

TO  
SYNTHETIC OIL,  
THIS FILTER  
IS A MATCH  
MADE IN  
ENGINE HEAVEN.



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- 99% efficient\*
- Designed for synthetic oil
- Wire media support

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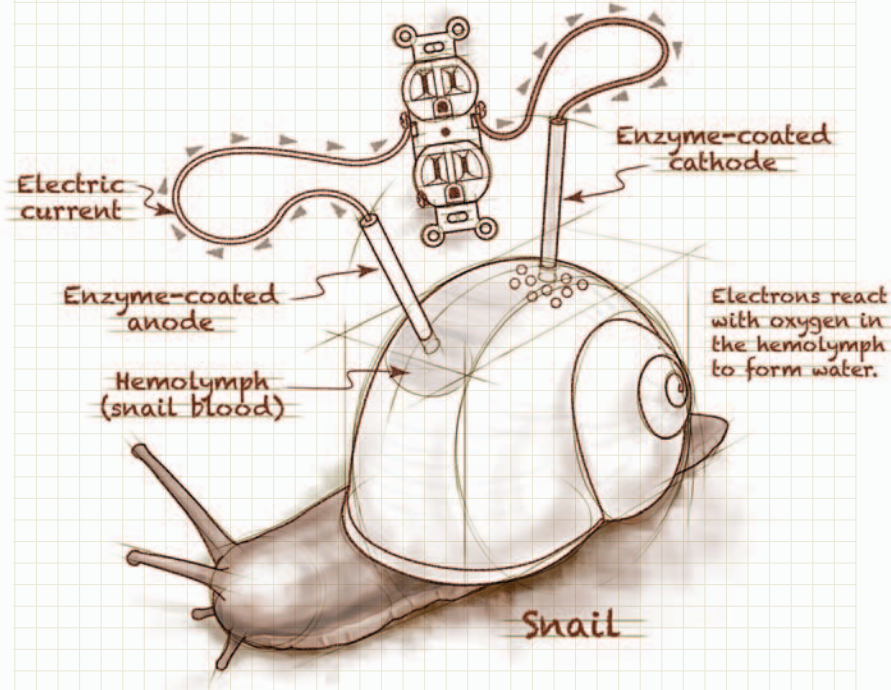


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The energy contained in a can of soda could power a 60-watt lightbulb for three hours.



ROUGH SKETCH

## Blood Cell

“A snail could be used as a battery to power small sensors”

**O**ur biofuel cell generates power from glucose sugar in a snail's body. We drill holes through the shell and implant enzyme-coated electrodes in the hemolymph, or snail blood, that naturally collects between the snail's body and shell. Like any battery, ours is based on chemical reactions that create a flow of electrons. One electrode grabs electrons from glucose in the hemolymph. The electrons then travel through an external circuit—including any device we want to power—and end up at the opposing electrode. There, the electrons react with oxygen in the hemolymph to form water. The power output is small, in the range of microwatts, and runs out after a few minutes as the glucose is depleted. After harvesting energy, the snail eats and drinks, restoring glucose levels in its body, and it can then generate power again. The snails don't appear to be harmed by the biocell.

The cell's power output is limited by two factors: (1) the amount of glucose in the snail's small body and (2) the time glucose takes to diffuse over to the electrode. If doctors implanted something like the biofuel cell in a person instead of a snail, we could get a stronger and more consistent flow of electricity, because human blood has more glucose than snail blood and because the human circulatory system would constantly replenish the electrode with fresh glucose (snails don't have a closed circulatory system). The idea is to use human-based variations on our biofuel cell to power implantable medical devices, such as pacemakers. A snail couldn't charge a cellphone, but it could power small sensors. That's another idea—to employ snails, worms and insects for environmental monitoring and homeland security. —Evgeny Katz is a chemist at Clarkson University; as told to Flora Lichtman

TREVOR JOHNSTON