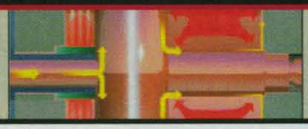
816
GPS to zero out

LEAD STORY 820
New cohesion in U.S. fusion



825
Long march for biodiversity

ciety of Plant Physiologists recently voted to talk to Varmus about adding this journal and *The Plant Cell* to E-biosci. "We are very interested," Chrispeels told *Science* in an e-mail, "but also worried" about the potential loss of revenue and need to charge authors for publication in E-biosci to offset potential losses in subscription revenues. Chrispeels calculates that the overhead charge for minimal review and editing would run to $1500 per article. This is "a hefty sum," he notes, and "prohibitive" for scientists in poorer countries. He worries also that it would drive authors into the arms of commercial publishers, which don't charge page fees. On the positive side, says Chrispeels, "we see a chance of integrating plant biology with the rest of the biological sciences" in one database. "Our stand," he adds, is to "see what the bigger players are going to do."

Like many editors and publishers, Chrispeels says his colleagues like E-biosci as a concept, but "an awful lot of details need to be worked out" before any final decision is made. **–ELIOT MARSHALL**

SCIENTIFIC PUBLISHING

DOE Builds a Web Site For the Physical Sciences

By October, if a plan under development at the Department of Energy (DOE) works out, the public will be able to tap into a comprehensive new database of scientific papers in the physical sciences called PubSCIENCE. It will offer Internet access to titles, authors, and abstracts from hundreds of journals, according to Martha Krebs, director of DOE's Office of Science, the project's sponsor. The goal, according to her staff, is to index just about every scientific journal that isn't already indexed in PubMED—the online collection of medical information based at the National Institutes of Health (NIH)—and to link abstracts back to each publisher's Web site. Unlike the E-biosci proposal being discussed by NIH (see previous story), DOE is not asking publishers for free access to the full text of articles.

DOE has already signed up a few major publishers willing to help test the system. The initial participants include the American Association for the Advancement of Science (*Science*'s publisher), The American Physical Society, Elsevier Science, and the Institute for Scientific Information. By October, DOE hopes to make available current information from 400 journals. It aims to increase its coverage to 2000 later.

The project has a history that reaches all the way back to 1947, according to Walter Warnick, director of DOE's Office of Scientific and Technical Information, which is curating the database along with the Los Alamos National Laboratory in New Mexico. Half a century ago, the Atomic Energy Commission created "Nuclear Science Abstracts," a compendium of references for nuclear physicists. When DOE took over the portfolio in the 1970s, it broadened the scope and created the Energy Database. Its clients were chiefly the thousands of scientists who work at DOE research centers. Now, DOE is building on this base to create a digital index of all physical science articles in English, linked electronically to their publication sources. This should allow readers to jump from almost any citation that turns up in a literature search to the publisher's Web site.

Most DOE scientists can use this service now to access many full-text articles, either because physical science journals permit free use of archival material or because DOE has paid publishers for online access. Recently, according to DOE, the Government Printing Office expressed an interest in making PubSCIENCE available to the public as well, through the "GPO Access" Web site.

If a tentative agreement works out as planned, DOE says, anyone with access to the Internet will be able to do simple searches on PubSCIENCE records, retrieve abstracts, and jump directly into an archive. Depending on the conditions set by the publisher, the reader may get immediate access to the full text of articles, or be required to pay a fee or provide a password at an entry gate. "We're not trying to replace publishers; we're trying to make it easier to get to the published material," says Krebs.

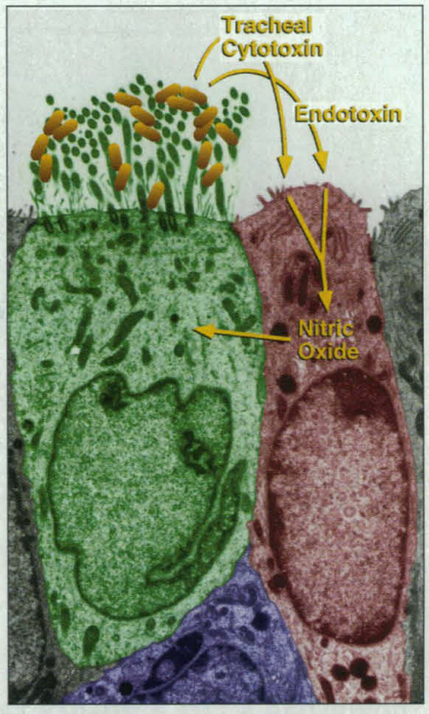
PubSCIENCE will overlap a bit with PubMED in the titles it indexes, Warnick concedes. Some topics like bioengineering will get double coverage. Publishers have responded enthusiastically, as PubSCIENCE is likely to bring customers to the door. DOE is preparing for a possible surge of interest. Warnick notes that data requests increased rapidly at PubMED when all barriers to public access were dropped in 1996. The number of searches climbed from a modest buzz of about 7.4 million per year to a torrent of 180 million this year. "We might not get that kind of usage at first," says Warnick, but the machines can handle it if it appears. **–ELIOT MARSHALL**

MICROBIOLOGY

New Clues to Whooping Cough Pathology

The whooping cough bacterium, *Bordetella pertussis*, appears to be a master tactician. According to new findings, the pathogen, after invading the respiratory tract, induces some cells to kill certain of their neighbors with toxic gas. The result likely contributes to the intense gasping cough that not only gives the disease its name but also spreads the bacterium to other victims.

Physicians and researchers have known for decades that the pathogen destroys the ciliated cells in the epithelial lining of the respiratory tract. The hairlike cilia sweep away mucus, but when they die, coughing provides the only way to clear the airway. Exactly how *B. pertussis* kills these cells has been a mystery, however. Now, results described in the July issue of *Cellular Microbiology* by microbiologist William Goldman of Washington University School of Medicine in St. Louis and Tod Flak, Goldman's former graduate student, may have revealed the mi-



Sabotage. Using tracheal cytotoxin and endotoxin, *B. pertussis* provokes secretory cells in the respiratory tract to produce nitric oxide that kills the nearby ciliated cells.

CREDIT: W. GOLDMAN, L. HEISS, AND S. MOSER

crobe's diabolical modus operandi.

Using a tissue culture system in which the microbe causes the same type of damage as in humans, the researchers found that two toxic substances produced by *B. pertussis* work together to kill the ciliated cells. One of those molecules, tracheal cytotoxin (TCT), has long been a suspect, but the other, endotoxin, is somewhat of a surprise. It is usually known for causing widespread immune system stimulation, which can lead to shock. "This is different," says Drusilla Burns, a microbiologist at the Food and Drug Administration's Center for Biologics Evaluation and Research in Bethesda, Maryland. "Endotoxin is not normally associated with specific pathology."

Even more surprising, the two toxins do not launch a direct attack on the ciliated cells. Instead, they work together to incite neighboring cells to produce a noxious molecule, nitric oxide (NO), which kills the ciliated cells by an as yet unknown mechanism. "This work might explain some of the pathology of *pertussis*," says Ferric Fang, a molecular biologist at the University of Colorado Health Sciences Center in Denver. And, he adds, it might also "provide strategies for intervention."

Such strategies are badly needed. In developed countries, vaccination largely holds whooping cough in check, but the incidence of the disease in adults appears to be increasing; in nondeveloped countries, *B. pertussis* still kills from 300,000 to 500,000 people every year. And although antibiotics eliminate the bacteria, by the time the characteristic cough develops, the microbes are often already gone, having set a cascade of destructive events in motion. Drugs that inhibit NO production might allow the tracheal epithelium to recover more quickly.

Earlier work by Goldman's group had shown that NO is involved in the attack on the ciliated cells and suggested that TCT acts as a trigger. But when the team tested whether TCT causes epithelial cells in cultured hamster tracheal tissue to activate production of an enzyme called inducible NO synthase (iNOS)—which makes NO—they got what Goldman describes as a "surprise result." TCT had no effect at all on iNOS production in epithelial cells. The researchers concluded that something in addition to TCT may be required to coerce the epithelium to produce NO.

Goldman and Flak suspected that this coculprit might be endotoxin, because the team had previously uncovered another case of TCT-endotoxin cooperation, in preventing the growth of a single type of respiratory epithelial cell in culture. It prompted the researchers to add endotoxin along with TCT to their culture system. The combination worked.

Because not all the cells in the tracheal epithelium are ciliated, the team wondered whether the ciliated cells themselves or their neighbors produce the NO. As Goldman recalls asking, "Are the ciliated cells committing suicide, or are they being assisted by other cells in the epithelium?" Further studies provided an answer: TCT and endotoxin induce the nonciliated, mucus-secreting cells to produce the toxic gas.

Goldman notes that both TCT and endotoxin are made by many other bacteria in addition to *B. pertussis*, although most of the other microbes recycle TCT rather than release it. "You've got almost an ironic situation," he says, "where you have this extraordinary specificity of pathology and of nitric oxide production" spurred by two extremely common molecules. Endotoxin and TCT might collaborate to kill other ciliated cells in the body as well. Work by Raoul Rosenthal's group at Indiana University School of Medicine in Indianapolis and collaborators suggests that *Neisseria gonorrhoeae* destroys ciliated cells of the reproductive tract using these same two molecules.

The researchers do not yet understand how NO kills the ciliated cells without harming the secretory cells that produce it. But, as Goldman points out, the strategy might be "exactly what [*B. pertussis*] needs," because it allows mucus to accumulate while eliminating the normal way for expelling it. The result is a hacking cough—an ideal way to transfer the bacteria from one person to another.

Many questions remain about how both NO and the TCT-endotoxin partners produce their effects. Researchers also need to find out whether *B. pertussis* operates the same way in humans. This might be addressed, says Erik Hewlett, a *B. pertussis* expert at the University of Virginia, Charlottesville, by seeing whether the iNOS expression patterns in trachea specimens from children who died from whooping cough mimic those seen in Goldman's experiments. If so, it might indicate that *B. pertussis* is putting its subversive tactics to work in environments other than the culture dish. **–EVELYN STRAUSS**

CREDIT: DSG

RESEARCH FUNDING

House Panel Cuts Space Science, NSF Budgets

Two weeks ago, NASA's leaders were popping champagne corks to celebrate the 30th anniversary of the "giant leap for mankind" on the moon and the recent launching of the x-ray telescope Chandra. Then last week, the atmosphere in NASA's Washington, D.C., headquarters turned funereal: On 26 July, the House Veterans Affairs–Housing and Urban Development (VA-HUD) appropriations subcommittee cut $1.4 billion, or more than 10%, from NASA's current budget. This carved a massive $640 million slice out of space science, threatening future Mars missions and the

ScienceScope

High-Tech Whipping Boy A federal program that funds high-risk industrial R&D is back in the congressional doghouse. Last week, House appropriators voted to zero out the 2000 budget of the Department of Commerce's Advanced Technology Program (ATP). House Science Committee chair James Sensenbrenner (R–WI) then piled on, calling reform efforts at ATP "a sham."

After much prodding from Congress, ATP in 1997 rewrote its rules to fund only those R&D proposals at companies that failed to secure private money for projects. But according to a new report from the Government Accounting Office, ATP officials still review initial proposals in which the prospects for private sector funding aren't spelled out.

ATP project for making semiconductor chips.

To Sensenbrenner, that means the reforms aren't working. ATP associate director Marc Stanley, however, says the program hews to its new line: Regardless of which projects ATP ends up reviewing, only those shunned by corporate financiers get federal dollars. The Senate has given ATP an easier go, allotting the program $226.5 million, nearly the full White House request; a House-Senate conference later this year will resolve the differences.

Darwin-Free Biology Kansas authorities are poised to approve a new set of science standards that eliminates most references to evolution. The decision is expected on 11 August, when the Kansas State Board of Education meets to approve wording of a text that has been the focus of a prolonged public battle.

Several members of the 10-member elected board have fought to keep evolution out of the document, which will be the basis for statewide achievement tests. Religious fundamentalists on the board have recruited a six-member majority in favor of a version that deletes most references to evolution from the biology curriculum, says John Staver, director of the Center for Science Education at Kansas State University in Manhattan and co-chair of the committee that drafted the standards. If approved, the curriculum will leave individual school districts free to decide whether to include evolution in biology classes. "It's a sad day for public education and an embarrassment for the state of Kansas," Staver says.