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Medicine balls

on 21 March 2001, 22:00



by [Niall McKay](#)

For 15 years, oncologist Dr. Uri Sagman, M.D., treated cancer patients in Toronto, Canada. As such, he had to live with the grim reality of the disease, like when a 20-year-old woman with breast cancer walked into his office holding a baby in her arms, and he had to tell her she was going to die.

Several years ago, Dr. Sagman decided that it was time to stop treating the symptoms and start finding cures. After some research, he stumbled across buckyballs, also known as fullerenes (named after R. Buckminster Fuller, designer of the geodesic dome). These are tiny geodesic-dome-shaped carbon molecules that could revolutionize the drug delivery business. They are so tiny, in fact, it would take 1 million of them to make up the diameter of a human hair. Unroll them and you have a material not unlike miniature chicken wire. This property, together with their size, strength, and nontoxicity (they are a simple carbon molecule), makes it possible for scientists to treat them as miniature pincushions, sticking various drug compounds into the chicken wire-like structure and putting them into the human body for deployment.

There was just one problem: the science is still in its infancy, and that means university research scientists are doing most of the pioneering work.

Dr. Sagman saw his opportunity. He joined forces with Stephen Wilson, professor of chemistry at New York University, and started [C Sixty](#), a company that raises venture capital and invests it in university research that furthers the modification of the fullerene molecule. It then takes the technology, helps commercialize it, and sells it to pharmaceutical companies. So far, the company has been able to sign up several prestigious universities: the University of California at Los Angeles, Columbia University, Rice University, Dartmouth College, and the University of Taiwan.

KILLER APP Only a few years ago Dr. Sagman's pitch would have been a much tougher sell because buckyballs (which were discovered in 1985 by Dr. Richard Smalley of Rice University) were considered near the fringe of science in the emerging discipline of nanotechnology. But times have changed. Just last year it was discovered that coating the tiny structures in sugar or other water-soluble compounds enables them to be discharged with the rest of the waste in the human body through the renal system or kidneys. And the outlook for buckyballs is very bright.

"There is no doubt that the killer application for buckyballs and their by-product, carbon nanotubes [sheets of buckyballs rolled into a cylindrical shape], will be in the life sciences industry," says Deepak Srivastava, senior scientist at NASA's AMES Research Facility in Silicon Valley, California, who is working on nanotube-based biosensors.

More recently, companies like IBM (NYSE: IBM) and Xerox (NYSE: XRX) have been investigating the use of buckyballs as electronic components or for energy storage. Indeed, next month Mitsubishi will announce a new division, called Mitsubishi Corporation-Fullerenes, dedicated to manufacturing and exploiting the properties of buckyballs.

SINKING PRICES, RISING HOPE Three years ago, the cost of the molecules was prohibitive, but recently prices have dropped dramatically from about \$600 per gram to about \$30 per gram. That price is expected to fall again to about \$10 per gram by 2002, according to Dr. Lon Wilson, chemistry professor at Rice University.

What's all this mean for potential treatments? Dr. Sagman believes that the first commercial application for buckyballs is likely to be for the treatment of HIV. Buckyballs fit perfectly into the socket in the HIV protease enzyme, which is responsible for the growth of the disease in the body.

"Think of it as a stopper fitting perfectly into a drain," says Dr. Wilson. "This is an extremely effective way to deliver the HIV drugs, and it's even effective against the many drug-resistant strains of HIV that are appearing today."

With HIV making a serious comeback and nearly 35 million people infected with the disease worldwide in 2000, we need new and stronger drugs and drug-delivery methods.

So far C Sixty has completed successful animal testing of the drug-delivery method and hopes that it will enter the Food and Drug Administration approval process as early as next year.

But HIV is not the only disease that can be treated with fullerene-based drugs. The carbon compound is also thought to be effective against cancer. Buckyballs can be,

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