Powering pacemakers with heartbeat vibrations

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Sick hearts may help to keep themselves beating longer with a device that could harvest energy from heartbeat-induced chest cavity vibrations.

Though pacemakers require only small amounts of energy (about 1 millionth of a Watt), their batteries have to be replaced periodically, which means multiple surgeries for patients. Researchers have searched for ways to prolong battery life – trying to generate energy to power a pacemaker using blood sugar, or the motion of the hands and legs – but these methods either interfere with metabolism or require a more drastic surgery, such as passing a wire from the limbs to the chest area. Aerospace engineers from the University of Michigan in Ann Arbor have developed a prototype device that could power a pacemaker using a source that is surprisingly close to the heart of the matter: vibrations in the chest cavity that are due mainly to heartbeats.

The authors describe the technique and their progress developing it in a paper recently published in the AIP's *Applied Physics Letters*. In their method, vibrations in the chest cavity deform a layer of piezoelectric material, which is able to convert mechanical stress into electrical current. Tests indicate that the device could perform at heart rates from 7 to 700 beats per minute (well below and above the normal range), and that it could deliver eight times the energy required for a pacemaker. Furthermore, the authors write, the amount of energy generated is always larger than the amount required to run a pacemaker, regardless of heart rate. Though the team has yet to develop a prototype that is biocompatible, they say that the potential to package this energy

harvester with pacemakers gives it an advantage over competing methods.

More information: "Powering Pacemakers from Heartbeat Vibrations Using Linear and Nonlinear Energy Harvesters" is published in *Applied Physics Letters.*

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