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.

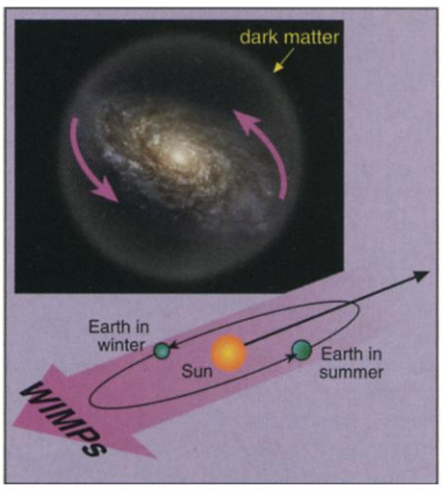
Both agree that it will likely be up to industry researchers to work out such practical issues and see whether the new process is economical. "Finding chemistry that is safe, cheap, and environmentally friendly isn't always easy," DeSimone says. But, he adds, "that's what makes it good science."

–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.

CREDIT: HUBBLE HERITAGE TEAM (AURA/STSCI/NASA)

the CDMS team says, all appear to be due to neutrons. If so, chances are that the DAMA team is seeing familiar particles, too. Stanford physicist Blas Cabrera says, "With respect to the DAMA results, we're ruling out the signal that they've seen."

Whether or not the DAMA result holds up, Turner says, the search for dark matter may be speeding toward an end. In recent years, researchers have determined that other once-prime suspects, such as neutrinos and brown dwarfs, cannot account for all the missing mass. But WIMPs might, and new experiments scheduled for the next few years will be capable of spotting particles as massive and as weakly interacting as theory says they ought to be. "It's a 70-year detective story," Turner says. "An arrest is imminent."

–ADRIAN CHO

GLOBAL HEALTH

Group Urges Action on Third World Drugs

How can the pharmaceutical industry be enticed to make drugs and vaccines for infectious diseases that sicken or kill billions of people worldwide, yet offer little in the way of economic returns? That conundrum occupied a group of senior policy officials last week at the Global Health Forum, a closed-door meeting hosted by the Institute for Global Health in San Francisco. The 3-day affair, which boasted an "all-star cast" of global health experts, came up with few new ideas, but its message is being heard loud and clear: President Clinton has already signaled his interest in launching an initiative aimed at narrowing the seemingly intractable gap in health between rich and poor countries, and last week a bill was introduced into the U.S. Senate that would incorporate many of the forum's suggestions.

Shot in the arm. Industry needs incentives to develop drugs and vaccines.

CREDITS: (LEFT) WHO; (RIGHT) PAYETTE ASSOCIATES/VENTURI, SCOTT BROWN

Pharmaceutical companies already have the scientific knowledge and tools they need to develop drugs and vaccines for scourges such as malaria, AIDS, and tuberculosis. What's more, such drugs could save millions of lives and spur economic development in poor countries, said the panel, which included representatives from the White House, the U.S. Congress, the World Health Organization, the World Bank, the World Trade Organization, and pharmaceutical giants Glaxo Wellcome and Merck. Yet these diseases attract minimal attention from the pharmaceutical industry because executives don't see a market. And even when effective drugs are available—such as the cocktail of AIDS drugs that has slashed mortality in wealthy countries—they may be too expensive for countries in Africa and Asia.

The solution, according to the panel, lies in a package of incentives that would make it worthwhile for the pharma and biotech industries to step in. One approach is for governments and multilateral organizations to push research and development by subsidizing part of the huge costs, either directly or through tax breaks. Another is to assure companies of a future market—for instance, by establishing "purchase funds" and agreeing to buy certain quantities of a product once it becomes available. The panel also lauded partnerships in which publicly funded scientists work together with industry, such as the recently created Global Alliance for Vaccines and Immunization (GAVI), to speed drug discovery and development.

The Global Health Forum's approach has already found a receptive ear in Washington. In his State of the Union address, President Clinton announced a $50 million U.S. contribution to GAVI, as well as a tax credit of up to $1 billion for companies investing in new vaccines for malaria, AIDS, and TB. A delegation from the Global Health Forum was scheduled to meet with Clinton this week to present their findings and discuss Clinton's proposals, which are "absolutely on the right track," says Richard Feachem, who directs the Institute for Global Health.

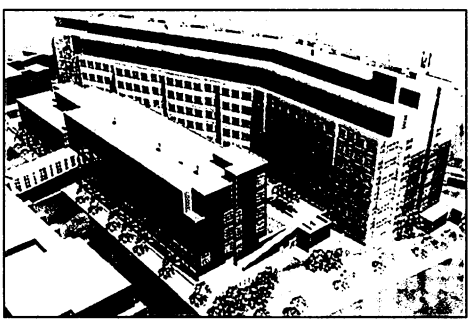
Meanwhile, Senator John Kerry (D–MA) introduced an ambitious bill, dubbed the Vaccines for the New Millennium Act, on 24 February. Kerry proposed to "change the death spiral" by making childhood immunization "a major goal of U.S. foreign policy." His bill calls for donations of $150 million to GAVI and $30 million to the International AIDS Vaccine Initiative. It also proposes several tax credits for industry and a purchase fund to buy and distribute vaccines as soon as they are approved. To cover the cost, Kerry is asking Congress to set aside $100 million a year for the next 10 years. The political fate of these plans is uncertain. Even so, Feachem is encouraged by these and other initiatives in the European Union and Japan. Says Feachem, "The global awareness of this challenge is running at a level which we haven't previously seen."

–MARTIN ENSERINK

RESEARCH FACILITIES

Glittering Future for Yale Medical School

The late Bartlett Giamatti, former president of Yale, was fond of saying that "if Yale intends to be the best, it has to be able to afford the best." Its current leaders seem to be taking that aphorism to heart: A month after announcing a planned $500 million upgrade of its science and engineering programs (*Science*, 28 January, p. 579), Yale said last week that it will pour another $500 million into renovations and new construction on its medical school campus over the next 10 years.



Thinking big. Yale's planned six-story lab building (right) is attached to new classroom building.

"The university is in a strong financial position," Yale president Richard C. Levin acknowledges. A 9-year bull market has beefed up Yale's endowment, now $7.2 billion, he says, and "fund-raising efforts have been very well received." He predicts that "invest[ing] simultaneously in science activities on both ends of our campus will be enormously synergistic."

The heart of the expansion is a new six-floor lab building that will increase the medical school's lab space by 25%. Some accompanying growth is also expected in research faculty. Yale is already the fifth-largest recipient of funds from the National Institutes of Health. The medical school will continue to turn out about 100 graduates a year.

"I'm a happy man today hearing this announcement," says Leon Rosenberg, a professor of molecular biology at Princeton University who was Yale medical school