Injected into a healthy mouse,nanoparticles of cadmium selenide glow under ultraviolet light. Such quantum dots can enter cancers and help surgeons remove sick cells without harming healthy ones.

A Cure for Cancer?

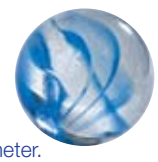
In the 1966 science-fiction film *The Fantastic Voyage*, a team of scientists and doctors are shrunk to microscopic[1] size and injected[2] into the body of an injured man to save his life. The tiny crew travels through the body's dangerous environment to locate and repair the damaged part of the man's body. Eventually the group manages to complete their task and the man awakens, fully cured.

Such an idea, while fun, sounds extraordinary to many. But what if it were possible to cure a disease like cancer, using tiny particles[3] injected into a person—particles that would not only find the cancer, but also destroy it without harming anything else in the body? Although it may seem like science fiction, tools like this are now being developed and may, in fact, become common in the near future—thanks to research currently being done in the field of nanotechnology.

The main thing to know about nanotechnology is that it's small—really small. The prefix "nano" refers to a nanometer, which is one-billionth of a meter. How small is that exactly? A comma on a page of a book or magazine, for instance, may be more than half a million nanometers wide. Understanding the "science of small" may eventually allow doctors to diagnose and cure illnesses like heart disease and cancer early, before they can do extensive damage to the body.

Researcher Ted Sargent, a leader in the field of nanotechnology, describes how using quantum dots[4]—particles that are a few nanometers in size—will help diagnose disease. The particles, Sargent explains, shine brightly when exposed to UV light. These particles can be inserted into the body and programmed to bond only to a certain type of cell—a particular cancer cell, for example. Doctors can then use a camera and look for the colored particles, which will help them determine where cancer cells are growing in a person's body.

◀ Millions of hairs on a gecko's toes are split into hundreds of tips, each 200 nanometers wide. The faint attraction between each of these tips and a surface, multiplied millions of times, allows a gecko to hold on upside-down to glass.



A nanometer is one-billionth of a meter. That's like comparing the size of a marble to the size of Earth. ▶

[1] If something is **microscopic**, it is so small you cannot see it with your eyes only.

[2] If you **inject** something into your body, you put it into your body using a needle.

[3] A **particle** is a very small piece of something.

[4] A **dot** is a very small round mark, like the period (.) at the end of this sentence.

Using this technology, it will be possible to detect cancer at a stage when there are perhaps only a thousand bad cells. Compare this to what happens today: doctors can diagnose cancer only after the dangerous cells have multiplied into the millions and developed into a tumor. One of the advantages of detecting and treating cancer at an early stage is that the cells are less likely to become resistant to drug treatment. In later stages, cancer cells often change and adapt to certain drugs so rapidly that many medicines become ineffective.

Once a certain type of cancer is detected, nanotechnology will also radically improve the way it is treated. Right now, most cancer treatments kill not only the cancerous cells but the healthy ones as well, causing a number of side effects in people, such as hair loss, nausea, and intense pain. Nanoparticles, on the other hand, will allow doctors to attack cancerous tumors without disturbing healthy cells. The goal will be to deliver cancer-killing drugs, carried via the nanoparticles, to the bad cells only. A second method will be to destroy cancer cells (identified by nanoparticles) using laser rays. Ultimately, technologies like this will allow doctors to deliver cancer treatment earlier, faster, and more thoroughly, with fewer side effects.

Unfortunately, even though nanoparticles have great medical potential, there are serious concerns that these same materials could have negative environmental and health effects. In recent studies, fish exposed to water containing large amounts of nanoparticles suffered brain damage. And people are at risk as well. After exposing lab-grown human cells to water containing large amounts of nanoparticles, researchers found that half the human cells died.

Because nanotechnology is so potentially useful, many scientists don't think research into its many uses should be stopped; learning more about nanotechnology should remain a priority. But scientists do believe that governments should allocate more money for safety-related studies—to make sure that large concentrations of nanoparticles do not get into our food and water supplies and cause serious problems.

Meanwhile, research into the uses of nanotechnology in health and many other fields continues. "What's amazing is how quickly this is evolving," says chemist Vicki Colvin. "Even ten years ago, a lot of these applications would have seemed pretty unrealistic." Perhaps that old movie, *The Fantastic Voyage*, isn't so hard to believe after all.

▼ Nanotechnology promises treatment for cancer. In this illustration, tiny gold-coated spheres 200 nanometers across are injected into a patient. They enter cancerous cells, and when the tumor is hit with an infrared laser, they heat up, destroying the cancerous cells without harming healthy cells.