity from fossil fuel-based and wasteful and expensive energy to the era of "clean" energy, free from waste.

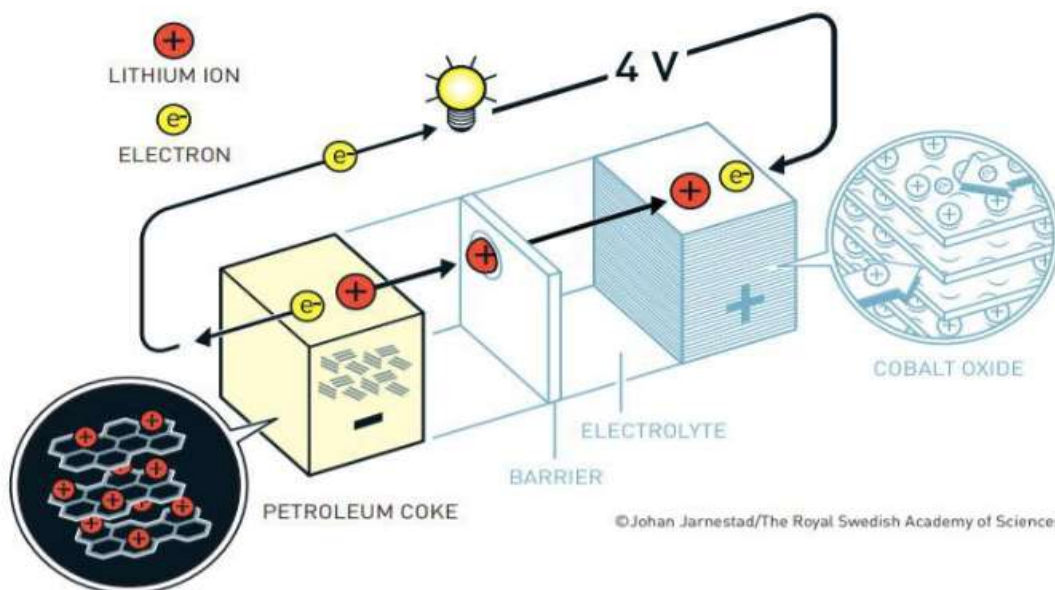
The need for lithium-ion batteries arose during the oil crisis of the 1970s. At that time, Stanley Whittingham began to work on the issue of inventing sources of electricity that could work without fossil fuels. Toward this end, while researching superconducting materials, he came across a material with a very high energy capacity and used it to make a cathode for a lithium battery. This material is titanium disulfide, which interacts with lithium ions on a molecular scale and serves to produce a chemical current.

The anode in the Whittingham battery is partially made of metallic lithium. This material has a strong electron-emitting property, and Whittingham's lithium batteries of the same model were able to produce a current of about two volts. However, a major drawback of this battery was that the lithium metal in it was reactive, and as a result, there was a risk of the battery exploding. Of course, using such batteries was dangerous. Nevertheless, the foundations of lithium-ion batteries were laid by those Whittingham developments.

Another US chemist, John Goodenough, began researching further improvements to lithium batteries. He theoretically justified the increase in electrode potential if metal oxide is used instead of metal sulfide in the battery. As a result of systematic research, in 1980 he developed a new generation of lithium-ion batteries based on cobalt oxide. His battery gave a voltage of about 4 volts. This scientific work served as an important step forward in the development of more powerful, but compact and lightweight batteries.

Using a new type of cathode developed by Goodenough, in 1985 Japanese chemist Akira Yoshino developed the first perfect lithium-ion battery. He proposed an innovative solution that eliminated the risk of explosion by using petroleum coke instead of reactive lithium metal in the anode. It was through Yoshino's inventions that the generation of lithium-ion batteries that we know well today and that provide electricity to all our portable devices was created. Thanks to his developments, lithium-ion batteries have been perfected to the point where they are compact, safe, lightweight and have a very high electrical capacity. Also, Yoshino's

services are great in producing a lithium-ion battery that can be used over and over again, and especially in making such a battery at a low commercial price suitable for mass consumption.



The advantage of lithium-ion batteries is that the chemical current produced in them is based on the movement of lithium ions flowing between the anode and cathode, rather than a chemical reaction that ends with the breakdown of the electrode.

The first portable devices equipped with lithium-ion batteries appeared in 1991. The creation of such batteries played an important role in the rapid development of portable electronic equipment. Experts are well aware of the importance of lithium-ion batteries in today's era of wireless communication and the coming era of fossil fuel-free electric vehicles. Regarding the use of renewable energy sources, without doubt, it is impossible to go far without lithium-ion batteries. Because there is currently no alternative option that can compete with such batteries in terms of storing and processing energy obtained through solar and wind energy.

**Laureates about in short :**

**John Goodenow** was born in 1922 in Jena, Germany. He graduated from the University of Chicago in 1952. Currently, head of the Department of Engineering at the University of Texas at Austin.

**Stanley Whittingham** was born in 1941 in Great Britain. He graduated from Oxford in 1968. Professor at the State University of New York.

**Akira Yoshino** was born in 1948 in Suita, Japan. Graduated from Osaka University in 2005. Currently, he is a professor at Nagoya University.

On October 4, Nobel Week began in Stockholm. The laureates of medicine and physiology awards were announced first. This year, the prize in this direction was given to scientists working in the USA - David Julius and Ardem Pataputyan for research on temperature and sensory receptors.

On October 5, three scientists were awarded the Nobel Prize in Physics. Part of the prize goes to American climatologist Syukuro Manabe and German scientist Klaus Hasselmann for their physical modeling of the Earth's climate and reliable analysis of global warming, and the other part to Italian physicist Giorgio Parisi for discovering the interaction of order and fluctuations in physical systems from atoms to planets.





**Conclusion:** To date, many scientists in the field of chemistry have received the Nobel Prize. The laureates of this award made great contributions to the development of science with their discoveries. The award ceremony will be held on December 10, the day of Alfred Nobel's death. Nobel laureates were usually greeted by the King of Sweden in person in Stockholm (with the exception of the Peace Prize laureates, who were awarded in Oslo). However, due to the coronavirus pandemic, in 2021 there will not be a solemn ceremony and party like last year. Winners will be awarded online.

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