

The Pacemaker

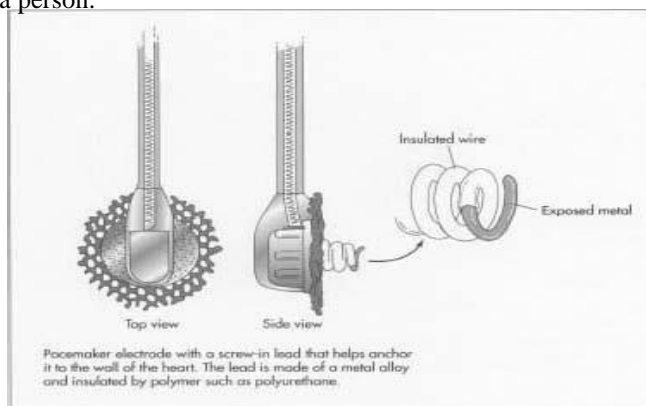
Corey Gomes, *Biomedical Engineering, University of Rhode Island*
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The pacemaker is a small device used to regulate a person's heartbeat. Pacemakers are a common used device that is very effective. Some causes of concern due to this biomedical device can be related to genetics and defects of the product. Biomedical engineers are developing this product so that each pacemaker is suitable for the patient individually and they are making them last longer, with higher efficiency.

There are three different types of pace makers in use today. Single-Chamber Pacemakers there is only one wire (pacing lead) placed into a chamber of the heart. Sometimes it is the upper chamber, or atrium. Other times it is the lower chamber, or ventricle. Dual-Chamber Pacemakers wires are placed in two chambers of the heart. One lead paces the atrium and one paces the ventricle. This approach more closely matches the natural pacing of the heart. This type of pacemaker can coordinate function between the atria and ventricles. Rate-Responsive Pacemakers have sensors that automatically adjust to changes in a person's physical activity. The pacemaker was first an experiment in 1889 by J.A. McWilliams later followed by Albert Hyman who was the first to call his device an artificial pacemaker. Future scientist John Hopps was working with radio frequencies and how they can be used to bring up the body temperature. His version of the pacemaker, although an external one, brought up the idea that when the heart stops due to cooling, it can be restarted. The main reason for pacemakers in the present state of the world is to help regulate ones heartbeat. Along with this bring a lot of problems due to ethics and the harms of the body. With the use of a pacemaker as an internal treatment the body must accept the device in order to work properly. The pacemaker sends electric currents through the body and the pacemaker must be set to send the correct amount of electrons through the body. Pacemakers are generally put in to treat arrhythmias and are often used after one undergoes heart surgery.

People with arrhythmias, bradycardia or heart block are all able to get a pacemaker. Other reasons a doctor would recommend a pacemaker is if you have a slow heart beat or take certain heart medicine such as beta blockers. Pacemakers send out electrical currents that are determined by ohms law. This electrical current is due to the diffusion of calcium, sodium and potassium ions across the region of the pacemaker. The materials used must be nontoxic and sterile and must be able to function properly in the body. The pace maker is composed of 5 general aspects, the casing, microelectronics, such as lead wires, a battery and circuitry. The casing is usually made out of titanium and the lead wires are also composed of a metal alloy. However, the wires are insulated by a polymer. The circuitry is generally composed of silicon-semiconductors. And the battery has two metals that

form the anode and cathode to transfer charge. The mother board consists of all the electrical circuitry of the pacemaker and is created using hybridization. The pacemaker is usually inserted with surgery in the chest or upper abdomen region of a person.



The results of a pacemaker can consist of thousands of malfunctions in pacemakers. Some of these did cause death in certain cases. In the recent years the malfunctions have declined drastically. The FDA agrees "it has been difficult to get a clear picture of device reliability". When the battery of the device runs low the patient must get it removed and replaced. This happens every five to ten years. Battery, capacitor or electrical problems accounted for half the failures. Thirty deaths were attributable to pacemaker malfunction and 31 deaths to malfunctions in pacemakers. However, weighing a little over an ounce the current day pacemakers are very light and small allowing the patient to continue to live their normal lives.

The pacemaker is overall a very successful product. With only a small portion of defects compared to the amount of patients with pacemakers. The future of this device solely relies on the structure and the efficiency of the battery to be improved. The current lithium/iodine battery has been improved to a lithium polycarbon fluoride battery. Some limitations would be strenuous exercise along with lifting heavy weights. Also EMI's would be the greatest concern to these devices. These devices are lightweight and are very effective for an average of 7 years which is high among many biomedical devices related to the heart. The pacemaker is being improved on with design, comfort, and overall battery life.

- 1] <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1502062/>
- 2] <http://www.medicinenet.com/pacemaker/page2.htm>
- 3] <http://www.whoinventedit.net/who-invented-the-pacemaker.html>
- 4] <http://www.nhlbi.nih.gov/health/health-topics/topics/pace/>
- 5] <http://www.madehow.com/Volume-3/Pacemaker.html>
- 6] <http://www.arrythmia.org/pacemaker.html>