working on this stuff pushing back the date" with ever more sophisticated analyses, he points out.

Strother is also searching for the first plants, and he, for one, is convinced that the fossil spores come from higher plants, not simpler organisms. And if these plants existed 520 million years ago, as the fossil record suggests, then there was likely to have been a complex ecosystem that included fungi from even earlier times. Indeed, "it's reasonable to assume that plants and fungi were together before, or were getting together as, plants invaded land," asserts John Taylor, a mycologist at the University of California, Berkeley.

Based on the group's new data, Hedges has proposed that early plants contributed to the sudden rise in oxygen and the widespread glaciation that occurred some 650 million years ago. But on that count, he loses the support of Taylor and others. Researchers don't really know what caused those changes. But to attribute them to land plants "doesn't really fit with the geological evidence or with our geochemical understanding of the carbon cycle," notes Harvard University geochemist Daniel Schrag. Graham suggests that these early land plants were likely rare and took up little carbon dioxide; otherwise, she says, some fossil record should exist.

For now, Hedges is sticking to his theory, challenging geologists and biologists alike to go out and prove him right—or wrong.

–ELIZABETH PENNISI

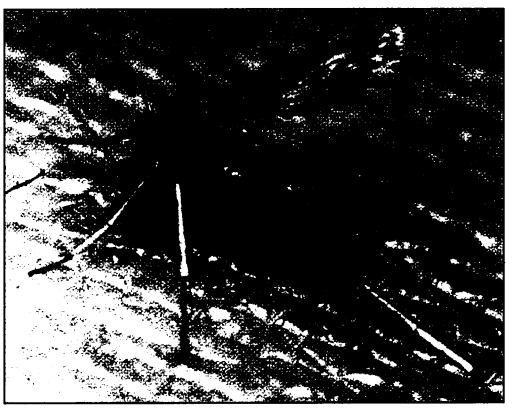
INFECTIOUS DISEASES

Sand Fly Saliva May Be Key to New Vaccine

The saliva of a fly may save human lives—if researchers can transform it into a vaccine. A new study shows that sand flies, minuscule insects that transmit a tropical disease called leishmaniasis, also secrete a protein in their saliva that protects against that disease, at least in mice. The team, led by José Ribeiro of the National Institute of Allergy and Infectious Diseases (NIAID), believes a similar vaccine may one day protect humans.

If true, it would be one of the strangest vaccines ever produced. Almost every existing vaccine directly targets a pathogen—whether it's a virus, a bacterium, or a parasite. Instead, this vaccine goes for one of the vector's proteins. By eliciting an immune response to sand fly saliva, the vaccine is thought to cause local changes in the skin whenever a sand fly bites, making it much more difficult for the parasite *Leishmania* to colonize that area. "It's a very intriguing and promising approach," says epidemiologist Barbara Herwaldt of the Centers for Disease Control and Prevention in Atlanta.

The vaccine would also be a welcome new weapon in the battle against leishmaniasis, says Herwaldt. About 2 million people a year in Africa, Asia, South America, and the Mediterranean come down with the disease, which can take very different forms, depending on which one of about 20 *Leishmania* species is involved. A type called visceral leishmaniasis is deadly when untreated, whereas so-called cutaneous leishmaniasis can cause terrible disfigurements of the face. No good leishmaniasis vaccines exist.



Flying vaccine? A salivary protein from sand flies protects mice from leishmaniasis.

CREDIT: J. M. C. RIBEIRO/NIAID

Ribeiro and his colleagues have long studied the saliva of blood-sucking mosquitoes, ticks, and flies for clues to the infection process. These insects have developed a small drugstore of chemicals in their saliva—for instance, blood vessel dilators and anticlotting agents—that help them guzzle blood fast and easily. Components of these cocktails help the insect-borne parasites as well: Without them, some would be unable to cause an infection. Ribeiro and a colleague discovered this in 1988 when they tried to infect mice. Simply injecting the parasite didn't cause disease, but injecting it along with a bit of fly saliva—as would happen in nature—did.

That finding suggested that if the researchers could somehow make the immune system block the action of saliva, that would prevent *Leishmania* infection as well. Indeed, 3 years ago, Ribeiro's team showed that when mice were inoculated with minute amounts of sand fly saliva, they didn't get sick when the parasite was injected along with saliva 2 weeks later.

Of course you can't vaccinate people with insect spit. But in their new study, which appears this week in the *Journal of Experimental Medicine*, Ribeiro's team has produced what may be a workable vaccine. They first isolated the 12 major proteins in the saliva of *Phlebotomus papatasi*, an important vector of *Leishmania major*, which causes cutaneous leishmaniasis in Africa. They identified one protein, which they called SP-15, that seemed best at protecting mice from infection. Although they don't know what SP-15's function is, they produced a DNA vaccine based on it. Vaccinated mice could eliminate the parasites, while a control group developed large skin ulcers and was unable to clear *Leishmania*.

Ribeiro suspects that vaccinated animals develop a localized immune reaction, called delayed hypersensitivity, when they come into contact with saliva. Immune messenger molecules called cytokines and certain types of immune cells are recruited to the skin site, making it inhospitable for the parasite.

"You prevent the implantation of the organism. ... That's a very interesting new concept in vaccine development," says Antonio Campos-Neto of the Infectious Disease Research Institute in Seattle—and it may work in other insect-borne diseases as well, he says. Even so, Campos-Neto would like to see more evidence of the vaccine's efficacy; for one, the researchers tested the vaccine in a mouse strain that is not as susceptible to leishmaniasis as some others.

One drawback of the strategy may be that about 30 sand fly species are *Leishmania* vectors, each with its own saliva composition, and SP-15 may not work for many of them. But, says Emanuela Handman of the Walter and Eliza Hall Institute of Medical Research in Melbourne, Australia, "there's nothing to stop people from pulling [saliva] genes from those sand flies, too." And Handman points out one advantage of the saliva vaccine: Because it doesn't target *Leishmania* proteins, it would be very difficult for the parasite to evade it by mutating some of its genes. "This really points the way forward," says Handman.

–MARTIN ENSERINK

FIGHTING BRAIN DRAIN

Ireland Gives Its Stars A Big Pot o' Gold

HERTFORDSHIRE, U.K.—Known for a high-tech buildup that has earned it the nickname Silicon Bog, Ireland has now taken a major step in shoring up the basic research end of its R&D pipeline.

Last week, Science Foundation Ireland (SFI), the country's nascent grants agency, announced that 10 scientific stars will share $67 million. The money is a down payment on an ambitious effort to stem the country's accelerating brain drain problem: The foundation will dole out another $530 million over the next 5 years for a host of measures

to retain Irish talent and lure big fish to its shores. "This is the largest investment in scientific research in our history," gushes Mary Harney, Ireland's deputy prime minister.

Ireland's economy is booming, thanks in part to generous aid from the European Union over the last 15 years. But although high-tech companies spreading across the Irish landscape have fueled a 7.5% average rise in annual gross domestic product over the past 5 years, that prosperity hasn't extended to academia. "Ireland has not been seen as a location to carry out world-class research in the past, and traditionally the best of Irish researchers went overseas to complete their doctorates," says SFI spokesperson Martin Hynes. Even worse, few returned. Attracted by higher salaries and better grant support, many talented scientists set up shop elsewhere in Europe and in the United States.

SFI would like to counter this disturbing trend. The government set up the foundation in July 2000, handing it $600 million to spend on peer-reviewed research over the next 5 years. Seeking to model the agency partly after European bodies like the Wellcome Trust and partly on the U.S. National Science Foundation (NSF), SFI imported as its new director-general William C. Harris, a chemist and former vice president of the University of South Carolina. Harris also spent nearly 20 years at NSF, including a stint as head of the agency's math and physical sciences directorate. A key part of Harris's remit is to keep the SFI's sights trained on basic research.

SFI's first move was to put up major funds for 10 world-class labs to beef up basic research connected to its high-tech industry. The agency advertised a global competition last year, inviting applications from anyone working in biotechnology or information technology—areas deemed vital to the country's economic development. The so-called SFI Principal Investigators, selected by international panels, each will get about $6 million over 5 years, including unpublicized premium salaries said to be more in line with industry than academia. Six are relocating to Ireland or within the country, while the other four are Trinity College researchers enticed to stay put (see table). The SFI has placed no restrictions on how the scientists spend their money, although foundation officials expect the researchers to use the funds to recruit top-notch team members, refurbish aging labs, and purchase major equipment.

Movers and Stayers

Trinity College Dublin	
Michael Coey (IT)	—
Seamus Martin (biotech)	—
Kingston Mills (biotech)	from NUI* Maynooth
John Pethica (IT)	from University of Oxford, U.K.
Igor Shvets (IT)	—
Ken Wolfe (biotech)	—
NUI Cork	
Eoin O'Reilly (IT)	from University of Surrey, U.K.
Eugene Freuder (IT)	from University of New Hampshire, U.S.
NUI Maynooth	
Douglas Leith (IT)	from University of Strathclyde, U.K.
Dublin Institute of Technology	
John Lewis (IT)	from Dublin Institute of Advanced Studies

* National University of Ireland.

Rainbow's end. The Science Foundation Ireland has showered its new Principal Investigators (eight of whom are shown here) with generous 5-year grants.

"The winning candidates are key people in their fields," says biochemist Brian Heap, foreign secretary of the U.K.'s Royal Society, which last year launched a similar initiative to retain top scientific talent. "In terms of brain gain," he says, "Ireland will benefit substantially."

And there's more to come. SFI will continue a rolling call for proposals from candidates for principal investigatorships. It will also create an award for outstanding young scientists, again following an NSF model, with grants of about $300,000 a year for 5 years. Although such programs should empty SFI's coffers by 2006, the government has pledged to continue funding the agency at an annual level of $120 million. **–JOHN PICKRELL**

John Pickrell writes from Hertfordshire, U.K.

ScienceScope

Up in Arms Two federal legislators want to help bail out U.S. researchers sinking under new rules that restrict their use of foreign graduate students to help design and build science satellites.

Scientists have been complaining in vain about the regulations, which require researchers to get State Department licensing in some cases. They were put in place last year following a congressional outcry over satellite technology transfers to countries like China (*Science*, 24 March 2000, p. 2138). So far, the scientific fallout has won little attention from politicians.

Part of Gravity Probe B.

But last month two House members urged President George W. Bush to exempt scientific satellites from the regulations and remove "the cloud of confusion and uncertainty that currently overhangs our nation's space science." The 20 July letter from Representatives Sherwood Boehlert (R–NY) and Ralph Hall (D–TX)—respectively the chair and ranking minority member of the House Science Committee—cites a government decision 15 years ago that kept such satellites off the so-called munitions list.

Administration officials, however, say that the highly charged debate over technology controls will make that plea a hard sell.

Well-Oiled Academy The African Academy of Sciences (AAS) kicked off its $20 million endowment drive last week with a $5 million gift from Nigeria. The donation, three times the academy's annual budget, is the latest sign that science is riding high in the oil-rich nation. President Olusegun Obasanjo also recently established a science council to advise him on issues such as bridging the digital divide and improving the country's biotech industry.

The AAS gift will help fund peer-reviewed scientific grants across all of Africa. "We think this is quite visionary," says AAS president Mohamed Hassan, who hails from Sudan. Founded in 1985 and headquartered in Nairobi, the AAS has 112 fellows from more than 24 countries.

Contributors: Andrew Lawler and Richard Stone

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