cials declared that the patent, awarded to the University of Edinburgh, U.K., should have been restricted to "nonhuman" animals to prevent the possible cloning of humans. The German government has announced its intention to file a formal complaint, and the company licensed to use the technology says it is eager to work with EPO officials "to rectify the problem."

The patent covers a genetic selection method for purifying the highly treasured stem cells, a possible fountain of youth for all kinds of deteriorating organs. The last of its 48 claims refers to "a method of preparing a transgenic animal" using the stem cells. The patent uses the term "animal" in its scientific sense, to include humans. But that definition flies in the face of European patent guidelines that explicitly prohibit the patenting of processes that tinker with the genetic makeup of humans.

The apparent breaching of those guidelines sent activists into the streets in Munich, where they bricked up the main EPO entrance during a 22 February rally. "Issuing a patent that can be applied to create genetically engineered human embryos poses both ethical and legal problems," says Christoph Then, a gene technology expert at Greenpeace, the organizer of the event. The day before, Greenpeace had published a report on the patent that coincided with an article in *Financial Times Germany*.

Later that day, EPO issued a statement that admitted its "error" and said the EPO "regrets that it has occurred." But EPO can't erase that mistake by itself, says spokesperson Rainer Osterwalder. Critics have 9 months to respond to any patent issued, he explains, after which EPO will review the comments and take action. Any change in the patent could take several years, he notes. A day later, the German ministers of Health, of Education and Research, and of Justice decided to challenge EPO's decision.

But the controversy may not drag on that long. Co-inventor Peter Mountford, chief scientific officer of Stem Cell Sciences (SCS) in Melbourne, Australia, which has an exclusive license on the technology, says the company's goal is to coax the isolated stem cells to turn into several different cell types, such as nerve cells or liver cells, and then use them in drug-screening assays. "That would allow us to save lots of laboratory animals," says Mountford. SCS is "already talking to the EPO and exploring possibilities for clearing up the mistake," says George Schlich, the company's patent attorney.

In the long run, SCS also plans to develop cell replacement therapies for certain human disorders, such as neurodegenerative diseases or diabetes. "But the company never intended to produce genetically engineered humans," Mountford insists. Then says he never thought so, but he wonders if human stem cells "will be taken out of the patent entirely" given some of the company's therapeutic goals.

In the meantime, the patent remains in effect, and work, mainly with rodent stem cells, continues in Australia and in the United Kingdom, under co-inventor Austin Smith. Even so, a patent does not sanction work that violates national laws, notes Osterwalder, and neither country allows human cloning. —MICHAEL HAGMANN

CHEMISTRY

Novel Catalyst Runs Quick and Clean

Score at least a partial victory for green chemistry, the campaign to make industrial processes more environmentally benign. On page 1636 of this issue, three researchers at Delft University of Technology in the Netherlands report a way to clean up a commonplace family of chemical reactions—turning alcohols into aldehydes, ketones, and carboxylic acids, starting materials for everything from pharmaceuticals to fragrances. The Dutch work replaces reactions that rely on the toxic heavy metal chromium and dangerous organic solvents with alternatives that work with everyday oxygen and water. If adopted by industry, the new process has the potential to displace thousands of tons of hazardous waste every year.

"It's very interesting chemistry," says Terry Collins, a chemist at Carnegie Mellon University in Pittsburgh, Pennsylvania. "Getting rid of chromium is a great thing to be doing." Collins and others caution that the new method of converting alcohols to other compounds may not be quite ready for prime time. But in the lab, at least, it far outshines the standard approach.

Alcohols are short hydrocarbons that harbor an extra oxygen and hydrogen atom. To transform them, chemists must oxidize them in a controlled manner by stripping off two or three hydrogen atoms. The widely used oxidant chromium oxide is a master at such reactions, so thirsty for electrons that it readily swipes a pair of electrons from an alcohol's hydrogen atoms and pulls the protons along with them for good measure.

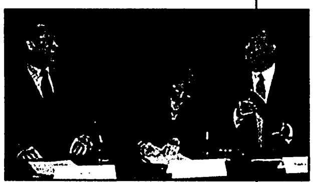
The problem is that once satiated, the chromium oxide is unable to give up the hydrogens again. To transform another alcohol molecule, more chromium is needed, so waste is generated as fast as the desired product is. To get rid of chromium, the Delft researchers—organic chemists Roger Sheldon and Isabel Arends and graduate student Gerd-Jan ten Brink—sought a catalyst that could perform the same reaction over and

ScienceScope

Second Helping Thrilled by the response to a 1997 program to refit university laboratories, the Canadian government surprised academe on Monday by announcing that it would pump an additional $615 million into the Canada Foundation for Innovation (CFI) for ongoing rejuvenation of academic research infrastructure.

The money is part of the government's 2000–01 budget, which starts on 1 April. With the CFI awash in applications and its existing $680 million endowment scheduled to run dry next year, a cash injection is needed to maintain "one of the cornerstones of our plan to support the new economy," says Finance Minister Paul Martin. Martin also announced that Ottawa will spend $109 million to establish five centers for genome mapping and proteomics. The new investments, combined with existing plans to spend $245 million over 3 years to create 2000 new research chairs (*Science*, 22 October 1999, p. 651), represent a "significant" reaffirmation of the value of academic research, says Robert Giroux, president of the Association of Universities and Colleges of Canada.

Brain Trust In one of the largest gifts ever to a U.S. university, a high-tech couple is giving $350 million over the next 20 years to the Massachusetts Institute of Technology (MIT) for a brain research center. The new McGovern Institute for Brain Research, based at MIT in Cambridge, Massachusetts, will be directed by MIT molecular biologist Phillip Sharp.



CREDIT: D. COVENEY/MIT

The McGoverns (right, with MIT president Charles Vest) have deep connections to MIT. Patrick McGovern studied neuroscience as an undergraduate and later founded the International Data Group, a $2.6 billion computer publishing company in Framingham, Massachusetts. Lore Harp McGovern, a computer entrepreneur, has chaired the board of MIT's Whitehead Institute for Biomedical Research for the past 3 years. The McGoverns said their gift will enable neuroscientists to "address the daunting complexity of the mammalian brain and to begin to understand the biological basis for human thought, language, and behavior." Sharp, a Nobel laureate, says he plans to assemble a team of 16 investigators, including 10 with faculty appointments, in biology, computer science, and linguistics.

Contributors: Wayne Kondro and David Malakoff

over again without being used up in the process. Other groups had shown that a palladium atom linked to an organic group called phenanthroline—a trio of hydrocarbon rings—was capable of just that sort of catalysis. The palladium atoms initially snatch hydrogens from the alcohols but later give them up to oxygen atoms in the solvent, generating water and returning the catalyst to its original state. Thus, even though palladium is expensive, far less of it is needed to run the reaction. The rare metal is also less toxic than chromium, another environmental benefit.

That took care of the chromium, but problems remained. The process still required dangerous organic solvents. What's more, recovering the reaction products from the mix of solvent and catalyst required turning up the heat to distill the solvent, a treatment that could destroy the catalyst, ten Brink says.

Sheldon and his colleagues set out to coax similar palladium catalysts to work in a friendlier solvent: water. By linking palladium to phenanthrolines modified with sulfur-containing groups, they made the catalyst water soluble. When the researchers added various alcohols, they found that the catalyst worked well, especially when helped by a common basic compound such as sodium hydroxide, which speeds the reaction by plucking hydrogens off the alcohol. And because the oily reaction products—the useful aldehydes, ketones, and most carboxylic acids—do not dissolve in water, they float atop the palladium solution, where chemists can easily siphon them off while keeping the catalyst intact.

So far the Delft team has shown that the catalyst neatly strips hydrogens from 10 different simple alcohols. If it works equally well on more complex molecules, such as those with delicate appendages that are used widely in organic chemistry, then it could be useful for a wide variety of lab reactions, Collins says. But making the jump to industrial scale could be challenging, says Joseph DeSimone, a chemist at the University of North Carolina, Chapel Hill. The difficulty, ironically, is in the water. "Water-based systems inevitably get contaminated in the process," DeSimone says; even though oily products don't mix with water easily, it takes expensive distillation processes to get them all out. Sheldon counters, however, that reusing the catalyst solution over and over will keep water waste to a minimum.

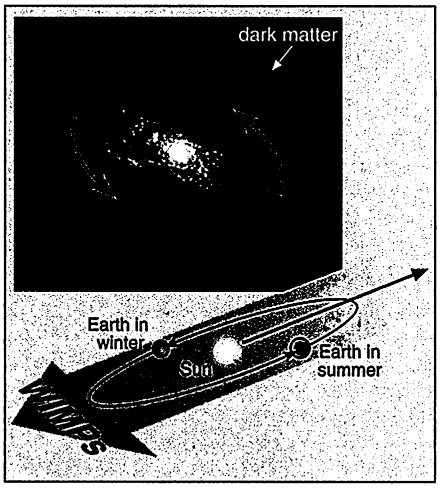
Both agree that it will likely be up to industry researchers to work out such practical issues and see whether the new process is economical. "Finding chemistry that is safe, cheap, and environmentally friendly isn't always easy," DeSimone says. But, he adds, "that's what makes it good science."

–**ROBERT F. SERVICE**

ASTROPHYSICS

WIMPs at Last? Or More Wimpy Sightings?

In the latest chapter in a decades-long whodunit, a group of physicists claims to have identified dark matter, the shadowy stuff thought to account for 90% of the universe's mass. Researchers from the Dark Matter experiment (DAMA) at Gran Sasso National Laboratory in Italy reported on 25 February that the number of particles entering their underground detector varies slightly with the seasons. The result, they say, proves that the Milky Way galaxy twirls in the midst of a gigantic cloud of weakly interacting massive particles, or WIMPs. But the case isn't quite closed: Physicists conducting the Cold Dark Matter Search (CDMS) at Stanford University in Palo Alto, California, reported at the same conference* that they see no evidence of the particles.



Against the wind. Particle counts should increase if Earth swings into a flow of cosmic WIMPs.

Physicists and astronomers have long known that there must be more mass in the universe than meets the eye. If not, the galaxies themselves should fly apart. Like riders on a fast-spinning carousel, the stars whirling around a galaxy are flung outward by their own inertia. Indeed, in the outer reaches of a spiral galaxy like the Milky Way, the stars travel so fast that the gravity from all the other matter that can be seen in the galaxy could not hold them. Some other type of matter, invisible and elusive, must therefore provide the missing mass and the extra gravity. The nature of this dark matter has remained a mystery. Although the DAMA discovery would solve it, other scientists are greeting the announcement with caution. "This would definitely be one of the biggest finds in science ever," says Frank Avignone, a physicist at the University of South Carolina, Columbia. But, he adds, "what [the DAMA researchers] have is tantalizing evidence."

To amass that evidence, the DAMA researchers counted light flashes generated by an array of nine sodium iodide crystals, each a kilogram in mass, kept in a copper box more than a kilometer underground. Each flash signaled the passage of a particle, possibly a WIMP. The researchers tracked the count rate over the last 4 years. They looked for a slight annual increase peaking in June and a concomitant annual decrease bottoming out in December.

If the galaxy spins in the middle of a huge stationary WIMP cloud, then Earth rushes into a WIMP wind averaging 220 kilometers per hour. But the speed of that wind varies slightly with the seasons as Earth zips around the sun. In June, Earth swings into the wind, which then appears to blow roughly 15 kilometers per hour faster than average. In December, Earth swings to leeward, and the wind drops off by the same amount. Just as a bike rider gets wet faster when riding directly into a driving rain, the DAMA detector should count more events when Earth pushes directly into the WIMP wind.

A year ago, the DAMA team announced tentative evidence of a seasonal variation (*Science*, 1 January 1999, p. 13); last week, they reported seeing a difference that they say has only one chance in 10,000 of being a statistical fluke.

The question is whether the changing signal is caused by WIMPs or by something originating closer to home, says Michael Turner, a cosmologist at the University of Chicago. A variety of less exotic particles such as neutrons will also produce flashes of light when passing through the detector, and the DAMA researchers must rule out all possible sources of contamination that might vary throughout the year. "Whether [the variation] has to do with the seasons of the Earth or the seasons of the galaxy remains to be seen," Turner says.

Researchers from CDMS believe stray neutrons account for all 13 events they see in their much smaller detector. The CDMS device consists of three discs of germanium with a total mass of half a kilogram, cooled to within a tenth of a degree of absolute zero. When a particle crashes into the ultracold semiconductor, the researchers measure both the number of electric charges it knocks loose and the amount of heat it deposits. A low ratio of charge to heat indicates that a massive neutral particle—a WIMP or neutron—has bounced off a germanium nucleus. Of the few collisions bearing that telltale signature,

* Fourth International Symposium on Sources and Detection of Dark Matter in the Universe, 23–25 February, Marina del Rey, California.

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