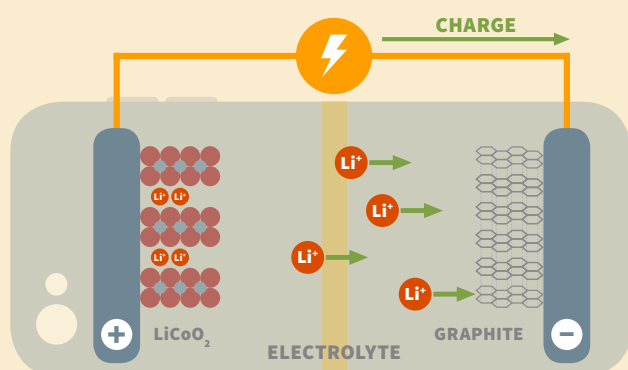


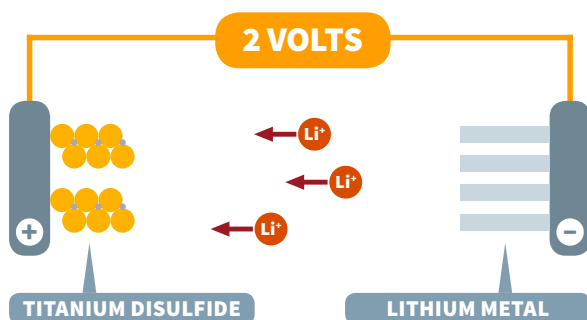
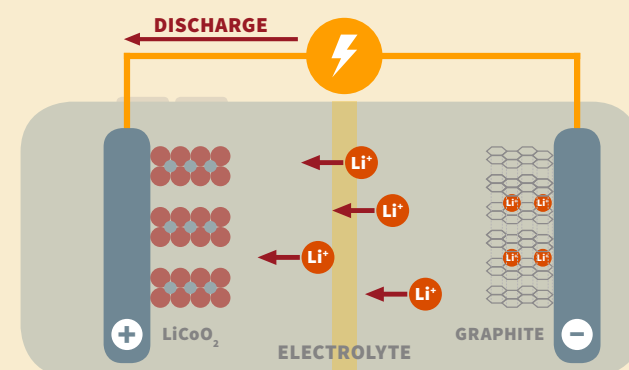
2019 NOBEL PRIZE IN CHEMISTRY



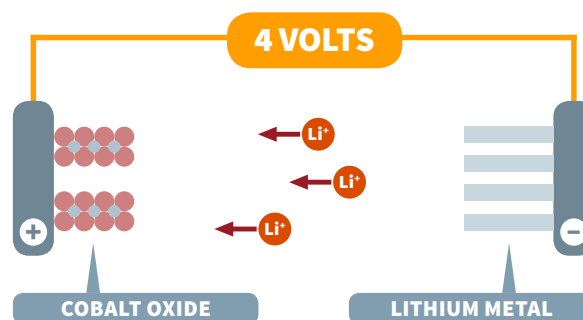
The Nobel Prize in Chemistry 2019 was awarded jointly to **John B. Goodenough**, **M. Stanley Whittingham** and **Akira Yoshino** for the development of lithium-ion batteries.



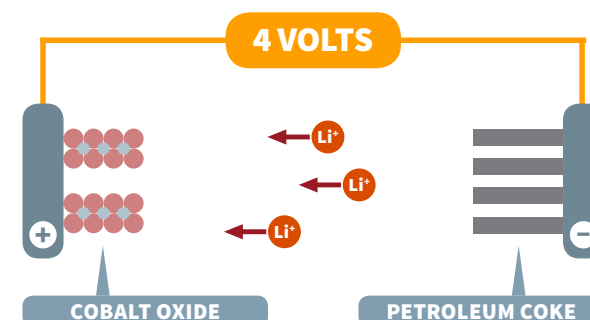
Lithium-ion batteries power many of our electronic devices. When lithium-ion batteries charge, lithium ions and electrons move from the positive electrode to the negative electrode. When the battery is discharging, the opposite happens and the flow of electrons powers the device.



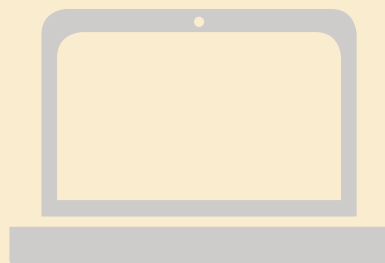
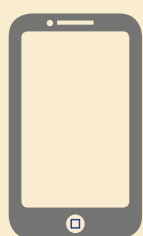
In the 1970s, **Whittingham** created the first functional lithium battery with a titanium disulfide cathode and lithium metal anode. The lithium metal made it explosive and unsafe.



In the 1980s, **Goodenough** used a cobalt oxide cathode instead of a metal sulfide. This doubled the battery's voltage, but it still contained lithium metal in the anode.



Yoshino replaced the lithium metal anode with petroleum coke, a carbon-based by-product from the oil industry. This led to commercial lithium-ion batteries in 1991.



WHY DOES THIS RESEARCH MATTER?

Many of the devices we use are powered and made possible by lithium-ion batteries. They are also commonly used in environmentally friendly electric cars. Improvements to these batteries continue to be made.

Nobel Prize in Chemistry press release: <https://www.nobelprize.org/uploads/2019/10/press-chemistry-2019-2.pdf>