Neandertal tot enters human-origins debate

Around 60,000 years ago, one or more Neandertals buried a dead 10-month-old infant in a cave in northern Israel. Before filling the grave with dirt, someone placed the jawbone of a red deer against the baby's hip in a gesture that apparently held symbolic meaning.

That, at least, is the scenario presented by scientists who unearthed the infant's remains in 1992 at the Amud cave near the Sea of Galilee. Their analysis of the fossil, set to appear later this year in the JOURNAL OF HUMAN EVOLUTION, supports the view that Neandertals inhabited the Middle East along with *Homo sapiens.* It also suggests that Neandertals possessed enough unique skeletal traits to exclude them from playing any role in the evolution of modern humans.

"The exciting thing is that we can identify a Neandertal infant based on anatomical structures outside the midfacial region," asserts Yoel Rak, an anatomist and paleontologist at Tel-Aviv University in Israel. Neandertal midfacial bones portray sloping foreheads, swept-back cheeks, and projecting jaws.

Only the lower jaw, skull base, and several cranial bones remain in good shape on the Israeli specimen, report Rak and his co-workers, William H. Kimbel, an anthropologist at the Institute of Human Origins in Berkeley, Calif., and Erella Hovers, an archaeologist at Hebrew University in Jerusalem. The vertebral column and ribs also survived the millennia, as did incomplete pieces of the pelvis and other lower-body bones.

The Amud infant displays three features unique to Neandertals, Rak argues: a chinless lower jaw; an oval-shaped hole in the base of the skull, called the foramen magnum, through which the spinal cord passed; and a bony lip at the back of the lower jaw, on the inner surface, where an important chewing muscle attached.

From below, the Amud jaw shows a "squarish" profile, indicating the lack of a chin, Rak contends. A similar profile characterizes older juvenile Neandertal jaws found in Eastern Europe and the Middle East, he says. In contrast, fossils of anatomically modern children found at Israeli sites from the same period contain triangular lower jaws, signifying the presence of a chin, he says.

The oval foramen magnum of the Amud specimen also departs from the rounded shape of this feature in living humans and most other primates, Rak adds. Four other partial skull bases of Neandertal children found elsewhere show an oval-shaped foramen magnum, he maintains.

It remains unclear whether this trait reflects any major differences in the workings of the Neandertal spinal cord and central nervous system.

The third clue to the fossil baby's species comes from bony protrusions for a chewing muscle known as the medial pterygoid. These bumps along the jaw's inner surface get larger toward the back of the mouth. Thus, the muscle thickened as it moved up the lower jaw, Rak holds.

The muscle markings end at a bony lip, which served as an anchor for the medial pterygoid, the Israeli researcher notes. The same feature occurs on other Neandertal fossils but not on fossil or modern *H. sapiens*, he asserts.

The function of a thick medial pterygoid muscle at the back of the mouth eludes Rak. In fact, it contradicts his prior theory that Neandertals chewed their food most vigorously with their front teeth.

Still, Neandertals apparently passed these three traits on genetically, since the features appear even in an infant, Rak argues. Only a species distinct from *H. sapiens* could display these and other unique structures, he adds.

Controversy over Neandertals in the Middle East continues, however (SN: 6/8/91, p.360). Some researchers, such as Fred H. Smith of Northern Illinois University in DeKalb, welcome the new find, yet still class Neandertals and early modern humans in that region as closely related subspecies. Others place the two groups in a single population of "archaic" *H. sapiens.* *– B. Bower*

Polymer dendrites: Making tiny connections

As an information processor, the human brain derives its power not from the brute force of fast transmission, but from its ability to process in parallel. It owes this skill to its vast array of interconnections. Brain cells sprout branches, or dendrites, that enable them to communicate with many neighboring brain cells, creating complex trees of associations.

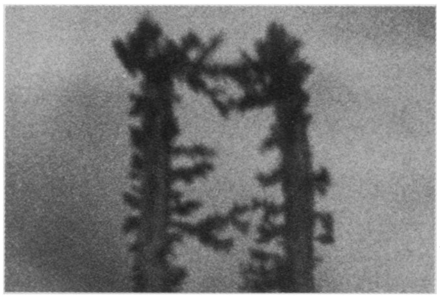
The effort to make computers that can "think," or at least simulate human thought, remains hamstrung by flat silicon chips that process information in sequence rather than in parallel. But that may begin to change.

In the Dec. 24 SCIENCE, Michael J. Sailor, a chemist at the University of California, San Diego, and his colleagues report a new method for connecting minute, hairlike wires that could someday lead to computer chips capable of storing information in three dimensions. Such interconnections could, in theory, make possible computers with quick, parallel processing.

Specifically, the chemists describe a way to cause electrically conducting polymers to form dendritic branches that can selectively link with other branches in a solution. Using the polymer poly(3-methylthiophene), which only grows when conducting current, they caused particular polymer dendrites to link with each other electrically by alternating a current between them.

"The polymer dendrites alternate between conducting and nonconducting states until they come into contact with each other," the team says. "When an actively polymerizing strand electrically contacts a nonconductive strand, the nonconductive strand switches into its conductive state in the region close to the connection."

This technique, while in an early phase of research, could potentially enable scientists to build information webs with "nodes," or processors, connecting to many other nodes three-dimensionally. "There are really no good tools to construct microelectronic devices in three dimensions right now," says Sailor. "But we're moving in that direction."



Jason E. Ritchie, Sailor

Polymer connections less than 10 micrometers in diameter.

"We've been able to show that we can take an arbitrary number of wires and hook them up in an arbitrary number of ways," Sailor adds. "The wires don't have to connect one to one. One wire can connect to five others, which is essential to parallel processors."

"Your brain can recognize a dollar bill in a split second, a task that takes a serial computer a fairly long time," says Sailor, because it processes information in parallel. "When you pack a logic system into three dimensions, a large amount of information fits into a small volume and it works much faster."

But before Sailor can think about such ideas as neural networks, he must overcome some basic hurdles. To be useful for computing, the wires must conduct current only in one direction, not two. He also wants to simplify and automate this procedure, shrinking it down, shortening the distance between connections, and building more complex arrays than the simple test nodes he has fabricated. Ideally, he wants to grow the wires, make the connections, and insulate them "in one pot," without having to move the wires between solutions.

"The dream is to make a thinking machine analogous to a living brain," Sailor says. "This procedure is one of many tools that might be needed to make one."

– R. Lipkin