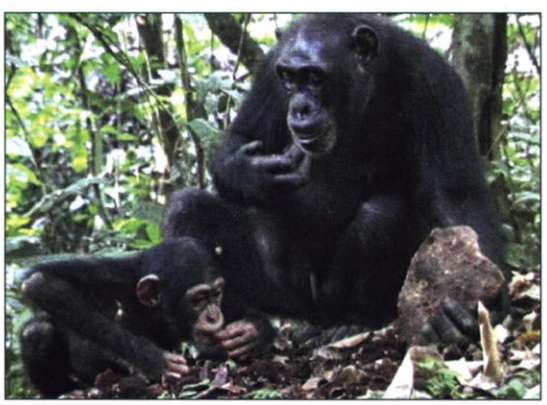
ARCHAEOLOGY

Can Chimps Ape Ancient Hominid Toolmakers?

As anyone with a weakness for pistachios knows, eating nuts can be a lot of work, but the rewards are worth the effort. The high-fat, high-protein foods are also a favorite of humans' closest living relatives, chimpanzees. In the tropical forests of West Africa, chimpanzees are especially avid nutcrackers, spending hours patiently using stone or wooden hammers to break open the tough shells of *Coula*, *Panda*, and other nuts. That behavior, studied for decades by primatologists (*Science*, 25 June 1999, p. 2070), now may also shed light on how early hominids began to make and use tools.



Fruits of their labor. Chimpanzees use stone tools to break nutshells, leaving shattered stone pieces (*top*) behind.

On page 1452, primatologist Melissa Panger and archaeologist Julio Mercader, both of George Washington University in Washington, D.C., with primatologist Christophe Boesch of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, present one of the first research reports on chimpanzee archaeology—a description of stone pieces they dug up at a chimp nutcracking site in the Taï forest in Côte d'Ivoire.

Scientists have watched enough chimps to know that these fragments were created by accident, whereas many early hominid artifacts were clearly intentionally shaped. But the researchers argue that the chimps' leavings bear some resemblance to some of the simplest artifacts left by hominids millions of years ago—although other anthropologists disagree. In any case, says Mercader, the chimp assemblage raises the possibility that scientists could identify sites where ancient hominids, like the chimps, used unmodified stones as tools—something that so far hasn't been spotted in the archaeological record.

The work "opens new ways of looking at some of the oldest human sites," Mercader says. It may also deepen understanding of ape behavior. "We now have a way to detect and trace ape culture back in time," he says.

Written observations of chimpanzee nutcracking date back to Portuguese explorers in the early 1600s. Mercader and Panger teamed up with Boesch to see whether they could uncover evidence of even earlier nutcracking. To have a baseline with which to compare perhaps earlier finds, the team excavated a site around the remains of a recently deceased *Panda* tree. Boesch, with his wife Hedwige, had observed chimpanzees cracking nuts there for 2 decades.

The team members identified six wooden anvils around the tree where chimpanzees had cracked nuts. As they dug, they found a wealth of stone pieces, evidently broken off as the chimpanzees pounded their hammers on the nuts. Some pieces, the team claims, resemble some of those found at certain early human sites, with sharp edges and signs that they had been broken more than once.

The authors—and other anthropologists—emphasize that the chimpanzee site does not resemble classic early human toolmaking sites, where there is clear evidence that the inhabitants used sophisticated flaking techniques to detach stone slivers, used as cutting tools, from larger "cores." But the chimpanzee data, coupled with the wealth of behavioral observations, might help researchers interpret some of the more ambiguous sites containing fewer cores, Mercader argues.

The work shows that chimpanzees can leave a definite record of nutcracking, says archaeologist Jeanne Sept of Indiana University, Bloomington. The description "should encourage archaeologists to examine Paleolithic assemblages more closely" for signs of ancient nut feasts, she says.

Stanley Ambrose of the University of Illinois, Urbana-Champaign, points out that because chimpanzee and hominid hands are different, early hominids probably had different tool-using skills. However, sophisticated tools appear suddenly in the archaeological record about 2.5 million years ago, so additional study of chimp sites might help researchers detect ancient assemblages that represent earlier steps in toolmaking. "It is a short step from accidentally producing sharp-edged flakes and cores to discovering their utility for cutting and chopping," Ambrose says.

But several paleoanthropologists, including Ambrose, were not impressed by some of the similarities the researchers found between the chimp stone fragments and those of early hominids. For example, the team notes that at both the chimp site and at three early hominid sites, the stone pieces were chiefly small and large pieces were rare. But that's not surprising, says Ambrose, because there were no naturally occurring large stones available in at least one of the ancient sites.

Paleoanthropologist Tim White of the University of California, Berkeley, finds that "what they have excavated is utterly unsurprising. … Even the 'simplest' Oldowan sites are fundamentally different" from those of the chimpanzees. He notes that the chimpanzees show no evidence of selecting stone for its material properties aside from weight.

The original goal—finding evidence of ancient chimpanzee nutcracking—will take much more digging, says Mercader. Anthropologist Frédéric Joulian of École des Hautes Études en Sciences Sociales in Paris, who has also analyzed chimp and human nutcracking sites in and near the Taï forest, agrees. Separating chimp from human or prehuman activity, he warns, will not be an easy nut to crack. **–GRETCHEN VOGEL**

OPTICS

Theorists Doubt Claims for Perfect Lens

A spat has broken out in the normally calm world of optics over whether it is possible to make a perfect lens. Two years ago, physicist John Pendry of Imperial College in London predicted that a strange class of optical materials, known as negative index media, could make a lens that focuses all the parts of a light wave, even those that normally decay. But now, two different groups of researchers are attacking Pendry's conclusions.

When light crosses a boundary between two materials, it changes speed; because it changes speed, it bends. The "index of refraction" of a material is a measure of how much it bends a beam of light. In 1968, Russian physicist Victor Veselago used Maxwell's equations—the basic laws governing electricity and magnetism—to predict that in certain specialized materials the refractive index can be negative, with the re-

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sult that light bends in the opposite direction. Veselago's speculation appeared to have been confirmed last year, when a group at the University of California, San Diego (UCSD), made a "metamaterial"—a microscopic lattice of circuit boards imprinted with copper "split ring resonators" and wire strips (*Science*, 6 April 2001, p. 77)—said to display a negative index of refraction for microwaves.

Their work was spurred by Pendry's calculation that these negative index media have an added bonus: They amplify so-called "evanescent waves." In most materials, parts of a light wave decay—the evanescent wave—and this ultimately limits the clarity of a lens. Pendry's insight was that these waves do not decay as usual when light is refracted negatively.

But some researchers think such a phenomenon is too good to be true. A team led by Prashant Valanju at the University of Texas, Austin, says in the 6 May issue of *Physical Review Letters* (*PRL*) that Veselago himself made a mistake in the direction of a light ray in a fundamental diagram. That purported error casts doubt over all subsequent research with these materials. Negative refraction "would violate two basic laws of physics: that no signal can travel faster than light, and that causality must be obeyed," says Valanju.

In the 20 May issue of *PRL*, Nicolas Garcia and Manuel Nieto-Vesperinas of Spain's Higher Council for Scientific Research in Madrid claim that it's Pendry, not Veselago, who's in error. For the evanescent waves to be sufficiently amplified, they say, the energy density in the material would have to be infinite—a physical impossibility. Valanju thinks the UCSD group did not see negative refraction in its metamaterial but rather "diffraction effects."

"Whatever our experiment was," says David Smith of the UCSD team, "the [critics] wouldn't be happy," because it conflicts with Valanju's theoretical predictions. Pendry stands by the UCSD data. He believes that Valanju errs in calculating the velocity of light in these negative index media and that the objections to the "perfect lens" are largely emotional. Pendry and Smith are submitting another paper to *PRL* that they believe answers Valanju's theoretical criticisms. But new experiments—at UCSD and elsewhere—may be the only way to bring this debate into sharper focus.

–KONSTANTIN KAKAES

Konstantin Kakaes is a writer in Paris.

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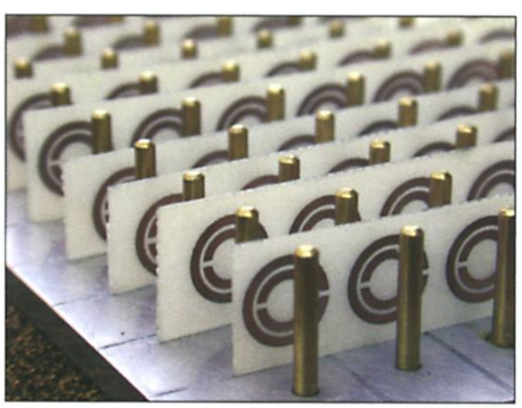

Weird stuff. Researchers say this "metamaterial" can refract microwaves the wrong way.

RUSSIA

Scientists Wary of New Academy Reforms

MOSCOW—A revolution appears to be under way at the Russian Academy of Sciences (RAS)—but it's unclear whether this is a genuine transformation of Soviet-style management at the country's research behemoth or a cynical attempt to thwart real reform.

At the RAS general meeting last week, academy members approved a sweeping overhaul that would merge several of the disciplinary fiefdoms, stripping power from top officials on RAS's governing board, the presidium. The academy's leadership portrays the reorganization—creating nine divisions out of the existing 18—as a way to steer more funding to the cream of its roughly 400 institutes. However, others view it as shuffling chairs on the deck of the *Titanic*.

In either case, observers agree that the academy has indeed hit an iceberg in the form of President Vladimir Putin. At a meeting of his top advisers last March, Putin declared that the state would no longer distribute research funding as a kind of welfare but instead focus it on several unnamed priority directions. That would be a radical change for RAS, which since the Soviet collapse has fiercely defended its system of doling out crumbs to each scientist, rather than conducting merit-based competitions. In the meantime, the unknown fraction of scientists who actually perform research has had to subsist on tiny Russian grants or team up with foreign labs.

The new system, which incorporates Putin's thinking, could strengthen areas such as mathematics that once commanded respect worldwide but have since lost scores of top minds to emigration. Merging RAS's two mathematics divisions, says Guriy Marchuk, who until 1991 served as president of RAS's Soviet predecessor, could resurrect the discipline. A single division will now be responsible for funding much of Russia's mathematics, with explicit instructions to funnel more money to the elite and eliminate redundant projects, says Gennady Mesyats, deputy to RAS presi-

ScienceScope

Favored Fauna Animals in Germany, which already enjoy some of the strictest legal safeguards in Europe, are about to be labeled a protected resource. On 17 May, the lower house of parliament, the Bundestag, voted overwhelmingly to amend the constitution to include animals in a phrase pledging the state to protect "natural resources" for "future generations." The vote—543 in favor, 19 opposed, and 15 abstaining—brushed aside objections from the country's leading research organizations. Next week Germany's upper house, the Bundesrat, is expected to go along.

Although the change is expected to have little immediate impact, many scientists worry that it will give activists new grounds on which to attack the use of animals in research. Another section of the German constitution that protects scientific freedom means researchers should win such suits, says Ivar Aune of the Gesellschaft Gesundheit und Forschung e.V. in Berlin, a research advocacy organization. But the resulting delays, he says, might mean "we could win the battle and lose the war."

Now Batting for NSF The House and Senate spending panels that oversee the National Science Foundation's $4.8 billion budget made it clear during recent hearings that they view the 5% boost proposed by President George W. Bush to be inadequate. Although it's impossible to predict NSF's budgetary fate before either panel gets its spending allocation for all the agencies under its jurisdiction, here are some educated guesses based on comments from influential members and their staffs:

- An overall increase of between 8% and 10%;
- More money for disciplinary research, especially in the physical sciences;
- More money for large new facilities already partially funded, such as a high-altitude airplane and a millimeter-wavelength astronomical array in Chile;
- More money for undergraduate research; and
- Full support for initiatives in nanotechnology and information technology.

Sadly, from NSF's perspective, legislators will also almost certainly include money for their pet research projects.

Contributors: Gretchen Vogel, Andrew Lawler, Adam Bostanci, Jeffrey Mervis