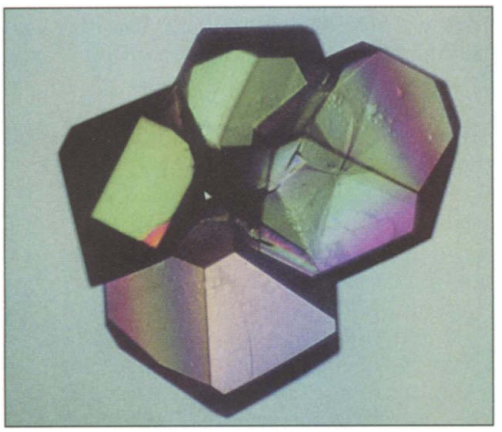
tainly a big advance." Robert Lehrer, who first described human defensins in 1985, agrees. "The data are very convincing," says Lehrer, a researcher at UC Los Angeles.

But several leading AIDS researchers aren't convinced. Levy himself applauds "the great effort" to find the defensins in CD8s, but he says that it's not the factor he postulated. Levy says his lab has tested defensins and found that they did not meet his criteria for the factor, which he called CAF (for CD8 antiviral factor). Robert Gallo,



On the defensive. A claim that α-defensins (shown above in crystal form) are the long-sought factor is drawing fire.

head of the Institute of Human Virology in Baltimore, says that although he finds the work "technically sound," the paper relies on too few patients, offers no mechanism for how defensins stop HIV, and dismisses other factors that he believes are likely to be more important. Bruce Walker, whose lab at Harvard Medical School in Boston also recently described a candidate CAF, says the new data show that the defensins have "a very modest effect" against HIV.

In the study, the Aaron Diamond researchers teamed up with scientists from Ciphergen Biosystems Inc. in Fremont, California, to compare secretions of CD8 cells from three HIV-infected "long-term nonprogressors," four HIV-infected "progressors," and 15 uninfected people. Ciphergen makes tiny arrays of proteins that, with the help of mass spectrometry, allowed them to analyze the components in each sample. Company scientists found that only the long-term nonprogressors and uninfected people produced three small, related proteins that a database search revealed as defensins.

As first reported by Lehrer, human defensins are secreted primarily by neutrophils and break down bacterial walls, acting like natural antibiotics. A group in Japan 9 years ago showed that defensins from guinea pigs, rabbits, and rats could inhibit HIV, but the work received little notice. Some AIDS researchers also have incorporated defensins into their vaccines because the molecules can act like an adjuvant, boosting the immune response to the HIV components of the preparation.

When Ho and his colleagues depleted the defensins in the cell secretions from the long-term nonprogressors, they found that the secretions had markedly less anti-HIV activity. And when they depleted both defensins and immune messengers known as β-chemokines—which Gallo's lab in 1995 showed powerfully prevent HIV entry into cells—the secretions had almost no antiviral activity. In what's sure to be the paper's most controversial assertion, the researchers state that the α-defensins "collectively account for the anti–HIV-1 activity of CAF that is not attributable to β-chemokines." As for the mechanism, Ho and Zhang say the shortage of clean defensin material makes it difficult to conduct experiments that might tease out how it combats HIV. But they have now begun those experiments.

Gallo takes exception to the entire concept that a single mysterious, undiscovered CAF exists. "This is ludicrous," he says. He argues that CD8 cells secrete many substances that inhibit HIV, including one his lab has yet to describe that he says appears to be much more powerful than defensins. "We don't use the word 'CAF,' " says Gallo. "Throw it out."

Zhang agrees that CD8s might well secrete other, undiscovered molecules that inhibit HIV. "CAF is a black box," he says. "Different molecules could play different roles in different circumstances. We have no idea in vivo." Still, the α-defensins' apparent anti-HIV powers are likely to provide a new focus for research and, if they pan out, open new avenues for treatment. **–JON COHEN**

CREDIT: R. I. LEHRER, T. GANZ, M. E. SELSTED, *ASM NEWS* 56, 315–318 (1990)

CHEMISTRY

Catalyst Boosts Hopes For Hydrogen Bonanza

Solar cells are the best known way to turn sunlight directly into usable power. But green-energy aficionados have long dreamed of using the sun's rays to make a chemical fuel as well, by splitting water molecules to release hydrogen gas, which produces only water when it burns. For decades researchers have tinkered with light-triggered catalysts that encourage this water splitting. But although a handful of efficient catalysts have been found, none are both cheap and stable enough to be practical. Now researchers at Duquesne University in Pittsburgh, Pennsylvania, have come up with a novel catalyst that might bring the long-sought goal within reach.

On page 2243, chemist Shahed Khan and his graduate students Mofareh Al-Shahry and William Ingler Jr. report that

ScienceScope

Overseas Students Scrutinized U.S. graduate schools that train foreign bioscientists are looking for better ways to prevent cheats from slipping onto campus. The problem broke into the open earlier this month when University of California, Los Angeles (UCLA), dean David Meyer announced that his school will be heightening scrutiny of foreign applicants to its bioscience graduate programs. The change came after UCLA officials learned that a Chinese applicant had added phony courses to his transcript. To prevent future fraud, UCLA has begun verifying transcripts of foreign students—about half of them Chinese—accepted by its bioscience admissions program. Chinese students pose a special problem, Meyer says, because their universities don't directly supply transcripts. Meyer will also be briefing members of the Association of American Medical Colleges, with an eye toward holding a meeting next April in Montreal on screening out fraudulant applicants.

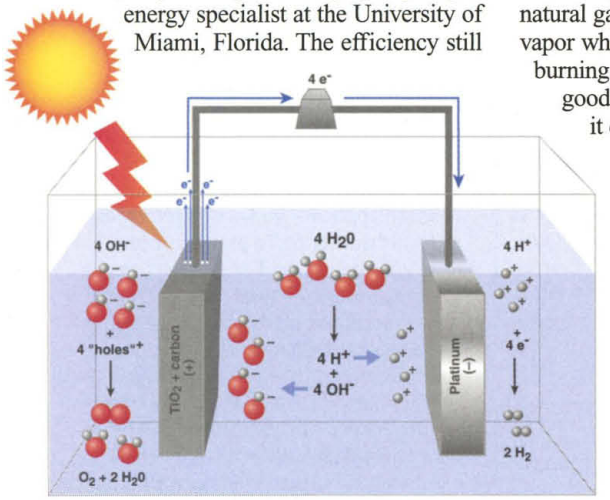
Curbing Conflicts U.S. medical colleges are attempting to set their first standards for limiting conflicts between their corporate financial interests and their duties as overseers of clinical research. A task force of the Association of American Medical Colleges (AAMC) this week issued a report that calls on members to manage "institutional conflicts of interest" more aggressively.

The task force, headed by former Washington University chancellor William Danforth, does not offer specific rules. But it recommends that institutions separate the management of finances and research and create special committees to examine every financial relationship that might "reasonably appear to affect human subjects research." For example, the panel says a university should conduct a "fact-driven inquiry" whenever it acquires more than a $100,000 equity interest in a publicly traded company that also sponsors human subjects research at the school.

Reaching agreement on the guidelines was a "very significant accomplishment," says AAMC's David Korn, a former dean of medicine at Stanford University. He says the panel wants to "set a very high standard of oversight and management" that will convince Congress and federal regulators that the government doesn't need to intervene. Korn expects AAMC to undertake a follow-up study in 18 to 24 months to learn how its members responded.

Contributors: Dennis Normile, Daniel Clery, Constance Holden, Eliot Marshall

adding carbon to the well-known water-splitting catalyst titanium dioxide increased the material's ability to absorb visible light. The change boosted the catalyst's ability to convert the energy in sunlight more than eightfold, to 8.5%. "That's an excellent result," says T. Nejat Veziroglu, a hydrogen energy specialist at the University of Miami, Florida. The efficiency still falls just below the U.S. Department of Energy's 10% benchmark for a commercially viable catalyst, notes Eric Miller, an electrical engineer at the University of Hawaii, Manoa. But he says Khan's team has a real chance to clear the hurdle: "It's a good lead in a good direction."



Hydropower. In an electrolyte, water molecules (center) split into H^+ and OH^- ions, which sunlight and catalysts turn into oxygen and water (left) and hydrogen gas (right).

Researchers started experimenting with TiO_2 as a water-splitting catalyst in the early 1970s. Like other semiconductors, TiO_2 absorbs photons, which excite electrical charges in the material. These charges can then break apart water molecules to produce hydrogen gas (see diagram). TiO_2's big advantage is that it is stable under prolonged sunlight, and the material, which is added to everything from paint to sunscreen, is cheap. But TiO_2 also has a big drawback: It absorbs only ultraviolet light, a small fraction of the spectrum of sunlight that reaches Earth. That finickiness makes TiO_2 an inefficient hydrogen-gas generator, converting less than 1% of the energy in sunlight to chemical energy in hydrogen.

Researchers have developed much more efficient catalysts, including other inorganic semiconductors such as gallium arsenide and TiO_2 laced with dyes that absorb visible light. But crystalline semiconductors such as gallium arsenide are expensive, and the TiO_2 dyes are unstable in the charge-carrying electrolytes that must be added to working water-splitting systems.

Khan suspected that part of the problem was that the high-temperature process of turning titanium metal to TiO_2 created other types of compounds in the mix that do a poor job of absorbing light. He also knew that water vapor helps oxidize titanium metal to TiO_2. So Khan's group designed a precisely controlled furnace and placed a sheet of titanium metal in a flame of natural gas. Methane, the most abundant component of natural gas, breaks down into CO_2 and water vapor when it burns. Khan's team found that burning the titanium metal at 850°C did a good job of oxidizing the titanium. But it did something else as well: It added some carbon to the mix.

When Khan and colleagues tested their new material as a water-splitting catalyst, they got a pleasant surprise. Unmodified TiO_2 absorbs UV light with a wavelength below 400 nanometers. The carbon-containing TiO_2 catalyst, however, also absorbed longer wavelength photons in the violet, blue, and green regions of the spectrum, yielding the eightfold efficiency boost.

Still, Khan thinks his team can do better. He believes that the amount of carbon incorporated into the TiO_2 varies as the titanium sheet is burned and that the higher carbon regions do a better job of absorbing longer wavelength visible-light photons. Khan says his team plans to look for ways to pack more carbon into the TiO_2 throughout the firing process. If that works, he says, "it would definitely increase the efficiency to above 10%." –ROBERT F. SERVICE

UNDERGRADUATE EDUCATION

Million-Dollar Plums For Teaching Biology

Research grants have always been the main source of prestige and money for academic scientists. Now one of the biggest funding sources for biologists, the Howard Hughes Medical Institute (HHMI) in Chevy Chase, Maryland, is hoping to add luster to researchers who are devoted to teaching. Last week, the philanthropic giant announced fellowships that will give each of 20 top U.S. biologists $1 million over 4 years to enhance undergraduate education.

The new awards are meant to improve science curricula at major research universities, where courses are often outdated, boring, and impersonal, says Peter Bruns, HHMI's vice president for grants and special programs. To rev up interest in the classroom, which frequently plays second fiddle to research, HHMI asked 84 research universities to nominate faculty members who are committed to working with students.

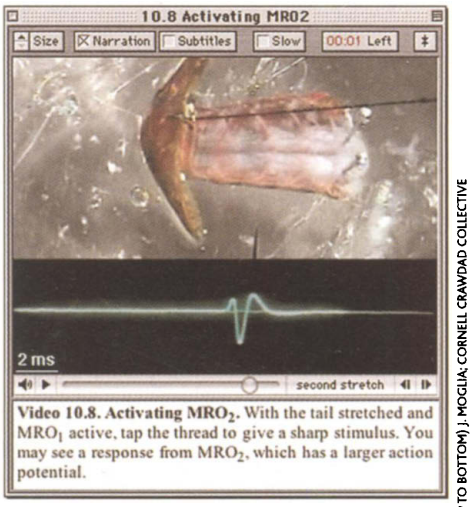
Many of the 20 winners* will use the money to give more undergraduates research experiences. Jo Handelsman, a microbiologist at the University of Wisconsin, Madison, will bring 15 undergrads into her lab. Although the undergraduates will require extra attention, Handelsman expects them to nourish her research. "I have always found undergraduates to be productive and creative scientists," she says. "They ask good questions and aren't as bound by dogma as the rest of us."

Providing those opportunities isn't cheap, though. Neurobiologist Ronald Hoy of Cornell University in Ithaca, New York, estimates that it will cost upward of $65,000 for a single setup of software and high-speed video cameras to enable undergrads to study behavior in mutant flies. He's also planning multimedia lab materials, akin to an earlier project involving crayfish (see figure). The award, Hoy says, "lets you make a very ambitious plan from the get-go."

Other winners will create programs to mentor prospective scientists, especially minorities. Hilary Godwin, a chemist at Northwestern University in Evanston, Illinois, is planning a summer workshop for incoming minority first-year students. They will learn chemistry skills by mapping lead levels in soil and correlating them with lead-poisoning rates. Afterward, they'll be eligible for further research stipends and training as student mentors.

The sterling research reputations of the new fellows should help leverage the program, Bruns says. "We wanted to pick people who could influence their colleagues" and promote more interest in improving education, he says. Geneticist Elizabeth Jones of Carnegie Mellon University in Pittsburgh, Pennsylvania, plans to reserve adver-

* Complete list at www.hhmi.org/news/091802.html



Video 10.8. Activating MRO_2. With the tail stretched and MRO_1 active, tap the thread to give a sharp stimulus. You may see a response from MRO_2, which has a larger action potential.

Stimulating. HHMI hopes that new lab materials, such as this multimedia crayfish experiment, will make undergraduate biology more exciting.

CREDITS: (TOP TO BOTTOM) J. MOGLIA; CORNELL CRAWDAD COLLECTIVE