Scientist John B Goodenough dies: How his creation of lithium-ion battery sparked the wireless revolution

Goodenough shared his 2019 Nobel Prize in chemistry with two other researchers, Michael Stanley Whittingham, a British-American chemist, and Akira Yoshino, a Japanese chemist. The three, although at different points in time, made significant strides in developing the lithium-ion battery, which transformed the world.

By: **Explained Desk**
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Nobel chemistry winner John B Goodenough poses for the media at the Royal Society in London, Oct. 9, 2019. (AP Photo/Alastair Grant, File)

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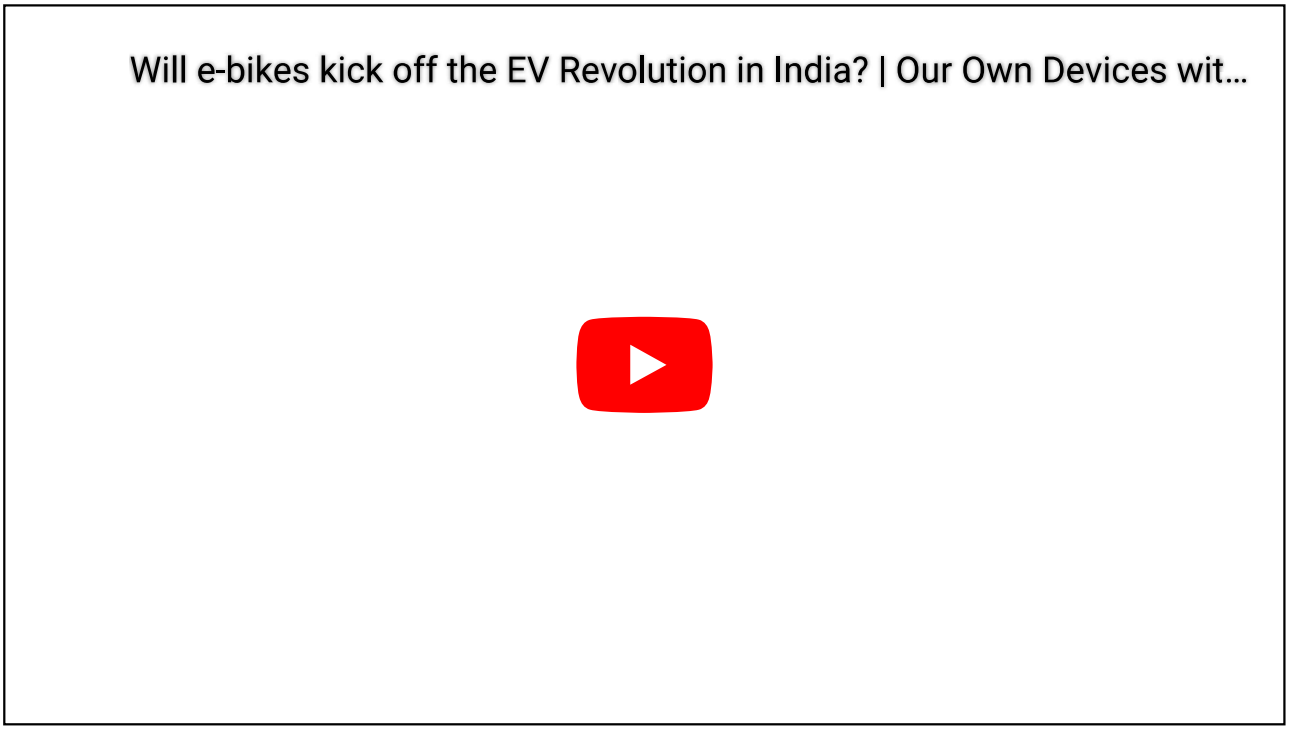
John B Goodenough, whose contribution to lithium-ion battery technology in 1980 helped him win the 2019 Nobel Prize in chemistry — making him the oldest man to receive the accolade — died on June 25 at the age of 100. His work transformed the tech world, sparking the wireless revolution that made portable electronics ubiquitous.

Goodenough passed away at an assisted living facility in Australia's Texas, according to a statement released by the University of Texas, where he was a professor of engineering.

The scientist had shared his Nobel with two other researchers, including Michael Stanley Whittingham, a British-American chemist, and Akira Yoshino, a Japanese chemist. Highlighting the importance of their contribution, the Nobel Prize website said: "This rechargeable battery laid the foundation of wireless electronics such as mobile phones and laptops. It also makes a fossil fuel-free world possible, as it is used for everything from powering electric cars to storing energy from renewable sources."



Evolution of battery

The desire for a powerful, safe and rechargeable battery isn't new. According to *The New York Times*, the first true battery was created in 1800 by Alessandro Volta, who by using disks of copper and zinc, linked with a cloth soaked in salty water, was able to generate electricity. But one of the first rechargeable batteries was invented some six decades later — they were lead-acid batteries, prominently used to power car ignition and its accessories like lights. There were several issues with them such as their short life cycle, bulk, high maintenance, and slow and inefficient charging.

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A breakthrough came in the early 1970s when Whittingham developed the first lithium-based rechargeable battery while he was working with Exxon. What he did was use **lithium** for his battery's "negative electrode (anode), and titanium disulfide (disulphide), not previously used in batteries, for its positive electrode (cathode)." The result was a groundbreaking invention as Whittingham's innovative battery could produce high voltage, work at room temperature and was rechargeable. He consciously used lithium because it easily releases electrons to travel to the cathode, making the battery work.

However, Whittingham's batteries had some shortcomings — they would either explode or catch fire in case of overcharging or repeated recharging. This is where Goodenough came into the picture.

Contribution of Goodenough

Goodenough arrived at the University of Oxford in 1979, where he began to focus on electrochemistry, including batteries. Being aware of Whittingham's invention, the scientist realised that if he made the battery's cathode from a metal oxide and lithium instead of a metal disulphide, it might have "higher potential", the Nobel Prize website stated. The metal oxide that he and his team finally zeroed in on was cobalt oxide.

"Whittingham's battery generated more than two volts, but Goodenough discovered that the battery with lithiumcobalt oxide in the cathode was almost twice as powerful, at four volts," the website added.

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Impact of Goodenough's work

Goodenough's improvement on Whittingham's battery was taken forward by Yoshino, who had been experimenting with the battery by using carbon-based materials as its anode. He ultimately made a breakthrough when he used petroleum coke as an anode, which, at the molecular level, has spaces for lithium ions.

"When he charged the petroleum coke with electrons, the lithium ions were drawn into the material. Then, when he turned on the battery, the electrons and lithium ions flowed towards the cobalt oxide in the cathode, which has a much higher potential," the Nobel Prize website described. This way, Yoshino invented the first

commercially viable lithium-ion battery, which began to be sold in 1991. It was powerful, lightweight, stable and offered a long life.

But lithium-ion batteries became mainstream when Sony started to sell them, sparking a revolution in the electronics industry. It finally paved the way for the emergence of mobile phones and laptops. Not only this, lithium-ion batteries are a crucial part of electrical vehicles, which are pivotal to the world's transition to clean energy.

According to a 2016 report by the University of Chicago, the original lithium-cobalt-oxide cathode structure of Goodenough is still used in the lithium-ion batteries that today power most of the gadgets.

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In a 2016 interview with the *BBC*, when asked about his contribution, he said: "I'm very gratified that I've provided something for the people of this world." Unlike many of his peers, Goodenough never received any royalties for his work, he shared patents, and donated the stipends he received with his awards and scholarships, *NYT* noted.

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