NOTABLE EVENTS IN THE HISTORY OF LITHIUM-ION BATTERIES

1799

Alessandro Volta creates the modern-day battery by building what came to be known as the voltaic pile. The pile was made of zinc and copper plates with vinegar- or brine-dampened pieces of leather or pasteboard placed between each plate.

1800

Brazilian chemist José Bonifácio de Andrada e Silva discovers Petalite in a Swedish mine.

1817

Swedish chemist Johan August Arfwedson discovers and names lithium when examining the elements in Petalite ore.

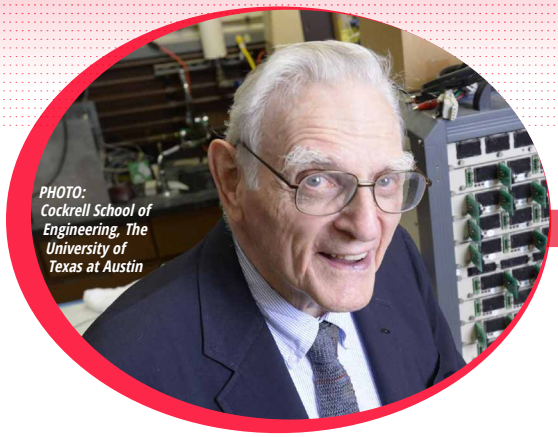


PHOTO: Cockrell School of Engineering, The University of Texas at Austin

Lithium's proud papa

1973

Adam Heller, an Israeli-American engineer, uses his knowledge of the physical chemistry of inorganic oxyhalide solutions to produce the lithium thionyl chloride battery, the precursor to the lithium-ion battery.

1980

John Goodenough develops a rechargeable lithium cell using lithium cobalt oxide as the cell's positive electrode and lithium metal as the cell's negative electrode.

THE NAME JOHN GOODENOUGH may not be familiar to most people, but anyone who's put a mobile phone to his or her ear is very familiar with his work.

Goodenough is credited as the father of the lithium-ion batteries — the ones that power your laptop and iPhone, among other devices — thanks to his work on developing a long-life rechargeable battery.

The fact that Goodenough is well known in scientific circles is an accomplishment in itself, considering the academic struggles he endured when he was younger. Suffering from undiagnosed dyslexia as a young student, Goodenough spent most of his time exploring the woods and rivers near his childhood home near New Haven, Conn.

He labored in the classroom but absorbed enough knowledge to earn a spot at Groton School, a prestigious academic institution in Massachusetts, where he learned to overcome his learning disabilities by mimicking the readings he needed to study. After a teacher told him that Shakespeare's sonnets were probably too much for him to understand, Goodenough began writing his own sonnets to better his comprehension of the form.

"I decided that the only way to understand poems was to try my hand at writing them," Goodenough told The Alcalde, the alumni magazine of The University of Texas, where he's still an active faculty member with the Cockrell School of Engineering — at 95 years old.

Goodenough earned a scholarship to Yale University, where he graduated summa cum laude, receiving a bachelor of science degree in mathematics. Goodenough then served as a meteorologist in World War II, eventually returning home to earn his Ph.D. from the University of Chicago in 1952. He headed to MIT afterward, continuing his A-list journey through the finest academic institutions in the country.

At MIT, Goodenough began researching computer memory in Lincoln Laboratory, eventually leading a team that developed a magnetic-core system that stored computer data on magnetic rings. It was cheaper, faster and more reliable than previous methods — think vacuum tubes, lightbulbs and computers the size of a one-bedroom apartment. Goodenough's work led to a series of rules that explained magnetism at the atomic level: the Goodenough-Kanamori Rules. Those guidelines would become the bible for engineers across the world as they worked to develop smaller, faster computers.

Goodenough eventually moved to England to head the inorganic chemistry lab at Oxford University and continue his research into batteries, which had taken on increasing importance after the oil crisis of the early 1970s. Although a lithium-ion battery, largely developed by chemist M. Stanley Whittingham, was commercialized in 1976 by Exxon, it had a high explosion rate.

Goodenough and his team worked with metal oxides to create a more stable battery, eventually developing cobalt oxide, which led to the lithium-ion battery as we know it today, albeit bigger and less powerful. Rapid development led to smaller, more powerful batteries, which are used in countless devices large and small. While companies make busloads of money from the technology, Goodenough receives no royalties and doesn't receive any financial benefits. Oxford never applied for a patent, and Sony quickly snatched up the rights to the technology.

You might think that financial injustice would have embittered Goodenough toward science, but it hasn't in the least. In fact, he's focused on improving upon his life's work. "What we need is not an incremental improvement, but a step improvement," Goodenough told The Alcalde. "Our society is still completely dependent on fossil fuels, and we've got to find an alternative soon."

Goodenough is already making good on that promise. Last year, he and his team introduced a glass electrolyte-sodium battery that recharges faster, is potentially less expensive and is three times as powerful as lithium-ion batteries.

1991

Sony develops a smaller lithium-ion battery that can be used to power smaller devices like cameras and CD players.

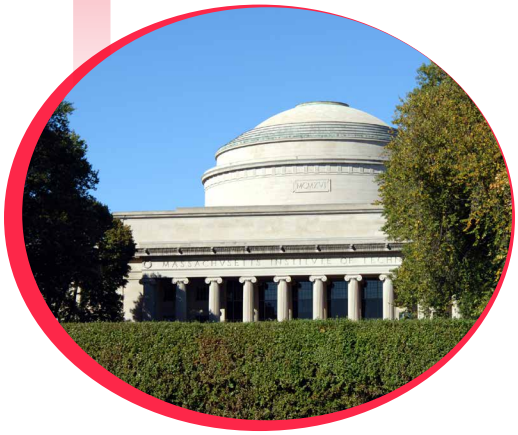
1992

The Chattanooga Area Regional Transportation Authority tests a fleet of 20 electric, rechargeable buses.

Sony adds a rechargeable lithium-ion battery as a $60 option for the Handycam CCD-TR1 8mm camcorder.

2002

Yet-Ming Chiang and his associates at MIT boost lithium-ion's conductivity by combining it with aluminium, niobium and zirconium, greatly improving the performance of lithium batteries.



2003

Marc Tarpenning and Martin Eberhard found Tesla, an electric-car company.

2006

2008

Tesla delivers the Roadster, the first mass-produced, all-electric car to use lithium-ion battery cells. The Roadster can travel 200 miles on a single charge.

2013

Lithium-ion batteries catch fire in Boeing 787 Dreamliners and Tesla automobiles. The Dreamliner fleet is grounded for review.

A Dell laptop bursts into flames in Osaka, Japan. After other incidents, Dell offers free replacements for 4.1 million laptop batteries.

2015

Tesla CEO Elon Musk unveils the Tesla Powerwall, a combined set of high-powered batteries that can be used for home energy.

2016

British transportation officials test a Class 379 Electrostar, a multi-car passenger train powered by lithium-ion batteries on the Mayflower Line in Essex, England.

Samsung Electronics recalls 2.5 million Galaxy Note 7 smartphones after a flaw in the battery cell caused some of the phones to catch fire.

The Consumer Product Safety Commission recalls more than 500,000 hoverboards after the lithium-ion batteries overheat and cause at least 60 fires.

The U.S. Department of Transportation bans e-cigarettes in checked baggage on aircraft, citing the possibility of fire during the flight.