Pacemakers and the nuclear option

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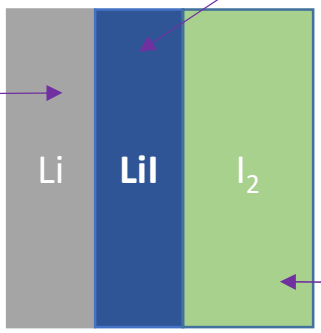
A Swedish doctor and engineer worked together in 1958 on developing the first pacemaker, it lasted just a few hours in a patient. The next lasted 6 weeks.

In the race to provide patients with anything that might work, a range of relatively dangerous options were used, such as using the decay of radioactive plutonium. In these batteries, the alpha particles impact on a surface and produce heat. Heat can be turned into electricity through use of thermocouples. But just 0.000,001g of plutonium in blood could be fatal. And travel between countries with a chest full of nuclear fuel could be tricky. The pacemakers also had to be recovered and disposed of properly after death.

More commonly, mercury-zinc batteries were used. These generated hydrogen, and in order to allow the hydrogen out they could not be hermetically sealed. Lucky, developments in lithium iodine batteries made them good enough to deploy in pacemakers from 1975.

Lithium metal melts at 180.5 °C. This limits this cells use in some other applications.



The lithium-iodide layer acts both as the electrolyte and a way to stop the Li coming into direct contact with the I_2. If it did, Li would simply react directly with the iodide and no electrons would flow around the external circuit.

Iodine contained in an electrically conductive polymer.

$Li^+ + e^- \rightleftharpoons Li \quad E^o = -3.04$ V (vs SHE)

$I_2 + 2e^- \rightleftharpoons 2I^- \quad E^o = +0.54$ V (vs SHE)

What would you expect the maximum voltage of this cell to be?

Why are these cells hard to manufacture?
What are the requirements for a pacemaker battery?
What would happen if the LiI electrolyte layer got cracked?

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