ficials advocated such a move last spring, arguing that Germany's academic research system should move toward the U.S. model, with "junior professor" slots replacing the Habilitation positions (*Science*, 21 April 2000, p. 413).

The Habilitation system is widely seen as a disincentive for young scientists, especially women, to remain in academic research. "There is every reason to get rid of the Habilitation, and to create a new position for young scholars and scientists that gives them more autonomy," says Lorraine Daston, an American historian who directs the Max Planck Institute for the History of Science in Berlin. The best young scholars are moving to academic positions abroad, where they do not suffer "the indignity of a system they consider feudal," as Daston puts it.

The German federal government backs the new initiatives. Edelgard Bulmahn, minister for education and research, has put reform of the state-governed higher education system at the top of her agenda. "It is urgently necessary that the laws which regulate the employment of professors, which were passed in the 19th century, be adapted to the new reality," she said in a statement last fall.

But these new initiatives are just the first step, and even they are controversial. A coalition of university professors has opposed doing away with the Habilitation because it could erode the quality of academic training. Others have argued that simply renaming the postdoctoral track from "Habilitation" to "junior professorship" will do little to alter dependency relations within the universities.

Gerhard Sagerer, a computer scientist and dean of the technical faculty of the University of Bielefeld, argues that the system is already changing fast. He says the Habilitation has lost its importance in some fields of science and that there will be fewer fixed professorships in the future. Instead, department heads will have much more freedom to allocate resources.

Marc Schalenberg, a young historian who has just started his Habilitation at Humboldt University in Berlin, hopes to be one of the first to profit from the new initiatives. Instead of "hanging completely in the air after my Habilitation," he says, "I could now try and apply for a junior professorship," which could put him on the road to a permanent academic position more quickly. But this revolution may come too late for those who are already at a relatively advanced stage of their Habilitation: Today, the average German academic is 44 by the time he or she is eligible for a tenured position.

–OHAD PARNES

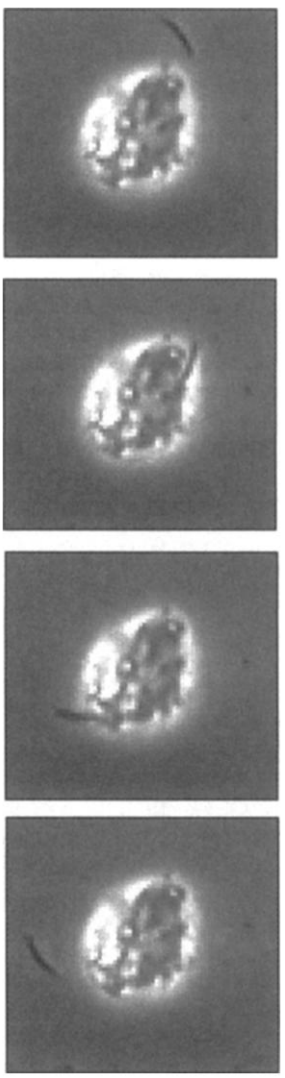
With additional reporting by Janina Wellman. Parnes and Wellman are writers in Berlin.

MALARIA

Old Movie Spawns a New Discovery

Tired of Hollywood's bland holiday fare? Check out a movie showing this week on *Science*'s Web site—a mystery thriller with a cast of two.* True, it's not a first-run film: The 87-second clip, featuring a human liver cell and a malaria parasite, was shot at a New York University (NYU) lab more than 10 years ago. But a series of recent experiments by NYU researchers, reported on page 141 of this issue, reveals a whole new story behind the video fragment.

The movie catches a so-called sporozoite (a stage in the life cycle of the malaria-causing *Plasmodium* parasite) entering a human liver cell, apparently jostling its way right through, then exiting at the cell's other end and moving away as if nothing had happened. That's strange behavior for a sporozoite. Most researchers thought that after being delivered via a mosquito bite, these needlelike cells quickly traveled to the liver to infect a single cell. Inside that host cell, the sporozoite produces tens of thousands of so-called merozoites, each of which can then go on to infect red blood cells. The fact that sporozoites may travel through as many as four other liver cells before settling down in one, as the new study suggests, comes as a surprise. "This parasite is not obeying the textbooks," says Rudolph Entzeroth, a parasitologist at the University of Technology in Dresden, Germany.



In and out. In a surprise move, a malaria parasite travels through a liver cell.

CREDIT: M. MOTA ET AL.

The textbooks also assume that, as they enter a cell, *Plasmodium* sporozoites induce the cell's plasma membrane to encapsulate the parasite inside a vacuole—a trick employed by most parasites. But, as the movie shows, when the parasite enters and exits liver cells during its quick passage through them, it rudely punches small holes in the cell membrane, like a well-working Votomatic machine piercing an election ballot.

NYU researcher Jerome Vanderberg, who shot the movie in 1989, was convinced all along that sporozoites didn't always follow parasitological doctrine when they invaded. Ten years ago, he published a paper showing that sporozoites could travel through a type of immune cell called a macrophage. He and several others also produced electron microscopy images showing malaria parasites inside host cells but without the typical vacuole surrounding them. But most researchers didn't know what to make of those findings, and some thought the behavior displayed in the short movie might be an artifact: The parasite might be swimming underneath the human cell, rather than passing through it. So the clip was never published, and Vanderberg's research eventually took another direction.

But when cell biologist Ana Rodríguez came to the department last year, she took a closer look at the old footage. "I really felt that it was not an artifact," she says. Together with her colleague Maria Mota, Rodríguez designed a series of experiments to find out what was happening. For instance, they used a test that can detect when cell membranes are wounded and repaired. When mosquito saliva containing *Plasmodium yoelii* sporozoites was added to cultured mouse liver cells, they found that 10% to 30% of the cells showed signs of wounding; these were wounds that would not be expected with an ordinary infection. This didn't happen when they added saliva from uninfected mosquitoes to the cells. The sporozoites also caused the liver cells to spill some of their contents—another sign that their membranes were punched.

The team went on to show that the parasites causing this damage didn't form a vacuole inside the cell and that their passage didn't result in an infection. Rather, their repeated stealthy invasions, followed by a rapid exit, seemed to mark a prelude to the final, classical invasion, with the formation of a vacuole. The team also found that liver cells in mice infected with malaria also showed signs of wounding, reassuring researchers that this wasn't just happening in the test tube. "All in all, I think it's a very elegant demonstration of a new phase in the

* www.sciencemag.org/cgi/content/full/291/5501/141/DC1

parasite's life cycle," says Stephen Hoffman, a malaria researcher at the Naval Medical Research Center in Silver Spring, Maryland.

But does that phase serve a purpose? Rodríguez can only speculate. Perhaps the parasites like to shop around to find a "good" liver cell to infect, she says. Or maybe passing through multiple liver cells somehow activates the parasite, preparing it for the real thing. Rodríguez's first priority now is to find out why parasites show this behavior and how they do it. Watch for the sequel.

–MARTIN ENSERINK

CANCER RESEARCH

Preventing Hair Loss From Chemotherapy

The images are painful: a cancer patient, perhaps a child without hair, or a woman wearing a scarf or all-too-obvious wig to disguise the hair loss caused by chemotherapy. Although this loss may seem trivial—it's likely to be temporary and the chemotherapy may well save the patient's life—it's not. "After nausea and vomiting, one of the harder side effects of chemotherapy is loss of image," says cancer researcher Stephen Friend of Rosetta Inpharmatics in Kirkland, Washington. "Keeping that image intact," he adds, "has a lot to do with fighting the disease." Now, researchers may be on the way to developing a drug that can prevent chemotherapy-induced hair loss.

Many chemotherapeutic agents cause hair loss because they are aimed at rapidly dividing cells—one of the defining characteristics of cancer cells. The problem is that these drugs also kill normal dividing cells, including those of the hair follicle. On page 134, Stephen Davis and his colleagues at Glaxo Wellcome Research and Development in Research Triangle Park, North Carolina, report that they can prevent chemotherapy-induced hair loss in rats by rubbing the animals' skin with a newly developed drug before administering the chemotherapy.

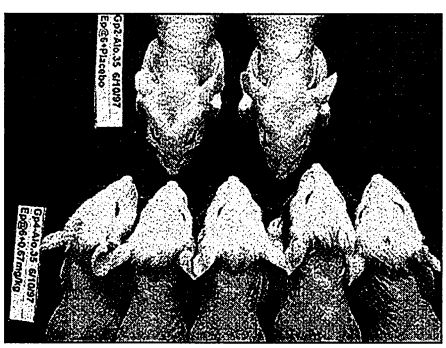
The new drug targets an enzyme called cyclin-dependent kinase 2 (CDK2), which drives a key step in the cell division cycle. Many researchers in both industry and academe are looking for CDK inhibitors, mainly in hope of developing agents to block the growth of cancer cells. But William Kaelin of the Dana-Farber Cancer Institute in Boston, who is among those doing this work, points out that CDK inhibitors offer two possibilities. They can be used, he says, to find "either smarter ways to kill cancer cells or smarter ways to protect normal cells."

In the current work, the Glaxo Wellcome group focused on the latter goal. They began by determining the x-ray crystallographic structure of CDK2 bound to a previously identified, but relatively weak, inhibitor of the enzyme. They then used this structural information to design a modified form of the inhibitor that would bind more tightly to the enzyme, making it a more effective inhibitor, and that would also be suitable for topical application. Tests with cultured cells showed that their design strategy worked: The modified inhibitor blocked the division of the cells at just the point where CDK2 comes into play. What's more, Davis says, it "protected the cells from a panel of currently used chemotherapeutic agents."

The team went on to test the prospective drug in two animal models. In one, the researchers transplanted human scalp hair onto immunodeficient mice that can't reject the foreign tissue. When they applied the CDK2 inhibitor to the actively growing hair transplants, Davis says, it reversibly inhibited hair follicle cell division.

In the second model, the researchers treated newborn rats with the CDK2 inhibitor, followed by either the chemotherapeutic drug etoposide or a cyclophosphamide-doxorubicin combination. Control animals subjected to the chemotherapies without the CDK2 inhibitor lost all their hair. But when applied to the heads of the rats before they were given etoposide, the inhibitor completely prevented hair loss at the application site in 50% of the animals and partially prevented it in another 20%. It was less effective against the drug combination, protecting 33% of the animals from hair loss. But the researchers were thrilled to see the hair still growing on many treated animals. "There's nothing better than visual proof," Davis says.

Because the CDK2 blocker inhibits cell growth, the team checked to see whether it interferes with the ability of the chemotherapeutic drugs to kill cancer cells in animal tumor models. Davis says that they didn't detect any such interference, and the fact that the drug is applied externally should also limit any potential



Hair preserver. The CDK2 inhibitor, when rubbed on the heads of mice (bottom), prevented the hair loss caused by etoposide.

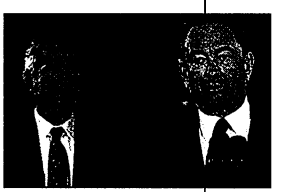
CREDITS: (LEFT TO RIGHT) S. DAVIS *ET AL.*; KENNETH LAMBERT/AP

ScienceScope

THE YEAR TO COME

With a new U.S. president and a host of hot global R&D issues in play, 2001 should be an eventful year for science. A few areas to watch:

Decisions, Decisions The incoming George W. Bush Administration has many R&D–related choices to make, including picking a White House science adviser and deciding biomedical research policy. At the **National Institutes of Health** (NIH), observers are wondering what the selection of Wisconsin Governor Tommy Thompson (right) to head the Department of Health and Human Services will mean for research using **stem cells** derived from human embryos. Last August, the Bush campaign criticized NIH's plan to fund such work, but Thompson's appointment has cheered some scientists. Although antiabortion groups that oppose stem cell funding consider Thompson an ally, he has praised groundbreaking stem cell work by scientists in his home state.



Antiabortion politics could also complicate the selection of a **new NIH director,** prompting some observers to recall a similarly prolonged hunt during the last Bush presidency. Whoever succeeds Harold Varmus, who left 13 months ago, will have to satisfy both conservatives and moderates. Also look for new heads at two institutes—eye and neurological disorders—and at the Office of AIDS Research.

At the **National Park Service,** Bush has pledged to undo a Clinton-era shift that sent the agency's 100 research scientists to the U.S. Geological Survey. Bush wants to return them to shore up protection for park resources.

Pay Hikes Look for the **National Science Foundation** (NSF) to propose higher stipends for graduate students and postdocs in its 2002 budget request, due out early this year. NSF officials calculate that it will take $52.4 million to raise postdoc pay under research grants to $40,000, a 45% hike, and another $30 million to boost grad student stipends from $18,000 to $25,000.

Director Rita Colwell is also hoping to launch a math initiative in 2002 that would triple or quadruple the division's current $130 million budget over 5 years. NSF is also searching for a catchy name for a social science initiative that it hopes to begin in 2003. "It's got to have 'human' in it, be short, and include the idea of technological change," says NSF's Norm Bradburn.