Technology approved $800,000 for preliminary work on a 500-meter spherical telescope, known as FAST. The money is widely seen as a downpayment on the $10 million facility, which would have twice the sensitivity and sky coverage of Arecibo at a fraction of the cost. If the design phase goes well, scientists hope to earn a place on the government's list of megascience projects that it will fund in the next 5-year plan, which begins in 2000. FAST, they hope, would then be the prototype for the square-kilometer behemoth later in the 21st century.

First, however, the scientists must overcome several logistical problems. Although a parabola is the preferred shape for a movable dish because it can focus radiation of any length at a single point, FAST—the size of 16 football fields—is too large to rotate. Instead, it will use a fixed, spherical reflector, which makes positioning easier by providing identical views along any axis. However, a sphere focuses radiation along a line rather than at a point. To gather the radiation, Arecibo, which also has a spherical dish, uses a long, rodlike waveguide suspended above the dish and kept rigid by a 160-ton platform. Such a waveguide can handle only a narrow range of radiation, however, so Arecibo recently added two special correcting mirrors to focus the radiation to a point, allowing the telescope to operate across a broad spectrum. But it's an expensive technical fix.

The Chinese design embodies a lightweight and less costly solution that, in effect, would turn the spherical dish into a parabola. The idea is to build the dish with hexagonal elements, roughly 12 to 15 meters on a side, that could be independently adjusted. "At this size, the difference between a parabola and a circle is only a few feet," says Strom. Differing combinations of panels would be rearranged as the telescope tracked objects moving across the sky.

The design also modifies the system used at Arecibo and other facilities to collect and amplify the signal before it is processed. (That system, called a feed, moves in tandem with the illuminated part of the reflecting surface.) Lasers will accurately detect the position of the feeding system in real time, and the information will be sent back to the central computer.

More than 40 scientists from research institutes and universities across the country are now working on FAST. "Technologically, we can make the telescope all by ourselves," says Peng. "But we would welcome foreign collaboration." Once the telescope is built, China hopes to convince the international science community that Guizhou, with its geography and its isolation from sources of electronic interference, is an ideal place to build the square-kilometer array.

Long before then, however, foreign scientists say that an operational FAST would provide a big boost for Chinese astronomy. "China would leap to the forefront of radio astronomy," says Wilkinson, part of a delegation from the British Royal Astronomical Society that is scheduled to visit next month. "And people seem to be very impressed with what they've seen so far." —LI HUI

With reporting by Jeffrey Mervis. Li Hui is a reporter for *China Features* in Beijing.

RUSSIAN MUSEUMS

Fight Erupts Over Rights to Profits From Holdings

Zoological Institute leads resistance to efforts by Russian Academy of Sciences to share revenue from exhibits and specimens with a new commercial agency

Russia's premier zoological institute is battling its parent body over control of an important source of research funds—revenue from traveling shows and products that showcase its vast holdings. The fight pits the Zoological Institute (ZIN) in St. Petersburg and like-minded institutes against a new agency of the Russian Academy of Sciences (RAS) called the International Academic Agency (IAA) Nauka. The outcome could affect not only ZIN's 15,000,000 holdings, including a prized mummified baby mammoth named Dima that was unearthed in 1977, but also the operations of dozens of other state-owned institutions struggling to adapt to the free market.

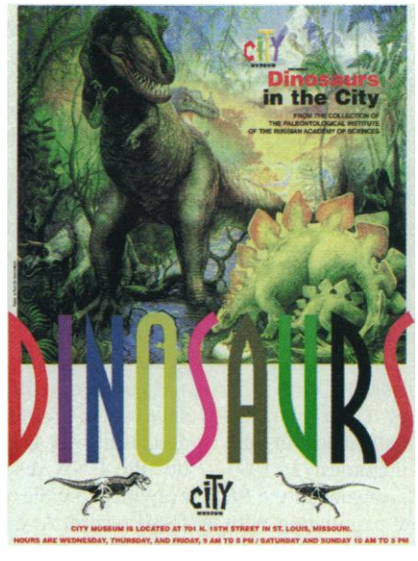
Nauka was created last year after RAS's leadership declared that its "museums, various precious collections, archives, and libraries" were "realizing only feebly" the possible revenue from copies, molds, models, and secondary samples of their collections. RAS set up the agency as a joint venture with Pleiades Publishing Inc., a U.S.–based firm that invested $245,000 in start-up funds. Institutes must receive permission from the academy's presidium to organize any exhibition that bypasses Nauka.

IAA Nauka director Nikolai Parin says that by scouting out new opportunities for exhibitions or by putting together shows involving material from several institutes, his agency should boost revenue flowing into museum coffers. "The whole is always greater than the parts," says Parin, who adds that his agency's cut will vary, depending on the agreement. "We're looking forward to collaborating with every RAS museum, and we hope we will." Some 50 museums are on Nauka's list of potential clients.

But researchers at some RAS institutes aren't convinced. ZIN officials say they fear that Nauka will take a big bite out of scarce revenue that supports ZIN's museum. For example, a 1996 exhibition in Germany commemorating the life of naturalist George Steller, discoverer of the sea cow that now bears his name, netted ZIN 20,000 German marks worth of high-quality microscopes. ZIN argues that Nauka, with the academy's blessing, intends to transform Russia's vast scientific collections into mere commodities, and that Nauka's commercial partner, Pleiades Publishing, stands to profit from Russia's precious collections. "To turn these treasures into property—it is a crime!" says Roald Potapov, director of ZIN's museum.

ZIN director Alexander Alimov has retained legal advisers to help the institute force major changes to the 10-year deal offered by Nauka. One of the lawyers, Konstantin Isakov, says the proposed agreement that Nauka has floated to ZIN and other institutes conflicts with Russian laws on "export of cultural values" and on "guarding cultural monuments."

To make their point, ZIN officials cite the experience of a sister organization, Moscow's Paleontological Institute. PIN has been mired in lawsuits, investiga-



CITY MUSEUM/BUCK COMMUNICATIONS

Curtain closer. St. Louis show was last that Paleontology Institute could broker on its own.

tions, and controversies involving, among other things, fossils that have disappeared from its collections. But it has formidable assets: Some 57 fossil skeletons—including a prized 70-million-year-old, $10 million *Saurolophus angustirostris*—are each valued at $100,000 or more. These specimens are an important source of revenue for an institute where scientists earn only about $100 a month. For example, a recent Russian dinosaur exposition—featuring unique Permian fossils such as the only known *Estemmenosuchus uralensis* and the species-describing type specimen of *Scutosaurus karpinskii*—generated $105,000 for PIN during a 7-month show ending last May at the new City Museum in St. Louis.

Similar support came from a 4-year-long Great Russian Dinosaurs exhibition, organized in August 1993 by PIN, the Monash Science Centre in Clayton, Australia, and the Queen Victorian Museum in Tasmania. The exhibition, featured on the cover of *Time* magazine's Australia edition, "was put together by scientists, and the funds all flowed back into research and education in one way or another," says paleontologist Patricia Vickers-Rich, science-centre director. The activities, she says, have "definitely helped PIN survive."

Nauka will now get a share of such proceeds. A 21 October draft "framework" agreement calls for PIN and Nauka to develop "commercial usage of museum exhibits, objects from collections, from archives, and other unique materials," as well as to make for sale "reconstructions, copies, and casts" of "original paleontological samples," with Nauka taking a 15% cut. But the percentage in the final agreement—signed last December by PIN director Alexei Rozanov, Parin, RAS vice president Rem Petrov, and Pleiades president Alex Shustorovich—was not revealed, leading to speculation that it may be higher. "Rozanov called it a commercial secret," complains Masha Hekker, a PIN paleontologist and outspoken Rozanov critic who was dismissed last December and is now fighting her dismissal in court. Seven PIN scientists, including Hekker, wrote to the All-Russian Paleontological Society, saying that the Nauka deal "looks like the beginning of the privatization of collections and other property of the institute."

And one U.S. collaborator with PIN shares such misgivings. Charles Dean Pruitt, a self-employed mathematician who hooked up with PIN serendipitously in 1993 during a visit to Moscow, organized the St. Louis exhibit and is now negotiating with Nauka to organize shows early next year at the Kansas City Children's Museum and afterward at the Florida International Museum. Pruitt questions the need for Nauka to be involved: "It's unfortunate that the efforts of the existing team of specialists and experts at PIN are being duplicated." Income from the show, Pruitt says, "goes a long way to keep these people in science instead of selling pencils in a kiosk."

R. STONE

Showtime. Acting PIN director Igor Novikov (posing with *E. uralensis*) says Nauka deal will be "fruitful."

A subsequent agreement has fueled fears that institutes may get little revenue from some activities. As part of a joint program, PIN staff members earlier this year made two casts of a fossil of an ancient flightless bird called *Diatryma steini*. The casts were then sold for $5000 each to two German museums. Igor Novikov, who is acting director of PIN while Rozanov recovers from heart problems, says PIN's share was "almost 50%." Parin defends the figure, saying that PIN staff who made the casts "earned much more than their regular income" and that the money has helped the institute purchase materials to make its own cast. "No casts would have been made at all if it was not for the Nauka effort," says Parin.

PIN's top staff members seem to agree. "We have to follow the order of the presidium," Novikov says. "But the agreement also will be fruitful for our institute." Other key staff members have accepted Nauka as well. "We have to organize these exhibitions to support our research," says paleontologist Alexander Karhu, PIN's exhibitions supervisor.

Besides the Zoological Institute, Nauka has approached three other institutions. They are the Kunstkamera—a world-renowned collection of pathological specimens and medical oddities in St. Petersburg that was started by Peter the Great—and two Moscow outfits, the Botanical Garden and the Archaeological Institute. Kunstkamera director Chuner Taksami says he too opposes the deal on the table from Nauka.

Staff at these institutes are anxiously watching the showdown between ZIN and Nauka. But, with most Russian scientists and officials spending large chunks of the summer at their dachas, or summer homes, Potapov says the dispute won't be resolved until September at the earliest. That means Dima and other Russian scientific icons must wait a bit longer to find out who'll be profiting from their next public appearance.

–RICHARD STONE

MEETING MAMMALIAN EVOLUTION

New Views of the Origins of Mammals

HAYAMA, JAPAN—Paleontologists and molecular biologists take different approaches to questions of evolution and often come to different conclusions. Fifty mammalian researchers from both sides of the fence tried to find common ground here at the International Symposium on the Origin of Mammalian Orders from 21 to 25 July.

Rallying Round the Tertiary Radiation

In recent years, researchers who determine how long species have been diverging based on differences in their DNA have pushed back the dates of emergence of modern mammals—the predecessors of everything from whales to tree shrews—to as much as 100 million years ago. That's far earlier than fossils suggest, but the DNA researchers blame the discrepancy on the notoriously incomplete fossil record. At the meeting, however, two paleontologists went on the offensive, claiming that a close look at the fossil record shows that it is complete enough to date the origin of the modern mammalian orders. If the DNA "clocks" can't agree with the fossils, says the author of one study, paleontologist J. David Archibald of San Diego State University, then "the problem is with the molecular clock."

Paleontologists have long held that the modern mammalian orders emerged and differentiated into families, genera, and species after the Cretaceous-Tertiary (K-T) extinction 65 million years ago. That event wiped out the dinosaurs and presumably gave mammals more evolutionary breathing room. But many in the molecular camp have argued that several orders of mammals, including primates and rodents, arose more than 35 million years