ally excited. "It is one thing to represent a horse, but another thing to represent something that is a figment of the collective imagination, something that doesn't exist in reality," says White. "People had ideas about the world that were abstractions, which we can only describe as religious. We are looking at a widespread belief system that is very ancient." –MICHAEL BALTER

ECOLOGY

## Plant Invader May Use Chemical Weapons

In Montana and other parts of the northwestern United States, an imported purple-flowered plant called knapweed grows so thickly that it looks as if ranchers are cultivating it as a crop. Yet in the Caucasus foothills of the Republic of Georgia where knapweed is native, this plant is so uncommon that plant ecologist Ragan Callaway of the University of Montana in Missoula had to enlist the help of local botanists just to find any at all.

**Clean sweep.** Knapweed is hard to find in its native land, but in Montana it colors the hills purple.

CREDIT: CATHERINE ZABINSKI/MONTANA STATE UNIVERSITY

Ecologists would love to know what explains the rollicking success of invaders such as knapweed, which in the United States is an aggressive, thistlelike weed that cows don't eat and ranchers and government agencies battle using herbicides. A traditional answer is that all the invaders' natural predators and pathogens have been left behind. On page 521, however, Callaway and colleague Erik Aschehoug offer a novel explanation for the success of invasive plants. By comparing how one species of knapweed, *Centaurea diffusa*, behaves with its natural neighbors and with foreign plant species that evolved separately, they found that the invader gains an edge in its adopted home not only by ditching its herbivores but also by wielding weaponry: chemicals exuded from its roots that hamper its new neighbors' growth.

The work is "important" because it could help predict which organisms will be successful invaders, says Kevin Rice, a plant population biologist at the University of California, Davis. "We haven't considered [such underground interactions] in the past." The finding that some plants use subsurface chemical warfare on foreign soil also suggests, says Callaway, that a popular strategy of fighting exotics—siccing insects from back home on the plants—may be even less effective than experts think.

To explore knapweed's underground maneuvers, Callaway and Aschehoug, now a plant ecologist with The Nature Conservancy in Ventura, California, began by pitting *C. diffusa*, or diffuse knapweed, plants against either American or Eurasian grasses in pots. The researchers found that the American grasses produced 85% less leaf and root mass when they were planted with knapweed, whereas knapweed's growth was unaffected. A more complex picture emerged when Eurasian grasses were planted with knapweed: The grasses' biomass dropped by 50%, and the knapweed's growth declined as well.

Callaway and Aschehoug suspected that knapweed's roots exude organic chemicals that stopped the Montana plants from absorbing nutrients. To test that idea, they added to their knapweed-grass pairs some activated carbon, which sucks up organic molecules. They found, Callaway says, that the addition "changed the balance of competition. The American grasses did better, and the Eurasian grasses did worse." Confirmation that knapweed interferes with the American grasses' ability to take up nutrients came when the team then injected the soil with a radioactive form of one potentially limiting nutrient—phosphorus—and tracked how much the various plant pairs snagged.

In the absence of the carbon, knapweed more than halved the amount of phosphorus captured by the American grasses; adding the carbon helped these grasses a bit. In contrast, the Eurasian grasses not only took up just as much phosphorus when grown with knapweed, but also appeared to pack weapons of their own: Adding carbon in the presence of knapweed drastically reduced the amount of phosphorus the Eurasian species took up, suggesting they had been pumping out chemicals that helped them

## ScienceScope

**Making Amends** Following through on a promise made earlier this year, the U.K. government has handed out grants totaling $36 million to scientists who lost the contest for a valuable facility. Last March, the government announced that the $880 million Diamond synchrotron, which will produce x-rays for studying materials, will be built at the Rutherford Appleton Laboratory in central England near Oxford and not at the Daresbury Laboratory in the northwest (*Science*, 17 March, p. 1899). As compensation, the government promised new science funds for the northwest.

This week, a panel awarded the first nine grants, choosing from 52 proposed projects. The winners include a $3.6 million genomics center, a $3 million virtual engineering effort, and a $10 million imaging institute. The panel recommended further study of two other big-ticket items, including a $120 million advanced light source at Daresbury and a $25 million biopharmaceutical facility.

Some scientists think the funding is inadequate. Physicist John Dainton of Liverpool University, a member of the grants panel, said that the "compensation is just a drop in the ocean compared with the loss of a synchrotron."

**Dedicated to History** The leaders of Germany's top basic research organizations gathered in Berlin this week to dedicate a monument to the victims of Nazi-era brain research, just days after a historical commission released a preliminary report on biomedical science abuses during the Hitler era.

The new monument to "the victims of Nazi euthanasia crimes" marks the site—now on the campus of the Max Delbrück Center for Molecular Medicine—where scientists at the Kaiser Wilhelm Institute for Brain Research experimented on brains taken from Nazi victims, including the mentally disabled. At the ceremony, Max Planck president Hubert Markl said his commission's new report makes it clear that "directors, scientists, and lab assistants of several biomedical Kaiser Wilhelm institutes placed themselves in the service of a criminal regime." Max Planck succeeded the Wilhelm institutes.

Markl joined Ernst-Ludwig Winnacker, head of the DFG granting agency, and Detlev Ganten, head of the Max Delbrück Center and the association of German research centers, in calling for a full accounting of Nazi-era abuses. Winnacker said a new DFG panel (*Science*, 2 June, p. 1576) plans to share information with the Max Planck commission's ongoing inquiry.

of the main prehistoric cultures of the Southwest. "Julian Wash is important because it was a very large village and very long-lived," says Henry Wallace, the DAI project manager overseeing the dig. "This excavation will give us important data on key questions about site organization, early economies, and cultural change over time."

The current dig, however, does not address two other pieces of the site, totaling 4 hectares, that will be opened up when the Arizona Department of Transportation (ADOT) shifts existing lanes of traffic a couple hundred meters to the west. Such land would ordinarily be sold off when the interchange project is completed. However, researchers believe crucial sections of the prehistoric village lie intact beneath the present roadbed. It is this area that DAI wants ADOT to set aside as a fenced preserve, at least until another entity can assume control, and perhaps indefinitely.

The idea has taken some getting used to. "This has never been done before," says Bettina Rosenberg, the department's historic preservation coordinator. "And we're not in the preservation business." Indeed, while other state transportation agencies may retain archaeological features along their rights-of-way, none seems to carry them on otherwise salable property, and none seems to protect them with so formal an arrangement as ADOT is contemplating. Still, the department has warmed to the preserve idea in part because of the challenge of selling a relic-filled parcel that requires perhaps $2 million in archaeological excavation—by ADOT or the developer—before it can be built upon. Such a sale might also be very time-consuming. "We're seeing this as good for archaeology, and it will save us the cost of doing more data recovery," says Rosenberg. She and DAI scientists note that the preserve would leave the cost of future excavations to others.

Archaeologists, for their part, are ecstatic about the stewardship. William Lipe, an anthropologist at Washington State University, Pullman, stresses that the "finite" number of archaeological sites makes it imperative that "you put some sites in the bank for future research." And Stephen Lekson, a curator at the University Museum of the University of Colorado, Boulder, suggests that the speed of technological advances—ranging from carbon dating in the 1940s to archaeomagnetic dating in the 1970s to the present era's use of ground-penetrating radar—vastly improves data collection. "We need to keep sites around, because we keep getting better at analyzing them," he argues. "Let's leave some raw data for the archaeologists of the future."

No one is more pleased than Bill Doelle, DAI's president. Although DAI stands to lose several million dollars in potential fees for excavating the preserve site, Doelle says he's willing to pay the price to conserve archaeological sites. "This business has to be about more than just digging for dollars. We have an ethical duty to the future of archaeology, and to Native Americans with ancestral ties to these villages, to leave some archaeology in the ground." **–MARK MURO**

Mark Muro writes from Tucson, Arizona.

RESEARCH FUNDING

## Windfall for French Biomedical Agency

**PARIS**—Researchers at France's giant biomedical research agency, INSERM, are rejoicing over a 16% hike in the organization's research budget for 2001. The windfall, announced by INSERM director-general Claude Griscelli last week, is the biggest such increase since 1983. It will give the organization's 260 laboratories an extra $13 million over the current research budget of about $83 million. In addition, 100 new research posts will be created, bringing the total number of scientists to nearly 4000.

The new money represents "a significant sum," says neuroscientist Marc Peschanski, director of the INSERM Laboratory of Neuroplasticity and Therapeutics near Paris. "It will really mean something" to the labs. Geneticist Judith Melki, director of the Molecular Neurogenetics Laboratory in the Paris suburb of Evry, adds that the influx of new money will help boost the "rather modest" support that INSERM labs have received in recent years.

Griscelli told *Science* that such a big increase was "entirely unexpected." Indeed, other public research organizations were awarded smaller amounts—the basic research agency CNRS, for example, will receive a 9% research boost. Griscelli says that one reason the government smiled so brightly on INSERM may be that the agency has been willing to shape its research agenda according to priorities laid down by the research ministry, which wants to see life sciences research pay off in new therapies and products (*Science*, 8 September, p. 1667). Whereas CNRS researchers have strongly resisted what many see as government meddling in research directions, INSERM has largely accepted the government's guiding hand. Thus the new money will be spent in a number of priority areas, including gene therapy, vaccines, psychiatric research, and epidemiology.

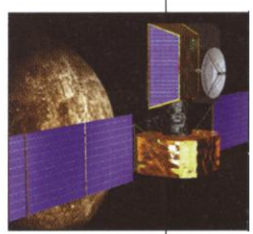
Griscelli insists that basic science will continue to receive strong support at INSERM: "I do not want to prioritize by diminishing funds for fundamental research."

**–MICHAEL BALTER**

## ScienceScope

**Mercury Bound?** European space scientists have suffered from flat budgets and modest plans in recent years. But that may be about to change. Science managers meeting in Paris last week approved an ambitious long-term plan by the European Space Agency (ESA) for five new space voyages (*Science*, 22 September, p. 2019).

The most dramatic proposal is for a half-billion-dollar mission to Mercury called Bepi-Colombo (right). It would be launched in 2009, the same year a smaller NASA-funded craft is scheduled to reach the planet. Another satellite would study the sun, while a third—also a half-billion-dollar project—would map the galaxy starting in 2012. Together with NASA, ESA also wants to launch a gravitational wave observatory and a follow-on to the Hubble Space Telescope.



CREDIT: ESA

The 13 October approval came from the agency's science program committee. Sergio Volante, ESA's astronomy missions coordinator, says the agency hopes to convince government ministers at a meeting slated for late 2001 to sign off on a budget increase to start work in earnest.

**Courting Openness** Federal officials are facing two lawsuits challenging their handling of controversial science issues. The Natural Resources Defense Council, an environmental group, last week sued the Department of Energy (DOE), charging that a panel examining a troubled laser project had violated a federal law requiring openness and peer review. The group has asked a judge to bar DOE officials from using the panel's upbeat report on the National Ignition Facility, a $4 billion laser being built at Lawrence Livermore National Laboratory in California, to win continued funding from Congress. The panel was riven by conflicts of interest, the group says.

A few days earlier, the Competitive Enterprise Institute (CEI) and several members of Congress sued President Clinton and science adviser Neal Lane to block the release of a congressionally mandated report on how climate change may affect the lives of U.S. taxpayers (*Science*, 23 June, p. 2113). CEI seeks a "scarlet 'J' of junk science stamp [on the report] until [it's] brought into compliance," says CEI attorney Chris Horner. Government officials said both groups' charges were unfounded.

**Contributors: Judy Redfearn, Robert Koenig, Andrew Lawler, David Malakoff and Jocelyn Kaiser**