control the star thistle."

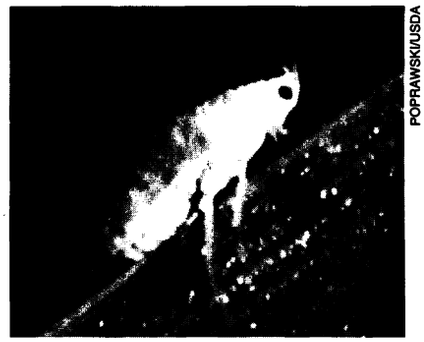
The kind of biological sleuthing that is helping to control the star thistle is also being applied to hydrilla, water lettuce, melaleuca, Eurasian water milfoil, water hyacinth, salt cedar, field bindweed, leafy spurge, and three species of knapweed. The ARS has imported candidate control species for all these pests except Melaleuca and saltcedar; candidates for those weeds have been identified but not imported yet, according to an agency spokesperson. Not all of these imports are being studied at Albany. The ARS also has quarantine facilities at Newark, Delaware, Frederick, Maryland, Stoneville, Missouri, Ithaca, New York, and College Station and Temple, Texas. Montana State University in Bozeman and the Florida Division of Plant Industry in Gainesville also have quarantine labs that ARS researchers work in, and the ARS has cooperative arrangements with more than a dozen quarantine facilities at universities and federal and state agencies.

The ARS sleuths at those facilities are not limiting their attention to plants; they are also looking for predators to control imported insects. Take *Diuraphis noxia*, the Russian wheat aphid, which, despite its name, is mainly a problem for barley growers. According to Tadeusz Poprawski, an ARS scientist in Ithaca, New York, the pest first came to the United States when aphids (originally brought from Europe) flew across the Mexican border into Texas in 1986. It has moved rapidly northward, and now infests between 50 million and 100 million acres of wheat and barley in 17 states and three Canadian provinces.

Poprawski spent 7 years—from 1983 to 1990—at the ARS lab in Behoust, France, which specialized in biological controls for introduced insects. (The Behoust lab was the predecessor of the facility in Montepellier, the newest addition to the far-flung empire of pest hunters, which opened on 1 October of this year.) Until 1988, he was working on several pests, including the gypsy moth, but since then he has concentrated all his energies on the Russian wheat aphid. Born in Poland and educated in Belgium, Poprawski is fluent in several languages, and he puts them to use tramping through grain fields in the Ukraine and Soviet Central Asia looking for plants harboring bugs. With the help of American colleagues and Soviet agricultural scientists, he has found about two dozen beetles and wasps that eat or parasitize the aphids, and three species of pathogenic fungi that infect it. Two of the most promising approaches involve several species of Aphelinus wasps and *Pandora neoaphidis*, a fungus that infects and kills the pest.

In a sense, the ARS campaign against *Diuraphis noxia* is an attempt to set nature's clock ahead: to speed up a process that might otherwise proceed on a much slower timetable. Although the ladybeetles, wasps, and fungi native to America now seem ineffective in controlling the aphid, "regions where the aphid is indigenous rarely sustain economic damage," Poprawski says, and the answer seems to be that the things that prey on the aphid seem to have caught up.

For example, the aphid was a terrible problem for Russian farmers at the turn of the century, but by 1910 its natural enemies had raced ahead and brought it under control. In 1950, it showed up in Turkey, and again caused severe losses at first; by 1965, though, it was no longer a major pest. "The same process is now under way in Ethiopia," Poprawski says. He concludes that "this history suggests that it takes 10 to 20 years for the aphid's enemies to catch up with it. By importing these enemies, mass-rearing them, and releasing them in infested fields, we hope to shorten this process dramatically."



POPRAWSKI/USDA

Illegal immigrant. *Russian wheat aphids probably entered the U.S. from Mexico.*

And indeed, whether it is shortening a process that would happen on its own but more slowly, or creating a competitive balance that is missing when a pest is imported, what the pest hunters of the ARS spend their time doing is helping level the Darwinian playing field by shipping in insects and pathogens to give the pests a run for their money. And whether the efforts now under way to find natural predators for more species are completely successful or not, advocates of the ARS's program say that it is already effective. Jack Coulson, head of the ARS Biological Control Documentation Center in Maryland, says "annual savings from our successful biocontrol programs (for both native and introduced pests), based primarily on the costs of pesticides no longer required, total over $155 million per year. That's six to seven times the total ARS budget for biocontrol." And in a social and political environment in which pesticide use is increasingly suspect, savings like those may seem more and more appealing. ■ JONATHAN D. BEARD

Jonathan D. Beard is a free-lance writer based in New York.

Hepatitis A Vaccine Shows Promise

Boston, Massachusetts—If you've ever been given a large and painful gamma-globulin shot to guard against hepatitis, you will be relieved to know that you may never have to repeat the experience. Researchers at Merck, Sharp, and Dohme in West Point, Pennsylvania, in collaboration with scientists at Johns Hopkins and Hadassah Hospital in Jerusalem, last week announced the development of an effective experimental vaccine against hepatitis A, a widespread strain of the virus—a vaccine that doesn't hurt and is much more effective than a shot of gamma-globulin.

Team member David Nalin, director for clinical research in infectious diseases at Merck, reported at the annual meeting of the American Society of Tropical Medicine and Hygiene here that a large-scale clinical trial in children has shown the vaccine to be 100% effective in stimulating protective antibodies against the virus after only a single injection. The data, says William Jordan, a consultant for the National Institutes of Health's National Vaccine Development Office, are "very exciting and convincing."

Hepatitis A is one of three major liver viruses. (Vaccines have already been developed against hepatitis B; hepatitis C is transmitted largely through blood transfusions, and screening of blood donors is reducing transmissions.) While young children are often infected with hepatitis A—most often from contact with an infected person—they are frequently asymptomatic. But, notes Nalin, they often pass the disease on to adults, who can become seriously ill for periods of up to 3 months with jaundice, fever, nausea, and abdominal discomfort. In addition, the disease is often the "nasty aftermath of a vacation to developing nations," where Western travelers may come into contact with the virus for the first time in their lives, says Nalin. Or it can be transmitted by contact with food contaminated by food handlers.

Reported cases in the United States have held steady at about 25,000 a year throughout the 1980s, according to the Centers for Disease Control (CDC) in Atlanta, but the incidence among drug users seem to be on the rise. Moreover, Eric Mast of the CDC's division of viral diseases believes the disease may be seriously underreported, with the actual incidence anywhere from 15 to 30 times higher than the statistics suggest, mostly

because infected children may not show the effects of the virus.

Despite such numbers, development of a vaccine against hepatitis A had not been a high priority in the United States until recently. Jordan speculates that this comparative nonchalance arises from the fact that, unlike the other two strains of the virus, hepatitis A is not a chronic disease and is not associated with long-term health effects like liver cancer. One reason it has now become more important, he says, is that the rise in day care centers has increased the opportunity for young children to pass around the virus.

Until now, the only prophylactic measure available was a large injection of antibodies, or gamma-globulins, isolated from blood. CDC estimates that these painful injections can be only 80% to 90% effective. Worse, protection does not last long: The shots have to be administered frequently, usually every 6 months for individuals in high-risk situations. In contrast, the new vaccine may be protective for as much as 7 years, Nalin says.

The data on the vaccine's effectiveness come from a trial conducted in Monroe, New York, that included more than 1000 children. Pediatrician Alan Werzberger, the study's principal investigator, gave half the participants a placebo and half the vaccine in a double-blind study. When the first analysis of the study results was made on 6 November, all of the 18 participants who manifested signs of hepatitis were found to be in the placebo group. Furthermore, says Nalin, all of the children receiving the vaccine had protective antibodies in their blood about 2 weeks after inoculation. In an earlier study that determined that the vaccine was well tolerated and had no serious side effects, 98% of adults receiving the vaccine had protective antibodies after receiving two doses.

The vaccine, says Nalin, causes the recipient to manufacture up to 200 times the protective antibodies that they could receive from a gamma-globulin shot. "This is the most potent human vaccine ever developed," he says. Which is why Merck is planning to request approval from the Food and Drug Administration to market the vaccine—a step that would relegate, at least in the United States, those painful gamma-globulin shots to the past. ■ MICHELLE HOFFMAN

A Cold Fusion Déjà Vu at Caltech

Pasadena—His hair was thinner, his voice trembled a bit, and his confidence seemed shaken, but Martin Fleischmann still managed to draw a full house at the California Institute of Technology on only 24 hours notice. He had appeared out of the blue to insist that cold fusion was real, whether or not the scientific community chooses to believe it. But to judge from the content of the lecture and the audience's tepid response, there's no sign he's about to elicit new scientific warmth about the prospects of cold fusion.

The 5 December seminar was the British chemist's first public discussion of cold fusion in the United States since serious interest in the subject faded a year or so after Fleischmann and Stanley Pons of the University of Utah made their electrifying claims in March 1989. In the meantime, Fleischmann has returned to England, while Pons, according to Utah sources, has been working in Nice, France. Neither researcher retains a clear institutional affiliation.

Officially, Fleischmann and Pons still hold research positions at Utah, though sources at the university say the chemistry department has unofficially informed the administration that it is not eager to have Pons, at least, return to the tenured teaching post he resigned a year ago. But the Caltech chemistry department was happy to hear out his cold-fusion collaborator.

Fleischmann had called Fred Anson, head of the department, to say he would be in the area and wanted to examine the negative cold-fusion data collected by Caltech chemist Nathan Lewis. "Martin thought the data-examination process had been very one-sided," said Lewis, "that his and Stan's experiments were under much closer scrutiny than those of people [like Lewis] who thought it was not cold fusion." To help settle the matter, Lewis suggested that Fleischmann bring a working cold fusion cell to Caltech, where they could verify it together. Fleischmann instead opted, at Anson's suggestion, to give the seminar on the state of cold-fusion research.

Fleischmann might have expected rough treatment from his listeners, but he didn't get it. Lewis and Caltech physicists Steven Koonin and Charles Barnes, all of whom had reported negative results in tests of cold fusion, had previous engagements out of town. Even the young researchers who did the cold-fusion benchwork 2 years ago had graduated and moved on. The audience Fleischmann did draw listened politely as he presented his compilation of cold-fusion data.

What's left to support the argument for cold fusion? In the case of what he called "the dominant signature of cold nuclear fusion"—the anomalous heat generated by the Utah fusion cells in 1989—Fleischmann listed only one group, at the Stanford Research Institute, that still purports to confirm it. As evidence of tritium generation in the cells, he cited only an ambiguous 2-year-old result from the Bhabha Atomic Research Institute in Bombay. In support of neutron generation, Fleischmann discussed 1989 work from "people in the Soviet Union." He also mentioned unpublished data from Steven Jones of Brigham Young University, who took cold-fusion cells to Japan, where he put the Kamioka neutrino experiment to work as an ultrasensitive neutron detector. And Fleischmann sought comfort in reports that helium-4—another fusion product Pons and Fleischmann had claimed to see—has been detected in cold fusion cells run by the Naval Weapons Laboratory at China Lake.

But many skeptics would call Fleischmann's report selective. For example, Jones' data may not offer the confirmation Fleischmann is hoping for: Paul Palmer, one of Jones' collaborators, says he wouldn't say they are positive, but, "Steve is cautiously optimistic." Similarly, researchers working with the China Lake group have said that those observations, like the original Utah results, could be explained by helium-4 contamination from the ambient atmosphere.

And Fleischmann made no mention of the negative results from Lewis's group—the work that had brought him to Caltech—nor of those from the British Atomic Energy Commission. Both groups have published extensive papers explaining the anomalous heat in the Utah experiment as an artifact.

When the hour-long talk ended, Fleischmann received a short round of applause, and then his audience quickly evaporated. No more than half a dozen out of maybe 150 listeners stayed on to ask questions of the cold-fusion pioneer. The answers they got were those of a true believer: "The thing is correct," he told *Science*. "This is the woeful thing. It's true. In the end people will have to give way." ■ GARY TAUBES

Gary Taubes is a writer in Santa Monica.