Dinosaurs used their heads to beat the heat

With their formidable horns and oversized skulls, *Triceratops* and its relatives appear well-dressed for battle. But one scientist suggests the horns may actually have served these dinosaurs as sensory devices much like a cat's whiskers instead of as weapons.

J. Keith Rigby Jr. of the University of Notre Dame (Ind.) raised this imaginative idea last week at the annual meeting of the Society of Vertebrate Paleontology in Austin, Tex., as part of a grand reinterpretation of ceratopsian anatomy. "If we're right, then every child's book on dinosaurs is wrong," says Rigby. Other paleontologists, however, have not rushed to throw away their children's books.

Rigby proposes that horns were arranged to protect against accidental injuries to the ceratopsian frill – a thin layer of bone sticking out from the back of the skull like a huge shield. According to his theory, the frill would have required protection because it was laced with blood vessels to help cool the animal.

A decade ago, James O. Farlow of Indiana University in Fort Wayne proposed that the row of plates along the backs of stegosaurids helped regulate the body temperature of this dinosaur group.

In support of this radiator idea for ceratopsian dinosaurs, Rigby described an unusual preparation of a *Triceratops* skull from east-central Montana. Normally, paleontologists prepare a fossil by removing the rock matrix from around the mineralized bone. But in this case, the rock was extremely hard and it stuck to the fossil. When he could not remove the rock from the bone, Rigby removed the bone from the rock, leaving an impression of the bone surface in the rock.

The impression reveals thick grooves in the top part of the frill that branch off into tubes of smaller diameter. According to Rigby, arteries ran through the grooves, carrying a significant amount of warm blood to the top surface of the frill, where the heat dissipated, cooling the blood before it returned to the interior of the body. He suggests that the frill served almost exclusively as a radiator and that this explains why ceratopsian dinosaurs flourished when seasons grew more pronounced during the end of the Cretaceous period – from 90 million to 65 million years ago. While others have noted the frill contained blood vessels and could release internal heat, Rigby is the first to suggest that the large amount of blood flowing to the frill made this structure primarily a cooling device.

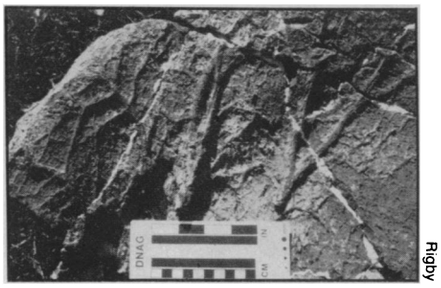
Rigby's theories drew criticism on several fronts. While researchers agree the frill may have helped cool ceratopsian dinosaurs, they say the structure performed other important functions. "It's the Swiss army knife of dinosaur haberdashery," says Robert T. Bakker of the University of Colorado at Boulder.

According to traditional theories, the frill served as an anchor site for powerful muscles that attached to the lower jaw. The large frill, which differed for each species, may also have helped dinosaurs recognize their own kind.

One of Rigby's more controversial suggestions concerns the function of the horns. Because the ceratopsian dinosaurs could not see their frill, which stuck out behind their heads, he proposes they used their horns to sense the frill boundaries in order to avoid injury to the blood-laden structure while tromping through brush and trees. He maintains the horns had neither enough support nor the proper orientation for combat.

Other researchers disagree, saying these herbivorous dinosaurs definitely used their horns in battle, both against large flesh-eating predators and against members of their own species. At the same meeting, Rolf E. Johnson of the Milwaukee Public Museum described a healed puncture wound in the frill of a ceratopsian dinosaur. The wound demonstrates that these animals did indeed use their horns for combat, possibly in a horn-locking style similar to that used by rutting deer, Johnson says.

– *R. Monastersky*



Rigby

Impression of Triceratops *skull shows blood vessels on frill surface.*

Why a man may mistake his wife for a cat

An unusual brain disorder that leaves its victims able to recognize most human-made objects but unable to differentiate among living things is helping scientists understand how the brain categorizes different kinds of information. The work may someday lead to new methods of rehabilitation for people suffering from cognitive disabilities resulting from head injury, brain infection or stroke.

The bizarre syndrome, caused by a loss of nerve cells in a part of the brain responsible for processing shapes and textures, leaves a person able to recognize there's an animal in the room, for example, but unable to tell whether the animal is a dog, a cat or a horse. People suffering from a related syndrome can differentiate among natural objects but not among human-made objects such as plates, photographs and books.

Scientists have so far identified about a dozen individuals with category-related disorders resulting from damage to specific parts of the brain, says Antonio R. Damasio of the University of Iowa College of Medicine in Iowa City. Among the better-known examples is prosopagnosia, which leaves people unable to recognize familiar faces. Patients with such perceptual defects represent unique natural experiments providing insights into the principles by which the brain organizes information, Damasio said last week at the annual meeting of the Society for Neuroscience in Phoenix, Ariz. The observation that some individuals cannot differentiate among most human-made objects, for example, suggests that some parts of the brain may deal primarily with objects displaying straight edges – most of which are hand-made – while other parts of the brain focus on objects featuring the uneven outlines typical of animals and plants.

Informative exceptions do exist. For example, Damasio says, among people with a general inability to differentiate among animals, "I have yet to meet a patient who cannot recognize an elephant or a giraffe." And among fruits, bananas stand out as recognizable even in people lacking the ability to identify most other natural objects.

Exceptions like these may provide hints about the kinds of information the brain finds easiest to remember or process, Damasio says. Moreover, that knowledge can bring therapeutic benefits. "By knowing about the strategies the brain uses to process categories, we have a chance to develop improved reeducation strategies" in brain-injured patients. Such strategies would use sensory or cognitive pathways left undamaged by the initial injury. For example, many injuries that result in a loss of visual processing ability leave unscathed the somatosensory system responsible for such senses as touch, taste and smell – senses that can prove helpful in the relearning process when visual processing becomes impaired. In the brain, says Damasio, "almost everything that gets done one way can be done another way."

Until recently, he concludes, people with processing disorders were considered neurotic. With the new realization that they suffer from specific brain diseases, "there's a lot of hope for rehabilitation." – *R. Weiss*