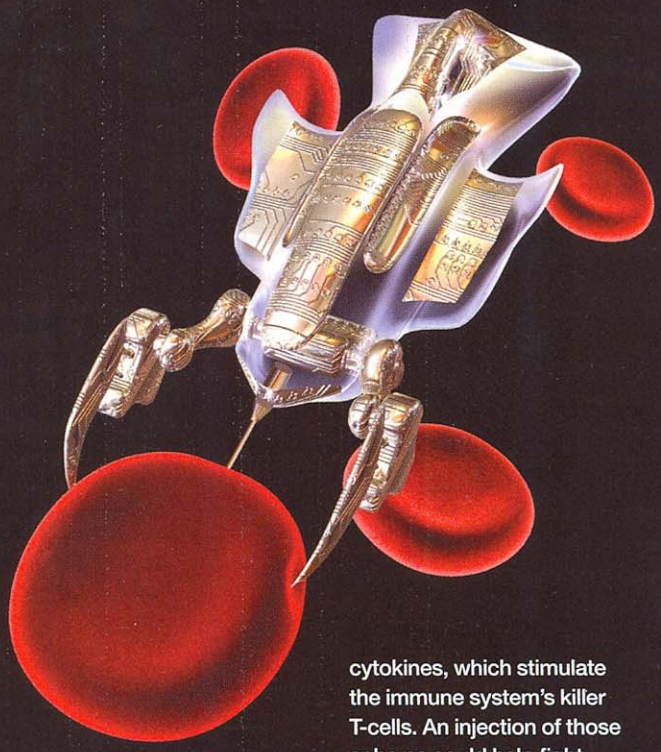
20 THINGS YOU DIDN'T KNOW ABOUT NANOTECHNOLOGY



1 Get small. A nanometer is about the width of a strand of DNA; if you design, build, or use functional systems smaller than 100 of these, you're a nanotechnologist.

2 By that definition, we have been doing nanotech for centuries. For instance, the colors in medieval stained glass windows result from nanocrystals created in the heating and cooling of the glass.

3 Size matters. At the nano scale, materials take on unusual properties. Their color, transparency, and melting point often differ significantly from those of larger clumps of the same stuff.

4 Nanoscale bits of metal oxide, carbon fiber, or metal blends can detoxify hazardous waste: Their extreme solubility and chemical reactivity help them zero in on the nasty stuff.

5 This approach is already being used at sites in a dozen states, mostly to clean groundwater fouled by solvents, metals, and petroleum.

6 Brighter colors! Richer flavors! Less spoilage! Those are some of the reasons why companies are dumping nanoparticles into hundreds of products, including cosmetics, sunscreens, and food.

7 Analysts say the global market for manufactured goods using nanomaterials could hit $1.6 trillion by 2013.

8 Uh-oh. Studies show that nanoparticles can work their way into the bloodstream, penetrate cells, and get past the blood-brain barrier. Research has linked such particles to lung damage; the brain may be affected too.

9 But if those particles don't kill us, they just might save us. Scientists at U.C. San Diego have designed a fluorescent nanoparticle that glows inside the body, making it easier to image tumors and organ damage.

10 Yale researchers have created plastic nanospheres that encapsulate proteins called cytokines, which stimulate the immune system's killer T-cells. An injection of those spheres could help fight disease and infection.

11 And in a University of Southern California lab, nanotubes have been used to create synthetic neurons.

12 The USC team is trying to assemble these neurons into functional networks, which would bring us closer to assistive brain implants.

13 In 1989, using an atomic force microscope, IBM engineer Don Eigler became the first person to move and control a single atom.

14 Eigler and his team later used 35 xenon atoms to spell out "IBM," thus performing the world's smallest PR stunt.

15 Atoms? Big whoop. Researchers at Princeton and U.C. Santa Barbara can control the spin of a single *electron*, trapping it in a "corral" created by applying voltage to minuscule electrodes.

16 But they're not playing cowboy. The breakthrough could lead to powerful quantum computers that store and manipulate data in the spin of individual electrons.

17 Not to be outdone, Stanford scientists used scanning tunneling microscopy and holograms to write information within the interference patterns formed by electron waves on a copper sheet. The letters are less than a third the size of Eigler's "IBM."

18 Government researchers have created arrays of chromium nanodots that can store magnetic data with unprecedented uniformity. One goal: drawing more complex integrated circuits on silicon chips.

19 For the rodent who has everything. Georgia Tech scientists made piezoelectric generators out of nanowires and attached them to tiny hamster jackets. When the critters ran, the generators created electricity.

20 Zhong Lin Wang, co-inventor of the jacket, envisions a shirt that charges your cell phone as you stroll, or an implanted device for measuring blood pressure that's powered by your own heartbeat. REBECCA COFFEY

DISCOVER® (ISSN 0274-7529) is published monthly, except for combined issues in January/February and July/August, by Discover Media LLC, 90 Fifth Avenue, New York, NY 10011. Volume 31, number 6; copyright 2010 Discover Media LLC. Periodical postage paid at New York, NY, and at additional mailing offices. In Canada, mailed under publication mail agreement 41245035, P.O. Box 875, STN A Windsor, ON, N9A 6P2. GST Registration #817800345RT0001. SUBSCRIPTIONS: In the U.S., $29.95 for one year; in Canada, $39.95 for one year (U.S. funds only), includes GST; other foreign countries, $44.95 for one year (U.S. funds only). Back issues available. POSTMASTER: Please address all subscription correspondence, including change of address, to DISCOVER, P.O. Box 37808, Boone, IA 50037, or call toll-free 800-829-9132; outside the U.S.A., 515-247-7569. Printed in the U.S.A.