シカゴ大学関係者のノーベル受賞者が92名（リチウムイオン電池の Goodenough 博士が受賞

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2019 年のノーベル化学賞には、リチウムイオン電池の開発応用で John B. Goodenough, M. Stanley Whittingham そして日本人の旭化成　吉野彰博士の三人が受賞しました。心よりお祝い申し上げます。

吉野博士の優れた業績は日本でも大きく詳細に取り上げられております。
当社ではスマートフォン、パソコン、電気自動車の充電バッテリーや防災時でのリチウム電池、充電バッテリースタンドの販売等で関係がありますが、岡部社長の卒業したシカゴ大学でも今回は、John B. Goodenough（シカゴ大学博士課程修了）が吉野博士と一緒に受賞しております。今回の受賞で、シカゴ大学の卒業生、教授、研究者のノーベル賞の受賞者は９２名に上りました。日本人のシカゴ大学出身者では、過去に小柴昌俊教授（物理）、南部陽一郎教授（物理）が受賞しております。

シカゴ大学から、下記のメールが届きました。「自分がビジネススクールで学んだ時の恩師の教授陣であったジョージ・スティグラー、ロバート・フォーゲル、ユージン・ファーマ各氏もノーベル経済学賞を次々と受賞され、今回のバッテリーでの日米研究での成果を大いに祝福するとともに、理論と実践で著名になったシカゴ大学の層の広さを感じるとともに、卒業生としても誇りに思います。」（岡部）。

シカゴ大学からのメール

An extraordinary number of Nobel Prizes and the Prize in Economic Sciences have been awarded to University of Chicago faculty members, students, or researchers at some point in their careers. Some of the Nobel winners whose work is closely associated with the University are Milton Friedman (Economic Sciences, 1976), Subrahmanyan Chandrasekhar (Physics, 1983), Saul Bellow (Literature, 1976), Charles Huggins (Physiology or Medicine, 1966), and Willard Libby (Chemistry, 1960). In addition, Alexei Abrikosov of Argonne National Laboratory (which has been operated by the University of Chicago for the U.S. Department of Energy since the laboratory was established in 1946) shared the 2003 Nobel Prize in Physics *"for pioneering contributions to the theory of superconductors and superfluids."* The University of Chicago's first Nobel Laureate was Albert A. Michelson. The first American to win the Nobel Prize in any of the sciences, Michelson was recognized in 1907 for his measurements of the speed of light. Robert A. Millikan (Physics, 1923) did both of his prize-winning experiments on campus in the Ryerson Laboratory.

Chemistry

- John Goodenough*, 2019
- Ada E. Yonath, 2009
- Irwin Rose*, 2004
- Richard E. Smalley, 1996
- Paul Crutzen, 1995
- F. Sherwood Rowland*, 1995
- Yuan T. Lee, 1986
- Henry Taube, 1983
- Herbert C. Brown*, 1979
- Ilya Prigogine, 1977
- William H. Stein, 1972
- Gerhard Herzberg, 1971
- Robert S. Mulliken*, 1966
- Karl Ziegler, 1963
- Willard Frank Libby, 1960

- Glenn Theodore Seaborg, 1951
- Harold Clayton Urey, 1934

Economic Sciences

- Paul M. Romer*, 2018
- Richard Thaler‡, 2017
- Lars Peter Hansen‡, 2013
- Eugene F. Fama*‡, 2013
- Thomas J. Sargent, 2011
- Leonid Hurwicz, 2007
- Roger B. Myerson‡, 2007
- Edward C. Prescott, 2004
- Daniel L. McFadden, 2000
- James J. Heckman‡, 2000
- Robert A. Mundell, 1999
- Myron S. Scholes*, 1997
- Robert E. Lucas Jr.*‡, 1995
- Robert W. Fogel, 1993
- Gary S. Becker*, 1992
- Ronald H. Coase, 1991
- Harry M. Markowitz*, 1990
- Merton H. Miller, 1990
- Trygve Haavelmo, 1989
- James M. Buchanan Jr.*, 1986
- Gerard Debreu, 1983
- George J. Stigler*, 1982
- Lawrence R. Klein, 1980
- Theodore W. Schultz, 1979
- Herbert A. Simon*, 1978
- Milton Friedman*, 1976
- Tjalling C. Koopmans, 1975
- Friedrich August von Hayek, 1974
- Kenneth J. Arrow, 1972

- Paul A. Samuelson*, 1970

Literature

- John M. Coetzee, 2003
- Saul Bellow*, 1976
- Bertrand Russell, 1950

Peace

- Barack Obama, 2009

Physics

- George E. Smith*, 2009
- Yoichiro Nambu, 2008
- Frank Wilczek*, 2004
- Alexei A. Abrikosov, 2003
- Masatoshi Koshiba, 2002
- Daniel C. Tsui*, 1998
- Jerome I. Friedman*, 1990
- Leon M. Lederman, 1988
- Jack Steinberger*, 1988
- Subrahmanyan Chandrasekhar, 1983
- James W. Cronin*, 1980
- J. Robert Schrieffer, 1972
- Murray Gell-Mann, 1969
- Luis W. Alvarez*, 1968
- Hans Albrecht Bethe, 1967
- Julian Schwinger, 1965

- Maria Goeppert-Mayer, 1963
- Eugene P. Wigner, 1963
- Owen Chamberlain*, 1959
- Tsung-Dao Lee*, 1957
- Chen Ning Yang*, 1957
- Ernest Orlando Lawrence*, 1939
- Enrico Fermi, 1938
- Clinton Joseph Davisson*, 1937
- Werner Heisenberg, 1932
- Arthur Holly Compton, 1927
- James Franck, 1925
- Robert Andrews Millikan*, 1923
- Albert Abraham Michelson, 1907

Physiology or Medicine

- Bruce A. Beutler*, 2011
- Roger W. Sperry*, 1981
- George Wald, 1967
- Charles Brenton Huggins, 1966
- Konrad Bloch, 1964
- Sir John Carew Eccles, 1963
- James Dewey Watson*, 1962
- George Wells Beadle, 1958
- Edward Lawrie Tatum*, 1958
- Hermann Joseph Muller, 1946
- Edward Adelbert Doisy, 1943
- Alexis Carrel, 1912

***The New York Times* より抜粋**

By Knvul Sheikh, Brian X. Chen and Ivan Penn

- Oct. 9, 2019

Lithium-Ion Batteries Work Earns Nobel Prize in Chemistry for 3 Scientists

John B. Goodenough, M. Stanley Whittingham and Akira Yoshino were recognized for research that has “laid the foundation of a wireless, fossil fuel-free society.”

The batteries developed through the work of John B. Goodenough, M. Stanley Whittingham and Akira Yoshino are used in “everything from mobile phones to laptops and electric vehicles,” the Nobel committee said.Credit...Naina Helen Jama/TT News Agency, via Associated Press

The Royal Swedish Academy of Sciences on Wednesday awarded the 2019 Nobel Prize in Chemistry to three scientists who developed lithium-ion batteries, which have revolutionized portable electronics and are very likely powering a device you’re using now to read this article. Larger examples of the batteries have given rise to electric cars that can be driven on long trips, while the miniaturized versions are used in lifesaving medical devices like cardiac defibrillators.

John B. Goodenough, M. Stanley Whittingham and Akira Yoshino will share the prize, which is worth about $900,000.

“Lithium-ion batteries are a great example of how chemistry can transform people’s lives,” said Bonnie Charpentier, president of the American Chemical Society. “It’s wonderful to see this work recognized by the Nobel Prize.”

The three researchers’ work in the 1970s and ’80s led to the creation of powerful, lightweight and rechargeable batteries used in nearly every smartphone or laptop computer, and in billions of cameras and power tools. Astronauts on the International Space Station rely on them, and engineers working on renewable energy grids often turn to them. By storing electricity generated when sunlight and wind are at their peak, lithium-ion batteries can reduce dependence on fossil fuel energy sources and help lessen the impact of climate change.

M. Stanley Whittingham, 77, a professor at Binghamton University, State University of New York, and one of the three winners, said that he always hoped lithium-ion technology would grow, “but we never envisaged it growing this far. We never imagined it being ubiquitous in things like iPhones.”

John B. Goodenough, 97, is a professor at the University of Texas at Austin. With the award he becomes the oldest Nobel Prize winner, but is still active in research.

And Akira Yoshino, 71, is an honorary fellow for the Asahi Kasei Corporation in Tokyo and a professor at Meijo University in Nagoya, Japan. He said after the announcement that he was pleased that the technology could also help fight climate change, calling lithium-ion batteries “suitable for a sustainable society.”

Ever since Alessandro Volta invented the first true battery in 1800, scientists have tried to find ways to get electrons to flow from a negative electrode called an anode to a positive electrode called a cathode. Volta did this by stacking discs of copper and zinc, and linking them with a cloth soaked in salty water. When wires were connected to the discs to complete a circuit, the battery produced a stable current. In subsequent decades, versions of these batteries powered telegraphs and other devices.

Image

A lithium ion battery production line in a factory in Dongguan, Guangdong Province, China.Credit...Joyce Zhou/Reuters

The first rechargeable battery came about in 1859. These were made from lead-acid, and are still used to start gasoline- and diesel-powered vehicles today. But lead-acid batteries were bulky and heavy. Nickel-cadmium batteries, which were less efficient but more compact, were invented in 1899.

For many years, there were no major advancements in battery technology. But the Arab oil embargo of 1973 made many scientists realize the extent of society's dependence on fossil fuels. Dr. Whittingham, who was working for Exxon at the time, began searching for improved ways to store energy from renewable sources and power electric cars.

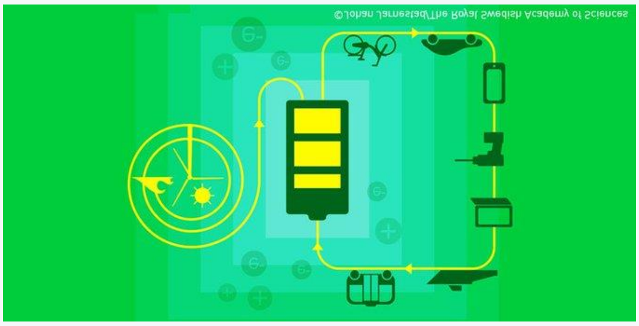
He knew that lithium would make a good anode because it released electrons easily. It also had the advantage of being the lightest metal. So Dr. Whittingham started looking for materials that had a high energy density and captured lithium-ions in the cathode — the side of your battery with the plus sign.

Dr. Whittingham discovered that titanium disulfide, which had never been used in batteries before, had a molecular structure that let lithium-ions into small pockets. This resulted in the first functional lithium battery.

"The big advantage of this technology was that lithium-ion stored about 10 times as much energy as lead-acid or 5 times as much as nickel-cadmium," Dr. Whittingham said. Lithium-ion batteries were also extremely lightweight and required little maintenance. "So there was a huge incentive to move to lithium-ion."

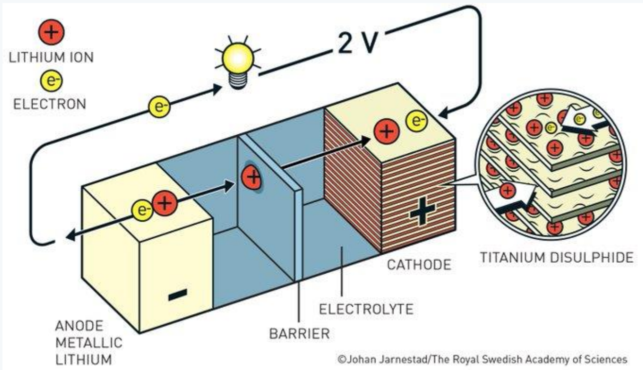
THE NOBEL PRIZE

Lithium-ion batteries have revolutionised our lives and are used in everything from mobile phones to laptops and electric vehicles. Through their work, this year's Chemistry Laureates have laid the foundation of a wireless, fossil fuel-free society.



THE NOBEL PRIZE

In the early 1970s, Stanley Whittingham, awarded this year's Chemistry Prize, used lithium's enormous drive to release its outer electron when he developed the first functional lithium battery.



Unfortunately, Dr. Whittingham's new battery had a problem. When it was repeatedly charged, thin strands of metallic lithium would grow out from the negative electrode. Sometimes, the strands would grow long enough that they reached the cathode and short-circuited the battery, and could cause an explosion.

Dr. Goodenough, then at Oxford, predicted that lithium-ion batteries would have greater potential if the cathode were made with a different material. He noticed that cobalt oxide was similar in structure to titanium disulfide. It could tolerate lithium being pushed into it and pulled out over and over. It also made the lithium-ion battery almost twice as powerful as Dr. Whittingham's. The battery now generated four volts.

Building from Dr. Goodenough's work, Dr. Yoshino, who was at the Asahi Kasei Corporation in Japan, then showed that more complicated carbon-based electrodes could house lithium-ions in between their layers too. This eliminated pure lithium from the battery entirely. Instead, the system used only lithium-ions, which are safer.

These developments ultimately led to commercialization of the lithium-ion battery in 1991 by another Japanese electronics giant, Sony Corporation.

The compact nature and reliability of lithium-ion batteries made the technology a staple in electronics that had once been powered primarily by disposable batteries that consumers always seemed to run out of at the wrong time. That included radios, hand-held gaming devices, laptop computers and eventually smartphones and wearable computers.

Image

A container transporter powered by lithium-ion batteries at a cargo terminal in Hamburg, Germany. Credit...Srdjan Suki/EPA, via Shutterstock

But the technology has its flaws, too.

There is a limited number of times that a lithium-ion battery can be replenished before it deteriorates and can no longer hold a charge. In addition, a faultily designed lithium-ion battery can turn into a miniature bomb.

Some of the biggest tech product recalls have involved battery defects. In 2006, Dell recalled 4.1 million laptop batteries because they could erupt in flames. More recently, Samsung Electronics recalled and discontinued the Galaxy Note 7, its flagship smartphone, after several reports of the device exploding.

Technologists often point to lithium-ion as an innovation roadblock: While computer chips have doubled in speed every few years and digital displays have become significantly brighter and sharper, tech companies have made only incremental improvements on batteries; there's not much that engineers can do beyond making the batteries bigger and implementing software algorithms to make hardware more power efficient.

Despite the hiccups, companies continue to rely on the batteries because they can be cheaply and reliably reproduced. They have also been scaled up for use in larger settings.

Energy storage, most often using lithium-ion battery technology, is widely seen as necessary for transforming the electric grid to a carbon-free system and combating the effects of climate change. Most electricity in the United States — and in many other parts of the world — comes from fossil fuel sources, predominantly natural gas but also coal.

Battery technology helps replace those carbon-emitting sources because it allows power companies to store excess solar and wind power when the sun does not shine nor the wind blow — the weakness of those carbon-free sources.

The most critical area for the electric grid has been providing power when people return home from work during the summer and turn on their air-conditioners, cook dinner and wash clothes, when utilities often rely on natural gas plants designed to meet those periods of high demand, known as peaking plants, which typically are more expensive.

"What's exciting about lithium-ion technology is it has the power to unlock the sun 24-7 to really help renewable energy power our future in a way that we haven't been able to capture until now," said Bernadette Del Chiaro, executive director of the California Solar and Storage Association, an industry group.

The potential of battery technology is highlighted in Northern California, where Pacific Gas & Electric is shutting off power to hundreds of thousands of customers on Wednesday because of the risk of wildfires.

Some of their neighbors who have combined solar and battery systems can continue to meet their energy needs.

“From a high level, lithium-ion batteries have increased reliability, they’ve enabled greater renewable penetration, they’ve reduced the reliance on centralized power,” said Ed Fenster, co-founder and executive chairman of Sunrun, one of the largest residential solar companies in the United States. “They’re going to do to the electric grid what the P.C. did to the mainframe computer.”

But while the batteries can be a part of the solution for reducing fossil fuel use, they have also resulted in other problems around lithium extraction and waste.

Image

Brine being trucked from an evaporation pool at a lithium extraction complex in Uyuni Salt Flat, Bolivia.Credit...Pablo Cozzaglio/Agence France-Presse — Getty Images

More than half of lithium is gathered using brine extraction from deep inside the earth, especially in South America, and the rest is still mined traditionally from rock. Both methods have caused environmental damage to areas around lithium processing operations. And as the demand for lithium increases, companies may resort to using energy-intensive heating to speed up brine evaporation. Some lithium sources could also be overextracted.

Once lithium-ion batteries are used up in electronics, they are often disposed of improperly by consumers. Less than 5 percent of lithium-ion batteries are collected and recycled in the United States, according to the Department of Energy.

“If you think about the batteries in cellphones, most of them are thrown away and end up in landfills,” said Alexej Jerschow, a chemist at New York University.

While some companies that make smartphones and other devices have attempted to improve their recycling records, dismantling the batteries and removing the metal for reuse involves another high-temperature melting and extraction process.

“It is just not economical,” Dr. Jerschow said.

Scientists have experimented with new power technologies that use alternate methods to replenish batteries, like pulling energy from the air or through radio signals. But any potential successor to lithium-ion would have to undergo rigorous safety tests before being introduced to the public.