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# TECHNOLOGY

UPDATED:
08:25 a.m. EDT (1225 GMT) September 23, 2003


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# Is life the key to new tech?

By Nick Easen for CNN
Monday, September 22, 2003 Posted: 9:27 AM EDT (1327 GMT)

**(CNN) -- Years have been spent trying to crack life's genetic code with high-powered computers.**

**DNA, the information-rich code of life may hold the key to new computers.**

Now scientists are looking at things from the opposite angle, and are harnessing life itself to generate a new strain of computer devices.

Unleashing the activity and properties of DNA -- life's basic building block -- as well as biologically-inspired computing, could soon form the basis of new devices.

"DNA computing has the potential to perform trillions of calculations at once," Peter Bentley from University College London, told CNN.

"Life is massively more powerful, and able to compute far more than anything we have created," says Bentley.

Although the convergence of biology and technology is in its nascent stages, it is increasingly regarded as the next frontier for science, with potentially endless commercial possibilities.

Scientists have already been trying to find ways of getting DNA -- the information-rich code in every living cell -- to calculate the way conventional computers do.

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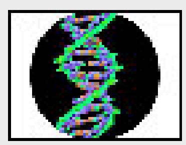

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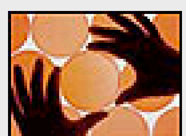

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Recently the first game-playing bio-molecular device was revealed -- an enzyme-powered tic-tac-toe machine, which could not be beaten.

Here organic building blocks act identically to digital logic circuits that we see in everyday electronic computers.

In February of this year the smallest biological computing device was announced -- a microliter of salt solution containing three trillion self-contained DNA computing devices.

It would have had the capacity to perform 66 billion operations per second.

### Ideal candidate for medicine

Their size, and the ease by which DNA computers could interface with living material, may make them an ideal for use in medicine.

"The ultimate application would be a 'doctor in a cell,' where a bio-molecular computer operates in the body," Udi Shapiro of the Israel's Weizmann Institute of Science told CNN.

"It would diagnose the disease by analyzing the data available in its biochemical environment, e.g. the tissue or organ in which it resides, and cure it by synthesizing and delivering the appropriate drug molecules," adds Shapiro, who's team made the world's smallest biological computing device.

But at present, DNA computers are little more than experimental toys, their power is on par with that of pocket calculators, and there is also no real life application in the market place.

And Shapiro believes that for DNA computers to be successful, they would have to go beyond one single application.

Business 2.0: DNA's disciples


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"Like conventional computers, DNA computing would need to be flexible and useful for a million different things," he said.

Scientists' caution that carbon-based or organic computers are unlikely to outdo their silicon-centered cousins, or microchips, anytime soon.

"I do not believe that any of the current (biological) technologies will ever be able to compete with silicon in serious computational problems," Milan Stojanovic, of Columbia University told CNN.

"However, in the control of biological processes, biological computing has its place," adds Stojanovic, who designed the enzyme-powered tic-tac-toe machine.

## A huge gap

Interfacing biology with silicon computers and getting neurons -- or nerve endings -- and cells to talk to chips maybe the most practical application, but at this stage the main stumbling block for bio-molecular computers is their production.

Currently there is a huge gap in the construction of hardware for the semiconductor and the biotechnology industry.

An advance in bio-molecular computers must await a breakthrough in designer enzymes, but this maybe a decade or more away, according to scientists.

"We have many ideas for designing bio-molecular computers, but current biotechnology has no way of producing them," says Shapiro.

Grants from the U.S. National Science Foundation (NSF) and the U.S. National Institute of Health (NIH) have been forthcoming for this kind of work.

NASA, notes Stojanovic, is also interested in futuristic approaches that could be used to follow astronauts' health on long space flights.

## Biologically-inspired

In the future there may also be a market for biologically-inspired computers. Although the science involved sounds similar to bio-molecular computing, they do not rely on real live DNA or any form of life to perform calculations.

Instead the technology analyzes how biology computes, and makes computers think in the same way.

By studying biological phenomena such as brains, swarming insects, evolution and immune systems, scientists are able to make computers do the same sorts of things.