



Nobel Prize in Chemistry 2019

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The 2019 Nobel Prize in Chemistry has been jointly awarded to **John B Goodenough, M Stanley Whittingham and Akira Yoshino** for the development of **lithium-ion batteries**.

- Through their work, this year's Chemistry Laureates have laid the foundation of a wireless, fossil fuel-free society.
- In the early 1970s, **Dr. Whittingham** developed the **first functional lithium battery**.
- **Dr. Goodenough doubled the lithium battery's potential**, creating the right conditions for a vastly more powerful and useful battery.
- **Dr. Yoshino** succeeded in **eliminating pure lithium** from the battery, instead **basing it wholly on lithium ions**, which are safer than pure lithium. This made the battery workable in practice.
- The result was a lightweight, hardwearing battery that could be charged hundreds of times before its performance deteriorated.

The advantage of lithium-ion batteries is that they are not based upon chemical reactions that break down the electrodes, but upon lithium ions flowing back and forth between the anode and cathode.

- The lithium-ion batteries have reshaped energy storage and transformed cars, mobile phones and many other devices in an increasingly portable and electronic world.

More power to batteries

M. Stanley Whittingham, John B. Goodenough and Akira Yoshino have been selected for the 2019 Chemistry Nobel for their roles in the development of the Li-ion battery



M. Stanley Whittingham

- In the 1970s, he used titanium disulphide as cathode and lithium, which is highly reactive, as anode. When put together, it generated two volts of electricity



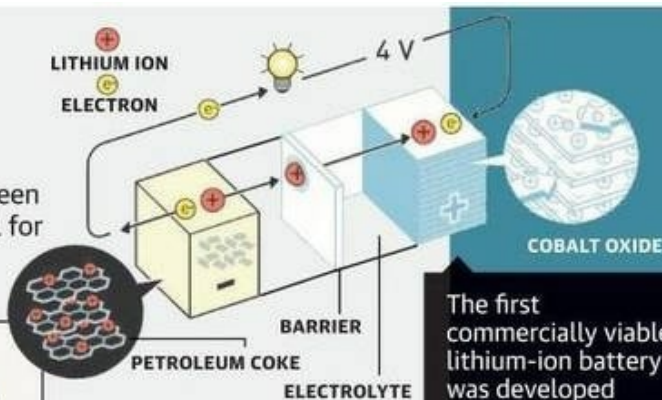
John B. Goodenough

- In the 1980s, he replaced titanium disulphide with cobalt oxide as the cathode. The battery's potential doubled because of oxide in the cathode but the use of reactive lithium remained a concern



Akira Yoshino

- He replaced lithium with petroleum coke, which drew the Li-ions towards it. Once the battery was operational, the ions and electrons flowed towards the cobalt oxide cathode



The first commercially viable lithium-ion battery was developed by Akira Yoshino in 1991

How does a battery work?

Electricity is the flow of electrons from one atom to another. In a battery, electrons flow from the negative electrode - the anode - to the positive one - the cathode, producing electricity

Source: TH