cluding authors, editors, and academicians." Brodsky notes that AIP—unlike most of its competitors—is a not-for-profit, noncommercial organization.

Some of the journals' Russian staff also appear to be upset by the move to publish the English versions from Moscow. *JETP* Editor Vsevolod Gantmacher told *Science* that the journal survived Russia's current financial crisis only because of the support of AIP, and it has now become one of the most popular journals among both Western and Russian scientists—a popularity boosted by its appearance on the AIP Web site in 1997. "Scientists turn to our journal only two times less frequently than to *Physical Review Letters*," Gantmacher says. To terminate the contracts with AIP, he says, "would mean that the journal would be deprived of all the existing advantages and doomed to become a second-rate journal." Says Starobinsky: "If all the journals are given to MAIK Nauka, then it will become a total monopolist."

—**ANDREY ALLAKHVERDOV**

Andrey Allakhverdov is a writer in Moscow. With additional reporting by Richard Stone.

RUSSIA

Relief From Finance Farce?

MOSCOW—Russian scientists got another painful lesson in the vagaries of the country's bureaucracy earlier this year, when the government installed a new system for distributing grants awarded by the Russian Foundation for Basic Research (RFBR) and its offspring, the Russian Humanitarian Scientific Foundation—the country's fledgling competitive grants agencies. Many scientists' grants failed to appear, others got only a fraction of their awards, and nobody at the foundations could track what had happened to the money. Now, the government is trying again. A new distribution system was installed this month, and researchers are keeping their fingers crossed.

The trouble began when the government decided to free the two foundations from the hassles of handling their own grant money. The foundations would simply choose their grantees and inform a section of the Finance Ministry called the Central Treasury. The ministry and a network of local treasuries around the country would then take care of disbursing the funds.

The system soon ran into problems, says Mikhail Alfimov, head of RFBR. Because of the weak and irregular flow of finance from the budget, he says, grantees would often receive no money or only a fraction of what they were due. The funds were also not marked as foundation money, so if it was not a sum that the institution was expecting, it would often be used to pay electricity or heating bills and the grantee would be unaware of its fate. Similarly, the foundations received no information on what was getting through. When money did arrive, the Central Treasury put strict limits on how grantees could spend it, says Alfimov. "Suppose a grantee urgently needs to go to a conference, but he receives money for equipment. ... The finance ministry does not allow [him to swap] it."

The problems came to a head at a meeting of RFBR funding managers in June. "We agreed that if we cannot effectively distribute grants, it would probably be honest to just resign," says Alexei Reskov of the RFBR's department of biological and medical research. And at a heated meeting of the RFBR's Scientific Council early this month, earth scientist Felix Letnikov from Irkutsk strongly criticized the system, saying that "the foundation's initiative has been hijacked by bookkeepers."

Last week, Alfimov says the finance ministry bowed to pressure and established a new system of grant distribution. The Treasury will now send a lump sum to the grantee, who will liaise directly with RFBR on how it should be spent. The funding will also be marked as an RFBR grant, and no institute will be able to use it for any other purpose. Although the new system can do nothing about erratic amounts of funding arriving from the budget, at least now the RFBR and its grantees will know where their money is. "We have managed to educate the Finance Ministry," says Alfimov. "They are used to operating the big volumes. But we have explained to them the specific needs of the foundations."

—**ANDREY ALLAKHVERDOV AND VLADIMIR POKROVSKY**

Allakhverdov and Pokrovsky are based in Moscow.

PALEOBIOLOGY

A Fruitful Scoop for Ancient DNA

In the movie *Jurassic Park*, a collector snapped up hundreds of thousands of mosquitoes preserved in amber for DNA they had sucked from dinosaurs. In the real world, however, amber has been a disappointment, yielding no reproducible traces of ancient genetic material. Now researchers report that the treasure of ancient DNA can instead be gleaned from a less glamorous material: fossil feces.

On page 402, a team led by molecular biologist Hendrik Poinar and geneticist Svante Pääbo of the University of Munich demonstrates a way to unlock DNA trapped inside ancient feces. The dung they studied, a firm lump left by an extinct ground sloth about 20,000 years ago, offers clues to that species' ecology. Applied to other droppings, the method may be able to provide a wealth of clues about the ecology and relationships of extinct animals—and perhaps even about early humans. "This adds several new dimensions to the study of ancient animals," says Bob Wayne, an evolutionary biologist at the University of California, Los Angeles.

The Pääbo lab is one of the few to have successfully extracted DNA from ancient bones (*Science*, 11 July 1997, p. 176). But

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Data dump. This 10-centimeter fossil dropping preserves DNA from the sloth's diet of greens.

the team wasn't having any luck with the well-preserved samples of fossilized dung, called coprolites, collected from Gypsum Cave near Las Vegas, Nevada, a gathering place for ice age animals. Then the researchers chemically analyzed the samples and found several compounds that indicated the presence of Maillard products—sugar-rich tangles of proteins and nucleic acids that prevent DNA amplification. "Everyone looks at the Maillard product as evil," says Poinar. But he realized that the tight cross-links might protect DNA by keeping out damaging water and microbes. The question was how to crack open that coat.

In 1996, the team spotted a possible answer in a *Nature* paper on a chemical called *N*-phenacylthiazolium bromide (PTB), which when given to diabetic rats cleaves the bonds between sugars and proteins—the same kind of bonds that may entangle DNA in the Maillard products. "We thought: 'Wouldn't it be great if PTB would release DNA?' But it was still a complete shot in the dark," recalls Poinar.

The shot hit home. Extracts from the sloth coprolite treated with PTB yielded sequences of mitochondrial DNA, presumably from intestinal cells shed into the feces. It probably came from an extinct ground sloth, *Nothrotheriops shastensis*, because the bones of that animal are scattered throughout the cave and because the DNA is a good match to that of a related extinct ground sloth, *Mylodon darwinii*, whose DNA was derived from bone and soft tissue.

The team was also able to extract a wide variety of plant DNA from the coprolite—clues to the vegetarian sloth's diet. They identified sequences from eight plant families, including grasses, yucca, grapes, and mint. The coprolite had identifiable fragments of only five families, so DNA analysis may help identify plants chewed beyond recognition, says Poinar.

The team hopes to study more sloth dung to help answer the question of why these and other large animals vanished from North America about 10,000 years ago. "We'd like to ... see if there's a change in diet before they go extinct," says Pääbo. Climate change, a possible agent of extinction, might show up as a change of diet, he says.

Right now, Pääbo is analyzing samples of what could be Neandertal feces, from 45,000-year-old cave deposits in Gibraltar. "They look human, but it's hard to be sure that they're not jackal," he cautions. If the samples do contain Neandertal DNA, they would be the second such sequences ever and could offer additional evidence in the continuing debate over this extinct human's kinship to our own species. "A second sequence would give a real window on Neandertal variation," says paleoanthropologist Christopher Stringer of The Natural History Museum in London, who discovered the feces last summer. They could also reveal what Neandertals dined on and what parasites may have plagued them. "Five years ago, we wouldn't have thought we would have the possibility of reconstructing Neandertal diet in this way," says Stringer.

Still, some paleontologists caution that DNA from dung may not reveal everything its proponents hope for. Changes in coprolite contents could simply reflect seasonal shifts rather than pointing to causes of extinction, says Russ Graham, a paleontologist at the Denver Museum of Natural History. The technique may not work on coprolites found in warmer or wetter conditions, or on very ancient samples, as most DNA is thought to degrade within 100,000 years, says Poinar.

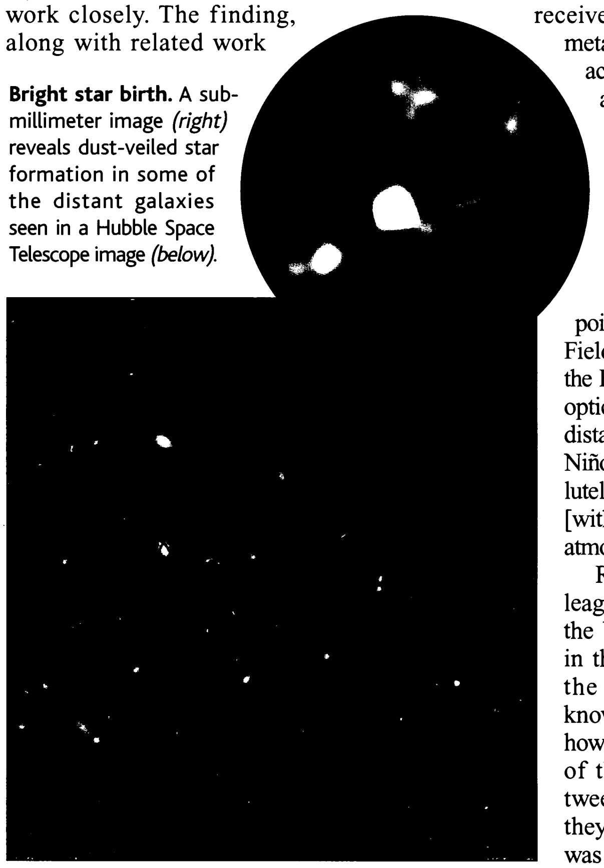
Despite such caveats, "I'm gathering as much poop as I can," Poinar says. "There's going to be a run on feces." **–ERIK STOKSTAD**

ASTRONOMY

Glow Reveals Early Star Nurseries

The universe shrouds many of its secrets in dust. Among them is the history of star birth, which transformed primordial gas into the countless starry galaxies of the present-day universe. Now a team of U.K. astronomers has used light absorbed by dust and remitted at longer wavelengths to look back in time. They saw signs of galaxies undergoing frenzied star formation when the universe was a fraction of its present age. The observation implies, says team member James Dunlop of the Institute for Astronomy in Edinburgh, that astronomers studying visible light "have only seen about a fifth of the star formation in the early universe."

Reported in this week's issue of *Nature*, the observations are "a very exciting new development," says Max Pettini, an astrophysicist at Britain's Royal Greenwich Observatory. Star formation is "part and parcel of the broader question of how the universe evolved from the smooth conditions of the big bang into the galaxies we see today," says Pettini, who has followed the work closely. The finding, along with related work reported in the same issue of *Nature*, suggests that large-scale star formation may have gotten a surprisingly early start.



Bright star birth. A submillimeter image *(right)* reveals dust-veiled star formation in some of the distant galaxies seen in a Hubble Space Telescope image *(below)*.

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The present-day universe is mostly past its reproductive prime. So astronomers have been searching at great distances—which correspond to earlier times—to find the heyday of star birth. But dust is particularly thick in star-forming regions, where it hides the light of hot, young stars, reradiating it in the infrared. "For objects that are very, very heavily obscured by dust, this is where all the energy comes out," says Charles Steidel of the California Institute of Technology.

Observations by infrared satellites have already revealed large numbers of galaxies that shine brightly in the infrared, signifying intense star formation, as much as halfway back to the big bang, says Michael Rowan-Robinson of London's Imperial College. But for even older, more distant stars and galaxies, the expansion of the universe stretches infrared into the submillimeter waveband, a twilight region of the spectrum between the infrared and radio waves. And until recently, astronomers had no way to make submillimeter images of the most distant star nurseries.

That gap is now being filled by SCUBA (for Submillimeter Common User Bolometer Array), the world's first submillimeter camera, based at the 15-meter James Clerk Maxwell submillimeter telescope on Mauna Kea, Hawaii. SCUBA has a palmtop-sized receiver made up of closely packed metal horns, each a few millimeters across, that funnel incoming radiation to heat sensors, called bolometers. To build an image, SCUBA shuffles through 16 slightly different locations and combines the results, like fingers mapping out a heat pattern by tapping around it.

Earlier this year, the team pointed SCUBA at the Hubble Deep Field, the small patch of sky where the Hubble Space Telescope captured optical images of some of the most distant galaxies ever. "Thanks to El Niño, we had nearly 2 weeks of absolutely perfect submillimeter weather, [with] almost no water vapor in the atmosphere," says Rowan-Robinson.

Rowan-Robinson and his colleagues were able to match five of the brightest submillimeter sources in their image to faint galaxies in the Hubble image, which have known redshifts—an indication of how far back in time they lie. Four of the five have redshifts of between 2 and 4, which means that they date from when the universe was between a third and a fifth of its present age—up to 9 billion years ago. Their submillimeter brilliance indicates that dust is shrouding large populations of hot, newborn stars, implying that these are "starburst galaxies," spawning stars at 100 times the rate of our own, says Dunlop. Additional SCUBA images made by a U.S.–Japanese group also reveal bright submillimeter galaxies in the distant universe.

SCUBA offers a mere two-hundredths of Hubble's image quality, which limits the certainty with which the submillimeter images can be matched with optical counterparts. As a result, the distance and hence the age of these submillimeter sources is "somewhat ambiguous," notes Steidel. "Really, we would like a few hundred sources to begin to say something more statistical and general" about star formation in the early universe, agrees Rowan-Robinson. **–ANDREW WATSON**

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