October 12, 2002

Nanotech finds biological inspiration

By Scott R. Burnell
UPI Science News

BETHESDA, Md., Oct. 12 (UPI) -- Nanotechnology research is focusing increasingly on DNA, nature's own molecular-scale instructions, as a possible building block for man-made devices, scientists said Saturday at a conference.

Top Stories

- Tourists flee Bali as death toll hits 190
- Police shrug off report of sniper
- Saddam took their men, so Kurd women work
- Club digs in on allowing women
- Democratic ranks cry for leadership on elections
- U.S. weans itself off oil from Mideast

Nanoscience, which seeks to work with matter at the molecular or even atomic scale, is not particularly interested in the genetic data encoded in the double-helix structure, said Nadrian Seeman, a chemistry professor at New York University in New York City. Instead, scientists are investigating the molecule, which is only 2.5 nanometers wide, for the relative ease with which they can alter its chemical pattern for architectural tasks, Seeman told attendees at the 10th Foresight Conference on Molecular Nanotechnology.

A nanometer is to an inch what an inch is to 400 miles.

"DNA won't ever compete with silicon for computer chips, but it will probably work to organize the next generation of silicon devices," Seeman said.

The molecule is fairly rigid in lengths shorter than 50 nanometers, Seeman said, and multiple strands can be combined to increase its stiffness. Scientists can synthesize artificial, repeatable DNA sequences that will assemble

AP BREAKING NEWS

- Bush: 'Long Way to Go' in Terror War
- Police Doused With Sniper Tips
- Indonesia Blames al-Qaida for Blast
- Britain to Control Northern Ireland
- Bin Laden Alleged to Praise Attacks

UPI BREAKING NEWS
Updated at 9:00 p.m.

- Al Qaida said to be behind Bali carnage
- UPI Political Roundup
- Bush says U.S. can fight on two fronts
- Brazil hikes rates to support currency
- Bali blast will hurt SE Asian tourism
- Extending Hubble's mission considered
- Engine test paves way for rocket's debut

automatically into geometric building blocks, he said.

Theoretical and experimental work has resulted in cubes and more complicated eight-sided structures, Seeman explained. Researchers also have succeeded in engineering "markers" that protrude from the DNA structures to aid in measuring the final results, which could include creating nanoscale patterns to control deposition of inorganic material.

The DNA molecule also could act as scaffolding for the assembly of computer circuits, said Chris Dwyer, a computer science researcher with the University of North Carolina at Chapel Hill.

"Computer engineers are already thinking about how to design circuits using these tools," Dwyer told the conference.

The DNA sequences would hold together metallic structures a few dozen nanometers long to create three-dimensional digital logic elements, Dwyer said. If designers are willing to allow a more time-consuming assembly process, only 15 separate sequences would be enough to fabricate most circuits, he said.

Dwyer's team has simulated a collection of DNA devices that would perform thousands or even millions of calculations all at once, instead of one at a time as with today's computers. The DNA devices would be much larger than the features of current computer chips, but because the process works as a whole instead of layer by layer, it might be a feasible manufacturing alternative for some uses, he said.

DNA-like structures also are capable of mechanical work, said Peixuan Guo, a biophysics researcher at Purdue University in West Lafayette, Ind. Nature has come up with a set of six RNA molecules that form a motor for packing viral DNA into its protein shell, he told the conference.

The structure, one of the most powerful natural nanomotors yet discovered, rotates the biological equivalent of a nut to act on the screw-like DNA, pulling it through, Guo said. His team can reproduce the motor with artificial RNA sequences and turn it off and on using substances found in humans, he said. The structure's "sticky" ends can be altered to latch onto specific substances, meaning it could be used for targeted delivery of virus-like medical treatments, he said.

The conference is organized by the Foresight Institute, a nonprofit organization located in Palo Alto, Calif., which works to ensure the proper development of nanotech and other emerging applications. The conference's primary sponsors include computer systems manufacturer Sun Microsystems of Santa Clara, Calif., and Zyvex, of Richardson, Texas, a company that explores methods of assembling devices molecule by molecule.