INSIGHTS

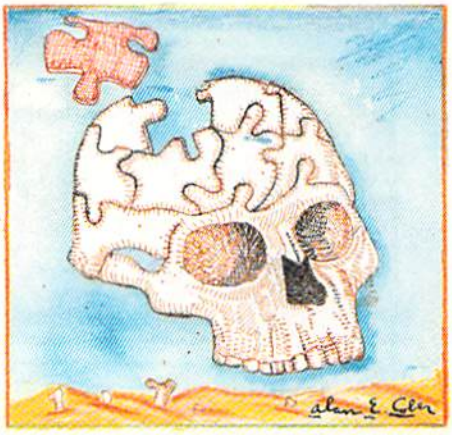
Rutgers researchers uncover new knowledge in the sciences and humanities.

The Original Handyman

FINDING CIVILIZATION'S FIRST TOOLS

In recent years, discoveries of ancient artifacts, cave paintings, and skeletal remains in parts of Africa, the Middle East, and Europe have provided scientists with important clues to an evolutionary jigsaw puzzle—the development of the human brain. Now, scientists have hailed a discovery by two Rutgers researchers as evidence that the ancestors of humans may have used tools half a million years earlier than widely assumed.

Since 1992, a team led by paleoanthropologist John W.K. Harris, chairman of the Department of Anthropology at Rutgers–New Brunswick, and student Sileshi Semaw, a doctoral candidate in anthropology, has found thousands of stone tools and ancient animal remains at 21 sites in the Gona region of Ethiopia. Tools discovered in the 1960s at Tanzania's Olduvai Gorge by Louis and Mary Leakey are about 2 million years old, and recent finds in Kenya and Ethiopia are several thousand years older. The Gona artifacts, however, are estimated to be 2.6 million years old, making them the earliest known artifacts created by humans or their direct ancestors.



At 2.6 million years, the tools found in Ethiopia are the earliest known artifacts created by humans or their direct ancestors.

Harris first discovered a few scattered samples in the Gona region in 1976 and 1977. Soon after, the Ethiopian government banned foreign researchers, and it wasn't until 1987 that Harris and Semaw were allowed to return to the region. The Gona site, which Harris says "contains some of the oldest artifacts in the world," is adjacent to the area in which the Leakeys found the earliest fossils of a hominid, a 3.2-million-year-old female *Australopithecus afarensis* known as Lucy.

Most of the tools consist of stone pebbles made of lava that had been struck repeatedly with a second pebble as a hammer, producing a crude chopper or scrapper. The tools are strong evidence that toolmaking, once thought to be a skill confined to the *Homo* genus, was practiced long before it emerged. Harris and Semaw believe that the tools were made by members of the more primitive *Australopithecus* genus, the only hominids known to have existed at that time.

Anthropologists standardly hold that significant signs of toolmaking did not appear until the emergence of the first species of the *Homo* genus, with its expanded brain, 2 million years ago. The tools that Harris and Semaw found and the possibility that they were created by a predecessor of *Homo habilis*, which means "handyman," has spurred debate about the beginning of tool manufacturing in the ancestors of humans.

From Bottles to Bridges

IMPROVING PLASTIC LUMBER DESIGN

At first glance, the arched structure in the desolate parking lot of Rutgers' Center for Plastics Recycling Research could be taken for modern sculpture, but it's actually the frame of a footbridge that Thomas J. Nosker, assistant research professor in the College of Engineering and project manager for the center, hopes will revolutionize plastic lumber design. The bridge—the first of its kind—is composed of plastics collected at curbside and other waste materials that generally end up in landfills. The largest plastics project ever, the structure will be installed this fall as a walkway between two piers at the New York Tiffany Street Pier project in the Bronx.

Although soda bottles made of a plastic called PET are highly coveted and recycled into rugs, upholstery, insulation, and fasteners, 6.5 billion pounds of other consumer plastics wound up in landfills last year. Since its founding in 1985, the center has sought a use for the wasted material. "This plastic is now used by about 30 companies in the United States to manufacture plastic lumber," says Nosker. "But combined, these companies use only about 40 million pounds each year. The rest is landfilled."

While plastic lumber is more durable and

Illustrations by Alan E. Cober

environmentally sound than treated wood, it is also less stiff, requires more support, and is more expensive than wood. To gain a place in the marketplace, plastic lumber needs to become more cost effective. "I woke up one morning with the answer," says Nosker. His idea was to use a technique called catenary structural design to bend the plastic lumber into a curved shape with its ends held at a fixed distance. By placing it under compression, its load-bearing capacity is increased relative to its stiffness. The 32-foot-long bridge, which can support 25,000 pounds, is made with only $4,000 in plastic lumber. "You couldn't even build something like this with wood, and it's 10 times cheaper than concrete or steel," says Nosker.

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The Rutgers facility—the nation's first university-based plastics recycling center—developed the world's first plastic lumber and then strengthened it with fiberglass and other waste materials. By demonstrating that curbside plastic could be turned into picnic tables, park benches, decks, and playground equipment, an entire industry was launched. Now, with the center's design breakthrough, Nosker believes that "the potential for alternate structural designs for decks and a variety of other construction-related projects is limitless."

Too Much of a Good Thing

Slowing an Immune System on Overdrive

When the body's immune system is working properly, it fights cancer and organisms that cause disease. But sometimes the immune system attacks the tissues it is meant to protect, causing such autoimmune diseases as lupus and rheumatoid arthritis, disorders marked by chronic inflammation. Debra Laskin, a professor in the Department of Pharmacology and Toxicology at Rutgers' College of Pharmacy, hopes that by studying chronic inflammation she may find inhibitors that will protect the body against an immune system gone haywire.

Inflammation stimulates immune cells to rush to the site of injured tissue, Laskin explains. Among the first responders are macrophages, killer cells in the immune army. Macrophages lead the assault by directing the release of cell-killing substances to destroy organisms that cause disease. "When inflammation works properly, the result is wound healing," says Laskin. "When it doesn't, the immune response damages tissue instead of healing it."

To discover what goes wrong, Laskin's eight-member research team is studying inflammation in liver and lung tissues that have been damaged by acetaminophen, a popular over-the-counter painkiller. This common analgesic compound is toxic to the liver, and overdoses are a major cause of liver injury. Because studies in animal models have shown that inflammation occurs before cell damage, Laskin's team suspects that a byproduct of inflammation is responsible.

They now think they've identifed a potential culprit—nitric oxide. Found throughout the body, this potent neurotransmitter helps direct vital functions and is one of the immune system's own weapons. "Macrophages release nitric oxide to kill their targets," Laskin explains. "In chronic inflammation, we think the killing action of macrophages gets turned on but doesn't get turned off. More macrophages are called to the site and induce more and more nitric oxide. Too much nitric oxide damages the tissue."

Laskin and her team hope to find inhibitors to protect the body from an immune system that attacks tissue it usually protects.

Funded by a $400,000 Burroughs Wellcome Toxicology Scholar Award and two five-year grants from the National Institutes of Health that total $1.3 million, the team hopes to prove that nitric oxide causes tissue damage in chronic inflammation. If their hypothesis is proved correct, the team will study whether nitric-oxide inhibitors can be used to prevent liver damage in cases of acetaminophen overdose or lung damage that occurs when macrophages respond to the inhalation of ozone, a toxic air pollutant.

"To intervene effectively in this very complex process, we have to understand not only nitric oxide, but the whole cascade of events in cell injury," says Laskin.—*Bill Glovin*