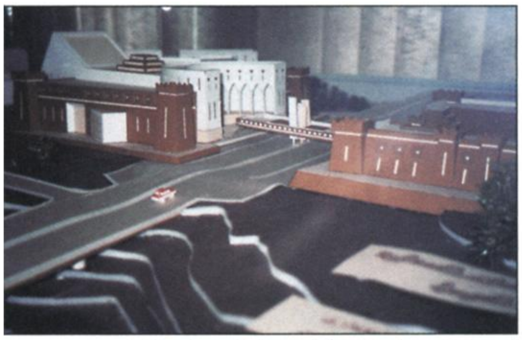


Model institute? The Saddam Institute in Mosul would house a research center and museum.

cuneiform databases—a potential boon to Iraqi researchers now mostly cut off from colleagues abroad. The grounds will include five houses for visiting scholars.

Humam is eager to obtain resin casts made from the British Museum's Assurbanipal collection. Curtis, who met with Humam in Baghdad in March, says the museum is happy to make casts, although he notes that the Iraqis will have to provide funding for the expensive work. It takes one technician a whole day, on average, to produce a single cast. But although Assurbanipal casts may be fine to showcase in a museum, they would be of limited value to scholars, as the texts already have been studied intensively.

The real need within Iraq, experts say, is for better care, conservation, and cataloging of current finds and preparation for a wave of incoming texts. A recent attempt at preserving important tablets discovered in the tombs of Assyrian queens in Nimrud, for example, went awry when the oven malfunctioned, apparently due to power outages, and turned the writing to dust. And even for preserved text, "they use some primitive methods for conserving tablets," notes Robert Englund of the University of California, Los Angeles. He estimates that there are about 70,000 tablets cataloged in the Iraq Museum—and an equal number not yet tagged.

But although Englund worries that the project may end up being little more than "a Saddam tourist center," Iraqi officials imagine the institute serving a much loftier purpose, as a gathering place for scholars to explore all aspects of cuneiform studies. "We are talking about human heritage, not just Iraqi civilization," Humam says. That notion will be put to the test this fall, when Mosul University holds an international conference to kick off the project. Iraqi officials are betting that, if they resurrect the Assurbanipal Library, the scholars will come.

–ANDREW LAWLER

MEETING AMERICAN ASSOCIATION OF PHYSICAL ANTHROPOLOGISTS

Humans' Head Start: New Views of Brain Evolution

BUFFALO, NEW YORK—About 1200 researchers converged here for the 71st annual meeting of the American Association of Physical Anthropologists (10 to 14 April), where brain evolution was one of the hottest topics, including reports on the diet needed to support an expanding brain and a new tool's view of how the human brain took shape in evolution.

Something Fishy About Brain Evolution

Illustrations of human ancestors routinely show brawny hunters bringing home the wildebeest, butchering meat with stone tools, and scavenging carcasses on the savanna. But a more accurate image might be ancient fishermen—and fisherwomen—wading into placid lakes and quietly combing shorelines for fish, seabirds' eggs, mollusks, and other marine food.

At a symposium on nutritional constraints on brain evolution, an unusual mix of anthropologists, neurochemists, nutritionists, and archaeologists debated the kind of diet that must have supported humans' dramatic brain expansion, focusing on how our ancestors consumed enough of the omega fatty acids essential for brain development. Although a few researchers suggested that the source was brain and other organ meat, most agreed that our ancestors must have relied on fish or shellfish. "A shore-based diet was essential for the evolution of human brains," says nutritional scientist Stephen C. Cunnane of the University of Toronto.

That's because humans, intelligent though we may be, are literally fatheads: About 60% of the brain's structural material is lipids, almost all of it in the form of two long-chain polyunsaturated fatty acids, docosahexaenoic acid (DHA) and arachidonic acid (AA), respectively known as omega-3 and omega-6 fatty acids. So when a fetus's brain is developing, a lack of DHA or AA is "catastrophic," says Cunnane.

These acids are vital to brain growth and function after birth, too. Infant humans and other mammals that lack these fatty acids show reduced cognitive ability and vision problems. (The retina has the highest concentration of DHA.) In adults, new data suggest that depletion of these acids may be linked to attention deficit disorders, dyslexia, senile dementia, schizophrenia, and other problems, according to a review by geochemist C. Leigh Broadhurst of the U.S. Department of Agriculture's Environmental Chemistry Laboratory and Michael Crawford of the University of North London in the April issue of *Comparative Biochemistry and Physiology Part B*.

People must consume DHA and AA in their diets, because the body cannot synthesize these molecules fast enough from other fatty acids found in vegetables, nuts, flaxseed, and other sources. Although by far the best source of DHA is shellfish and fish, particularly cold-water fish such as bluefish and herring, these acids are also found in brain meat and in the liver of some animals, says physiologist Loren Cordain of Colorado State University in Fort Collins.

But our ancestors couldn't support an expanding brain by eating brain alone: Crawford calculated that a 350-gram brain from a 1-ton rhinoceros would barely feed a party of hunters,

To catch a fish. Thousand-year-old stone fish traps and 90,000-year-old fishbones from Africa (*right*) show humans' long love affair with fishing.

CREDITS: (TOP TO BOTTOM) A. LAWLER; CHRISTOPHER HENSHILWOOD/UNIVERSITY OF BERGEN, NORWAY; A. BROOKS/GEORGE WASHINGTON UNIVERSITY much less those who needed it most: pregnant and nursing women and children. To have a reliable source of DHA, particularly to increase brain size rather than sustain it, Broadhurst says, "many generations of women had access to fish." She adds that many archaeological sites are by lakes and rivers, so our ancestors must have taken advantage of these obvious resources.

The hypothesis makes sense, says neurochemist Norman Salem Jr. of the National Institute on Alcohol Abuse and Alcoholism. "I would expect that those early brains as they expanded maintained the high DHA content we have today," Salem says. "It seems reasonable to me that they evolved around water with marine sources available."

Indeed, for at least the past 100,000 years, the archaeological record of modern humans includes hundreds of middens—piles of shellfish shells and fishbone—and other signs of fishing. By 70,000 years ago at Blombos Cave in South Africa, and perhaps as early as 90,000 years ago at Katanda, Zaire, people carved bone points for fishing, says anthropologist Alison Brooks of George Washington University in Washington, D.C.

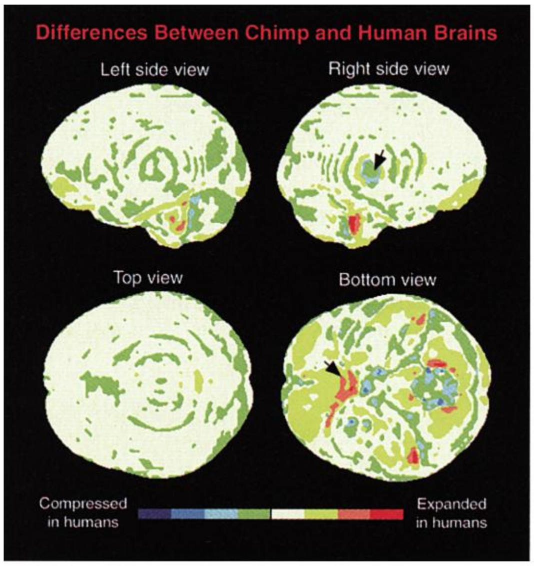
But the brain underwent explosive growth long before this time, probably beginning about 2 million years ago in hominids who lived in Africa and Asia. Methods to reconstruct their diet by studying the ratios of isotopes of carbon and strontium in their teeth or bone have so far failed to discern whether they ate marine foods, says Julia Lee-Thorpe of the University of Cape Town in South Africa. And although some new methods measuring barium ratios hold promise, it might be difficult to find the right hominid remains to test: "For the past 2 million years, the ocean was 10 meters lower than today," notes geologist Henry Schwarcz of McMaster University in Hamilton, Ontario. "Where were the fish-eating populations living? On the now-submerged coast." Many hominids did live near Africa's abundant lakes, however, and their bones may eventually prove whether or not fish gave our ancestors food for thought.

Hot Spots of Brain Evolution

Humans may pride themselves on their big brains, but just which parts of the brain expanded during evolution has been fiercely debated. Now it seems that, compared with chimpanzees, humans may be literally more right-minded. A powerful new imaging technique presented at the meeting revealed bulges on the right-hand surface of human brains that are not seen in chimpanzees, suggesting that these areas expanded during our evolutionary history, perhaps to aid in processing the rhythms and tone of speech.

"The surprise is the degree to which the right side expanded," says speaker Dean Falk, an anthropologist at Florida State University, Tallahassee. "It's generally been thought that the left hemisphere was most important because it is known to be the language-bearing side of the brain. That's true, but we see more changes on the right."

Although the findings are preliminary, the new method, which uses magnetic resonance imaging (MRI) to study and compare the brains of living people and chimpanzees as well as ancient skulls, is already winning rave reviews. "I was totally blown away by the technique," says Patrick Gannon, a comparative neurobiologist at Mount Sinai School of Medicine in New York City.



Brain spots. To match a human, a chimp's brain would have to expand in the right frontal lobe (shown in red and yellow; see arrow on bottom view) and shrink in a spot in the right temporal lobe (in blue, right side view).

CREDIT: K. ZILLES

The technical wizardry that impressed the audience was developed as part of an international effort to map the activity of living people's brains with functional MRI, which tracks oxygen use by tissues, says developer Karl Zilles, head of research groups at the Vogt Institute for Brain Research and at the Research Center Jülich, both in Düsseldorf, Germany. To compare scans of different people with different imaging methods, Zilles's team recently developed software that can shrink or blow up brain maps to a standard size without scaling problems.

Zilles realized that he could adapt the method to compare the sides of the brain, and even the brains of different species—specifically, people, chimpanzees, and extinct hominids. So Zilles and Falk used MRI to make highly accurate "virtual endocasts"—three-dimensional computer images of the right and left sides of human brains. Using the software to compare the two sides, they found two well-known asymmetries that cause bulges at the surface of the frontal lobe behind the right eye and the left occipital lobe at the back of the brain. But they also found new asymmetries, including many areas of the right brain that were larger than the left, such as a semicircle of expansion from just behind the eye socket to the back of the brain.

Next, they looked at how these areas changed during human evolution. They made virtual endocasts of 10 human brains. Then, because they couldn't use MRI on live chimpanzees, they submerged skull endocasts from seven bonobo chimpanzees in water and used MRI to image the water inside the braincase, revealing the shape of the brain. Next they took the "average" cast of each species and used the software to "warp" and overlay the chimp endocast on the human one, showing the areas of difference. They also overlaid a scaled functional human brain map to show the functions of these regions. For example, they discovered a spot behind the right temple (see illustration; shown in blue), thought to be used to analyze sound, that is smaller in humans than in bonobos.

All in all the team found five hotspots where the shape of the human brain differed from that of chimps, and three were more dramatic on the right side. Falk then compared the human and chimp casts with those of 13 hominid skull casts in her collection, ranging from a 2.5-million-year-old australopithecine to more recent archaic *Homo sapiens* and Neandertals. She found marked changes beginning in australopithecines, whose frontal lobes began to expand above the nose. But this and other areas, such as the bottom of the lobe behind the temples, expanded even more in archaic *H. sapiens* and Neandertals. In fact, notes Falk, the newly located asymmetries between the left and right brain "are the exact areas that change dramatically in fossils."

The next step is to figure out what functions are carried out by the expanded brain areas—and whether they reflect deeper underlying structural changes rather than just rearrangements of the tissue next to the skull, says Daniel Buxhoeveden, a biological anthropologist at the Medical College of Georgia in Augusta.

Falk thinks, for example, that the expansion of the semicircle on the right side may be important for understanding the prosodic features of speech, such as rhythm, tone, and emotional content. "It was surprising because most people, including me, are fixed on the idea that speech is dominant on the left side," says Zilles. "Speech is something human, but many changes are on the right."

—ANN GIBBONS