tors say, Simmons produced results that were in line with expectations.

After university officials were told of the co-worker's suspicions, they decided to investigate by laying an artfully designed trap. Simmons was asked to test cells that he was told should produce one type of result when, in fact, they should have produced the opposite. ORI documents explain that the test was designed to rule out the possibility that the whistle-blower was acting out of "possible frustration or anger at being unable to replicate Dr. Simmons['s] work [and] had himself spiked the vials." Simmons failed the test, and on 29 April 1999 university officials placed him on administrative leave. He resigned 2 months later following an investigation by three UT Southwestern academics—Frederick Bonte, head of the radiology department; Paul Bergstresser, head of the dermatology department; and James Forman, an immunology professor.

Simmons also falsified results on samples sent to him by collaborating researchers, concluded a subsequent investigation conducted by ORI. "A preponderance of the evidence" showed that Simmons had "systematically" falsified results "throughout his tenure as a graduate student and postdoctoral fellow," states the ORI report. Despite earlier denials of the allegations, Simmons signed an ORI settlement agreement on 10 August that called for the retraction of the 1997 *Immunity* paper and three others published since 1993 in the *Journal of Immunology and Immunogenetics*. A table in a 1998 *Journal of Experimental Medicine* paper was also withdrawn.

In the aftermath of the revelations, some of Simmons's former collaborators at The Jackson Laboratory in Bar Harbor, Maine, and the Wellcome Human Genetics Center in Oxford, U.K., are taking a tougher approach to cooperative research. "It's made me much more careful," says Derry Roopenian of the Jackson Lab, noting that he now deliberately hides the identity of reagents and other shared molecular tools from cooperating researchers in order to "blind" experiments. But most of all, Roopenian is upset that a number of young scientists—in his lab and elsewhere—"wasted a lot of time and money trying to reproduce results that weren't real to begin with."

–DAVID MALAKOFF

BIOTERRORISM

Experts Call Fungus Threat Poppycock

CAMBRIDGE, U.K.—The script seems straight from a John LeCarré novel. A former bioweapons lab in Uzbekistan tinkers with a fungus that destroys opium poppies, which Western antinarcotic teams then unleash on poppy fields in Afghanistan. Furious, Afghan heroin cartels retaliate by modifying the fungus to kill food crops in Western countries.

Far afield. British documentary on how an opium fungus could become a bioweapon is greeted with skepticism.

True? A documentary that was aired last week by the BBC and created a stir here paints the scenario as plausible. But experts contacted by *Science* play down the threat.

The real-life story begins in December 1989. A Soviet deputy minister "raised the issue of biological control of illicit narcotic crops" with a U.S. assistant secretary of state, according to Eric Rosenquist, head of the narcotics research program at the U.S. Department of Agriculture's Agricultural Research Service (ARS). The Soviet Union then approached the United Nations Drug Control Program (UNDCP) with proposals to develop biocontrol agents against opium poppies and marijuana plants that may be more effective and environmentally benign than herbicides, including 2,4-D and glyphosate. After the Soviet Union unravelled, several institutes—including some former bioweapons labs—pursued these proposals with help from the UNDCP.

One such lab, the Institute of Genetics in Tashkent, Uzbekistan, approached the U.S. embassy in Tashkent in May 1996 with its research on a naturally occurring fungus, *Pleospora papaveracea*, that kills poppies by attacking their roots. The institute, which the Soviet military had backed to develop agents to destroy crops, subsequently received U.S. and British funding.

The institute is now testing a version of *P. papaveracea* that can be sprayed from a plane. Research shows that the fungus doesn't affect any of 130 closely related plant species. On a recent visit by *Science* to the lab, institute director Abdusattar Abdukarimov said that the treatment could be deployed in a few years and that the research site, near the Afghan border, is heavily guarded.

The BBC program, "Britain's Secret War on Drugs," recycles concerns raised 2 years ago in the media that the Uzbek institute's efforts "touch the edge of biological warfare." In the program, Paul Rogers, a plant pathologist at the University of Bradford in the U.K., says the work "is providing new evidence as to how biological warfare could be used against crops." He later told *The Guardian* that "drug cartels could themselves acquire the technology and in revenge attacks use a form of agricultural terrorism against Britain or the U.S."

Other experts, however, play down such fears. "If drug cartels did acquire the fungus, they would have to adapt it to become a pathogen of food crops, and this would not be a trivial project," says plant pathologist Jan Leach of Kansas State University in Manhattan. Rosenquist questions whether *P. papaveracea* will ever become the weapon of choice against opium poppies. So far, he says, from the ARS's perspective the field tests have fallen short of showing its effectiveness as a herbicide.

Ironically, learning how *P. papaveracea* behaves and how to target it to certain fields may someday protect legitimate opium poppy plantations. The Uzbek work, says Rosenquist, could help "safeguard world supplies of analgesics" such as morphine.

–RICHARD STONE

CHEMISTRY

New Reaction Promises Nanotubes by the Kilo

Nine years ago, the news roused the slow-but-steady world of organic chemistry like a double espresso: Japanese researchers had discovered that carbon atoms can assemble themselves into tiny tubes with amazing properties. One hundred times as strong as steel and able to conduct like either metals or semiconductors, carbon nanotubes were soon being touted for uses as down to earth as lightweight fuel tanks and car bumpers and as fanciful as cables for elevators into space. The hitch, so far, has been that the most promising tubes—single layers of carbon atoms arrayed like sheets of rolled-up chicken wire—can be made only by the thimbleful. As a result, they have cost up to $2000 a gram, enough to make a single nanotube-based fuel tank worth more than a fleet of Lamborghini automobiles. But perhaps no longer.

At a meeting in Boston* last week, researchers from Rice University in Houston,

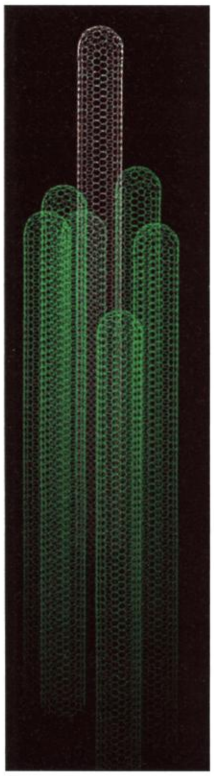
* American Vacuum Society, 47th International Symposium, Boston, Massachusetts, 2–6 October.

CREDITS: (TOP) AP PHOTO

Texas, reported a new chemical process for making single-walled nanotubes (SWNTs), potentially by the kilogram. The scheme combines simple and abundant gaseous precursors that react to form iron-based catalyst particles, which then promote the growth of the nanotubes. And because that type of gas-phase synthesis is akin to the way bulk plastics are made today, the new scheme has clear potential to be scaled up to make industrial quantities. "Within the next year we should easily be able to produce 10 kilograms of this stuff [in the lab]," says Richard Smalley, the leader of the Rice team, who shared the 1996 Nobel Prize in chemistry for his part in the discovery of fullerenes, a class of three-dimensional carbon molecules that includes nanotubes.

"It's a very important development that nanotubes can be made in big quantities," says Walt de Heer, a nanotube expert at the Georgia Institute of Technology in Atlanta. "It implies that the price [of nanotubes] will come down, and this could allow their use as large-scale construction materials." Still, de Heer cautions that inexpensive ingredients don't guarantee low costs. The round fullerenes known as buckyballs can be made from cheap starting materials, he points out, yet they remain more expensive than gold.

Smalley's new scheme isn't the first to use catalysts to create nanotubes. In 1995, his team at Rice came up with a method that blasts a graphite target with lasers in the presence of catalytic metal particles. The intense heat generated by the lasers blasts the graphite into a vapor of carbon atoms, which the metal particles then help to coalesce into nanotubes. But the laser apparatus is expensive and has yielded only about 300 grams of SWNTs in the past 2 years. What's more, the tangle of SWNTs that the process creates is contaminated with about 10% carbon soot, which must then be removed in another step to yield the pure nanotubes.



High hopes. Gas-phase process might yield nanotubes at nanoprices.

CREDITS: (LEFT TO RIGHT) CENTER FOR NANOSCALE SCIENCE AND TECHNOLOGY/RICE UNIVERSITY; THE COULSTON FOUNDATION

In search of better results, Smalley and his postdocs Michael Bronikowski and Peter Willis took a hint from the bulk-plastics industry. They looked for ways to make both the catalyst and nanotube starting materials gaseous. The key turned out to be a molecule called iron pentacarbonele, which has an iron atom surrounded by five carbon monoxide (CO) groups. They spray this compound along with additional CO into a chamber heated to about 1000°C. The heat rips the CO arms off the iron atoms, leaving the lone atoms energetically unhappy and eager to bond with one another to form more stable clusters. And—as in the laser SWNT scheme—those metal clusters excel at producing SWNTs. Meanwhile, the high temperature also causes CO molecules to react with one another to form the more stable CO_2, leaving behind lone carbon atoms, which quickly find the iron nanoparticles and begin to grow a SWNT. "The SWNTs just fall out of the chamber in an essentially pure form," Smalley says.

Still, Smalley cautions, "this isn't the ultimate" when it comes to making SWNTs. The tubes, he says, wind up as a tangled mat rather than perfectly aligned fibers. They also vary slightly in diameter, a drawback that can create tubes with a range of electronic properties. But Smalley and colleagues are confident that they can iron out the glitches. Last week, they announced that they were forming a new company—Carbon Nanotechnologies Inc.—to commercialize their SWNT production process. If their scale-up plans pay off, they may finally turn nanotubes from a research curiosity into the technological successor to plastics.

—ROBERT F. SERVICE

NEUROSCIENCE

Video Game Images Persist Despite Amnesia

The video game Tetris can be found on computers in almost any lab; grad students need their entertainment, after all. But few researchers have put the game to more explicitly scientific use than Robert Stickgold and his colleagues at Harvard Medical School in Boston. On page 350, they report the results of new work in which they used the game—which involves spatial reasoning to slot falling blocks strategically into place (see diagram)—to study how the brain reviews what it has learned.

The researchers found that people who have just learned to play Tetris have vivid images of the game pieces floating before their eyes as they fall asleep, a phenomenon the researchers say is critical for building memories. Neuroscientists have long known that memory consolidation goes on during sleep. But much more surprisingly, the team also found that the images appear to people with amnesia who have played the game—even though they have no recollection of having done so. Apparently, Stickgold says, the am-

ScienceScope

O Give Me a Home The fate of 288 chimpanzees used for research remains uncertain after the National Institutes of Health (NIH) rejected a proposal from their current caretakers to continue housing them.

The NIH assumed ownership of the chimpanzees in May after a settlement with the U.S. Department of Agriculture's office of animal welfare required the Coulston Foundation of Alamogordo, New Mexico, to give up ownership of the animals (*Science*, 12 May, p. 943). NIH then announced a competition for their care, to which Coulston applied. But on 5 October NIH sent a letter to Coulston, saying that an outside review committee had found its proposal unacceptable. The decision leaves Coulston temporarily in charge of the animals.

The latest decision is "an extension of NIH's mismanagement and irresponsibility," says Suzanne Roy, program officer of In Defense of Animals (IDA), a California-based animal-rights group. "We're working as fast as we can" to recruit another caretaker for the animals, counters John Stranberg, NIH's director of comparative medicine.

Sausagemakers The White House and Congress reached a tentative deal late last week on a 2001 spending bill that contains good news for NASA and the National Science Foundation (NSF). But at press time officials at both agencies were still waiting to learn what strings had been attached and how legislators planned to finish their work.

The bill would give NSF a 13.5% increase, to \$4.4 billion, from its current \$3.9 billion budget. That's close to the Administration's 17.3% request and much higher than the versions passed earlier this year by the House and a key Senate committee.

The \$14.3 billion for NASA would be \$250 million above the request and a sharp improvement over earlier bills, which were below what the agency had proposed (*Science*, 22 September, p. 2018). The additional funding would take care of most—although not all—of the pork-barrel projects larded into the conference bill by lawmakers. But it's not expected to rescue a Pluto mission or other moribund space science efforts.

Contributors: Richard Kerr, Robert Koenig, Gretchen Vogel, Andrew Lawler and Jeffrey Mervis