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Lab Rat: Small talk

on 04 October 2000, 22:00

by [Niall McKay](#)

For decades, skeptics have dismissed molecular nanotechnology as the dream of crackpots, fools, and technology visionaries.

The skeptics were wrong. Not that the science of manufacturing objects atom by atom has produced cell-sized robots that rush around the bloodstream chomping on cancer cells, injecting miracle serums, and knitting damaged tissue back to its former glory. But in the last two years, there have been new discoveries that may revolutionize the fields of medicine, microprocessors, and synthetic materials. Discoveries such as Northwestern University's new nanolithography techniques used for designing transistors smaller than a molecule, Cornell University's work on how to turn a living cell into a motor, or [NASA](#)'s progress on the development of carbon nanotubes -- super-strong, lightweight materials for use in future spacecraft.

Nanotechnology, it seems, is progressing from the science fiction of books like Neal Stephenson's *Diamond Age* to science fact. [NASA](#), [Sun Microsystems](#), [IBM](#), and [DARPA](#) are among those financing a bevy of new research projects.

MAKING IT REAL

One startup that straddles the worlds of science fiction and reality, perhaps even more than the propeller-heads at the various research institutions, is [Zyvex](#), based in Richardson, Texas.

More akin to a research institution than a startup, Zyvex is dedicated to developing a molecular manufacturing assembler: a device that can build materials by manipulating individual atoms. In theory, an assembler could build practically any material -- gold, diamonds, even wood. Of course, in practice, just picking up one atom, placing it next to another, and getting them to bind together is next to impossible.

I first met Jim Von Ehr -- a soft-spoken Texan who made his fortune by selling Altsys's FreeHand desktop publishing software company to [Macromedia](#) for \$69 million in 1994 -- in 1998. Then, molecular nanotechnology was little more than a pipe dream. Serious money wouldn't touch it. Wowed by a speech given to the [Texas Instruments](#) Young Innovators Awards by the controversial nanotech prophet K. Eric Drexler in 1994, Mr. Von Ehr decided that he would use his money to finance the world's first nanotech startup.

"I couldn't find anybody who was both interested in and capable of creating a startup, so I decided to do it myself," says Mr. Von Ehr, founder and CEO of Zyvex. "I calculated that I could put in \$2 million a year indefinitely. I believed that it could take between 10 to 15 years before we came up with an assembler."

NANO MILESTONE

Zyvex has passed its first milestone. Last year, the company and Washington University in St. Louis managed to pick up single atoms by using a scanning probe microscope (a type of atomic force microscope). Placing the atom with any precision, however, is quite another story.

"Unfortunately, the atomic force microscope does not give us the precision we need," he notes.

So Mr. Von Ehr decided that it was time to go back to the drawing board and rethink the company strategy.

He created three separate divisions: the "bottom-up" lab, composed of molecular chemists trying to get atoms to bind to each other; the "top-down" lab, dedicated to using microelectromechanical systems (MEMS) as the basic cogs and wheels of the nano-assembler; and the "advanced systems" group, dedicated to finding the properties of individual atoms.

"We are trying to hit a single molecule with light and detect the molecule's excitation," says Mr. Von Ehr.

Why bother? Because it's the only way that the company will be able to tell if it's using the right building blocks when it does try to build something.

Currently, the basic raw materials for Zyvex are carbon nanotubes. These are sheets of hexagonal atoms wrapped into the shape of a cylinder. They have a diameter of approximately 1/10,000 the size of a human hair, are capable of carrying a very high current, and are about 100 times stronger than steel. They are also more expensive than cocaine (costing around \$1,000 per gram) and are produced by universities and research institutions.

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