neticist Mike Hammer of the University of Arizona, Tucson, and molecular anthropologist Theodore Schurr of the Southwest Foundation for Biomedical Research in San Antonio. Markers from the mitochondrial DNA (mtDNA), which is passed down through the mother and so reveals women's movements, paint a more complicated picture. But even so, "we've got a place we can point to on a map now," says Hammer, "a place for archaeologists to start thinking about connections." And indeed, archaeologists report that about 20,000 years ago the Baikal region was home to a mysterious people called the Mal'ta, who have been suggested as ancestral stock for New World peoples.

Hammer's team tracked the ancient Asian homeland of Native American founding fathers by sampling the Y chromosome—which is found only in males—from 2198 men from 60 populations worldwide, including 19 Native American and 15 indigenous North Asian groups. They sought sites where the Y chromosomes from different populations tend to have different DNA bases. Earlier work had noted that many Native Americans have one particular set of such mutations, called a haplotype (*Science*, 5 March, p. 1439). Hammer also found this major haplotype, which he calls 1G, in half of all Native Americans. But his large sample yielded five additional New World haplotypes. For example, 25% of all Native Americans carry the set of mutations Hammer calls 1C, and 5% carry 1F; three other haplotypes are found at lower frequencies.

To trace these genetic variations back to their source, Hammer sampled more than 1000 men from across Asia. He found that all six New World haplotypes are now concentrated in two centers, northwestern and northeastern Siberia, but the indigenous peoples now in those regions are thought to have migrated from around Lake Baikal. "If you step back and look at the big picture, you're seeing a big generalized region around Lake Baikal," Hammer says.

Those findings fit with independent data presented by Schurr. In a sample of more than 300 ethnic Siberians and 280 Native Americans, he and his colleagues see two primary ancestral Native American patrilineages, which may include one or more haplotypes. One lineage turns up commonly in peoples west of Baikal, like Hammer's 1C. Schurr also sees a sublineage that apparently arose further east in Asia, perhaps near the Amur River, and then spread both west into Siberia and further north toward the Bering Strait and eventually the New World.

Schurr says that mtDNA markers hint at several Asian source areas, including one in Mongolia, perhaps indicating different Asian roots for the men and women who first populated the New World. And all this complexity suggests multiple migrations from Asia, say Schurr and Hammer. Other geneticists have suggested a single migration, but the diversity of markers in Native Americans makes that unlikely, argues Stephen Zegura of the University of Arizona, Tucson, a coauthor on Hammer's talk. "A single population that includes all the Y chromosome and mtDNA variants we're seeing would have to be very, very large. It's hard to explain it all with a single migration."

But no matter how many trips, many of the males in the party apparently started with the same peripatetic population in Siberia. Archaeologists have previously noted a potential source culture around Lake Baikal, dated 25,000 to 20,000 years ago: the Mal'ta, a mammoth-hunting people known for blade and biface tools that researchers have speculated might be the precursors of the Clovis points early Americans made 12,000 years ago. Some archaeologists had been skeptical of the link; as Ted Goebel of the University of Nevada, Las Vegas, notes, "there's a huge gap" between those dates, and later Siberian technologies don't look like anything in the New World.

That puzzle remains, says Goebel, but he is quick to add that the new genetic data will spur archaeologists like himself to focus even more intently on the Baikal region. Says Goebel: "For sure the answers, yea or nay, lie somewhere up there on the mammoth steppe." **–ELIZABETH CULOTTA**

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SCIENTIFIC COMMUNITY

Mathematics Gets Institutionalized—Again

The NSF is expanding its program of mathematics institutes to bring visiting researchers from second-tier universities into the mainstream

Mathematics is often a solitary pursuit, but it's showing signs of becoming markedly more social. Since 1982 the National Science Foundation (NSF) has funded two mathematics research institutes, where mathematicians from different institutions work in collaboration, often with scientists from other disciplines. Now NSF is set to expand the effort.

This month, the NSF announced plans to fund three institutes, the winners of a competition that drew between 10 and 20 entries. Two of the winners are the existing institutes at the University of California, Berkeley, and the University of Minnesota. The third is a new institute at the University of California, Los Angeles (UCLA). The proposed grants total approximately $8 million per year for 5 years, roughly 8% of the NSF budget for the mathematical sciences and a $2.5 million annual increase in spending.

Gathering place. The future home of the Institute for Pure and Applied Mathematics at UCLA.

NSF sees the institutes as a way to help research mathematicians at "second-tier" universities stay in touch with the mainstream, says Donald Lewis, program director for the Division of Mathematical Sciences at NSF. He points out that few of these mathematicians receive any NSF support: "Institutes and conference centers, if sufficient in number, would give nonfunded researchers an opportunity to keep abreast of the latest developments," he says. NSF also wants to create links between mathematics and other disciplines, a primary goal of the new UCLA institute.

Mathematicians applaud the move. "I think the institutes are an excellent idea," says William Jaco, a mathematician at Oklahoma State University in Stillwater and former executive director of the American Mathematical Society. "Having venues for this type of long-term collaboration is as valuable for mathematicians as a laboratory is for laboratory scientists."

The two existing institutes, the Berkeley-based Mathematical Sciences Research Institute (MSRI) and the Institute for Mathematics and Its Applications (IMA) at the University of Minnesota, opened shop in 1982. Each hosts upward of 100 visitors at any given time, including students and postdocs as well as scientists from other fields. The institutes run semester- or yearlong programs for collaborative research and teaching on broad topics, with shorter sessions on specific subjects. Slated for 1999–2000 at MSRI, for example, is a yearlong program on noncommutative algebra (a branch of mathematics that is especially important, for example, in quantum mechanics) and semester-

Private Money Adds Two Institutes

The National Science Foundation isn't alone in opening its wallet to support new mathematics institutes. Two new institutes are also getting under way with private funding. The American Institute of Mathematics (AIM) has begun operations in Palo Alto, California, and the Clay Mathematics Institute (CMI) is gearing up in Cambridge, Massachusetts.

The institutes are the brainchildren of two wealthy businessmen: John Fry, who owns a chain of electronics stores in California, and Landon Clay, former chair of the board of Eaton Vance Corp., a Boston-based mutual fund management firm. AIM's director, Brian Conrey, who is on extended leave from Oklahoma State University in Stillwater, says Fry has spent nearly a million dollars in the last 3 years to get AIM up and running. The institute currently operates out of office space in downtown Palo Alto, next to one of Fry's stores. There are ambitious plans to open a conference center in Morgan Hills, with an extensive mathematics library that would include a large collection of rare manuscripts that Fry plans to acquire.

For now, AIM is funding a number of "high-level collaborations on focused projects" in pure mathematics, Conrey explains, targeting big puzzles that take concentrated brainpower. The institute has brought together a group of researchers to work on mathematics related to the Riemann hypothesis, an important conjecture in number theory that has surprising connections with quantum chaos (*Science*, 20 December 1996, p. 2014). Off site, it is funding a group at Princeton University working on the three-dimensional Euler equation, which stems from the study of fluid dynamics. Another group, based at Oklahoma State, is tackling a problem in topology known as the Lopez conjecture.

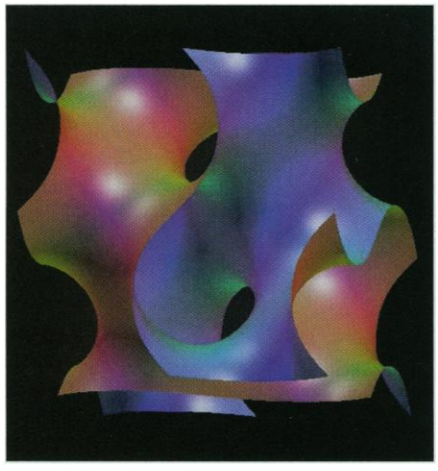
CMI's goal will be to encourage creative and original mathematical thinking, says director Arthur Jaffe, a mathematician at Harvard University, where he holds a chair endowed by Clay. Clay, who says the endowment will be in the "eight figures," says, "We're seeking to support individuals of promise."

CMI has no plans for a building, Jaffe notes. (It currently runs from the attic of his house.) Instead, it will operate more along the lines of a foundation, supporting research through grants. CMI has a number of projects in mind, including a joint project with the American Mathematical Society to support mathematicians at the Independent Moscow University in Russia. However, Jaffe says, "it's a new organization, so our plans are constantly evolving." **–B.C.**

length programs on inverse Galois problems and numerical methods.

Perched on a mountainside east of the Berkeley campus, overlooking the San Francisco Bay, MSRI was long viewed as a bastion of pure mathematics but has adopted a more interdisciplinary stance in recent years. It now has a network of corporate affiliates, including Hewlett-Packard and Pfizer Corp., and has held workshops on topics ranging from materials science to mathematics and the Human Genome Project. It has also begun sponsoring joint postdocs with some of the corporate affiliates. Says MSRI deputy director Hugo Rossi, "We really want to represent mathematics in the broadest possible way."

The focus at IMA, as its name implies, has always been on applications, notes IMA director Willard Miller: "We've helped a lot in showing people the importance of mathematics in other fields." The current yearlong program has been in the area of mathematical biology. On tap for 2000–01 is mathematics in multimedia, including speech recognition and natural language modeling, computer security and privacy issues, and geometric design for three-dimensional graphics. The institute also plans to set up "industrial consortia" to work on mathematical aspects of specific problems from industry, such as optical devices. Miller says he hopes these consortia will live on as online collaborations after the IMA program is over: "Once they're set up, we will bid them bon voyage and set up some more."



Mixing math and materials. A "minimal surface" that describes the internal structure of some materials, as imaged at MSRI.

CREDIT: D. HOFFMAN, *NATURE* **384**, 28 (1996)

The refunding of MSRI and IMA surprised no one, although the competition was fierce—"It was not just a pro forma application," remarks Miller. The two institutes' approach has generally been perceived as a huge success at creating collaborations among mathematicians and introducing them to other disciplines. Indeed, "it's a model that the rest of the world is copying," observes Gil Strang, a mathematician at the Massachusetts Institute of Technology who will serve on the advisory board of the new UCLA institute, pointing to a proliferation of mathematics institutes in locations from England to Singapore.

Lewis notes that the United States still lags Western Europe, which now has 10 institutes for roughly the same number of mathematicians, and even Canada, which has three institutes for a mathematical community 1/6 the size of the U.S. community. The United States doesn't have enough math institutes to do justice to the range of possible topics, says Lewis: "It's a strong argument why we should have far more institutes than we now have."

The new kid on the block, the Institute for Pure and Applied Mathematics at UCLA, won't open until the fall of 2000, but co-director Eitan Tadmor promises IPAM will be even more extensively interdisciplinary than MSRI or IMA. IPAM will aim at a roughly 50:50 mix of mathematicians and scientists from other fields, with three major programs each year. "The basic objective is to encourage cooperation between mathematics and other scientific disciplines," Tadmor says.

That thinking was crucial to IPAM's successful bid. "We have an enormous need right now for institutes that bridge mathematics to the other sciences," notes Lewis. "I think our idea was fresh enough," adds Tadmor, explaining that IPAM will aim to draw in scientists who don't already collaborate with mathematicians. "We wanted to have this interdisciplinary interaction, and we wanted to put together not the usual suspects."

No programs have been scheduled yet, but among the topics mentioned in IPAM's proposal to the NSF are programs in computational chemistry and geometric-based motion (which covers ground from crystal growth to image processing). IPAM also envisions holding "reunion" conferences for participants 1 and 2 years after their program. "We realize that to make real contributions in math and sciences takes time," says Tony Chan, chair of the UCLA math department (and a principal investigator on the IPAM proposal). "Our role is to facilitate that" by helping potential collaborators stay in touch. He thinks the setting will help: IPAM plans to use UCLA's Lake Arrowhead conference center, a lakeside resort in the San Bernardino mountains. **–BARRY CIPRA**