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NEWS  
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**New DNA Computer Functions sans Fuel**

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In 2001, scientists at the Weizmann Institute of Science in Israel announced that they had manufactured a computer so small that a single drop of water would hold a trillion of the machines. The devices used DNA and enzymes as their software and hardware and could collectively perform a billion transitions each second. Now the same team, led by Ehud Shapiro, has announced a novel model of its biomolecular machine that no longer requires an external energy source and performs 50 times faster than its predecessor did. The *Guinness Book of World Records* has crowned it the world's smallest biological computing device.

Many designs for minuscule computers aimed at harnessing the massive storage capacity of DNA have been proposed over the years. Earlier schemes have relied on a molecule known as ATP, which is a common source of energy for cellular reactions, as a fuel source. But in the new set up, a DNA molecule provides both the initial data and sufficient energy to complete the computation. Shapiro and his colleagues describe their DNA computer in a report published online this week by the *Proceedings of the National Academy of Sciences*.

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Both models of the molecular computer are so-called automaton. Given an input string comprised of two different states, an automaton uses predetermined rules to arrive at an output value that answers a particular question. For example, it can determine whether a string containing only a's and b's has an even number of a's, or if all the b's are preceded by a's. In the latest design, two DNA molecules bond together to perform the computational steps. An enzyme known as *FokI* acts as the computer's hardware by cleaving a piece of the input molecule and releasing the energy stored in the bonds. This heat energy then powers the next computation. [The illustration above shows an input DNA molecule (green/blue), software DNA molecules (red/purple) and *FokI* (colored ribbons.)] The authors report that a microliter of solution could hold three trillion computers, which together would perform 66 operations a second. -- Sarah Graham

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