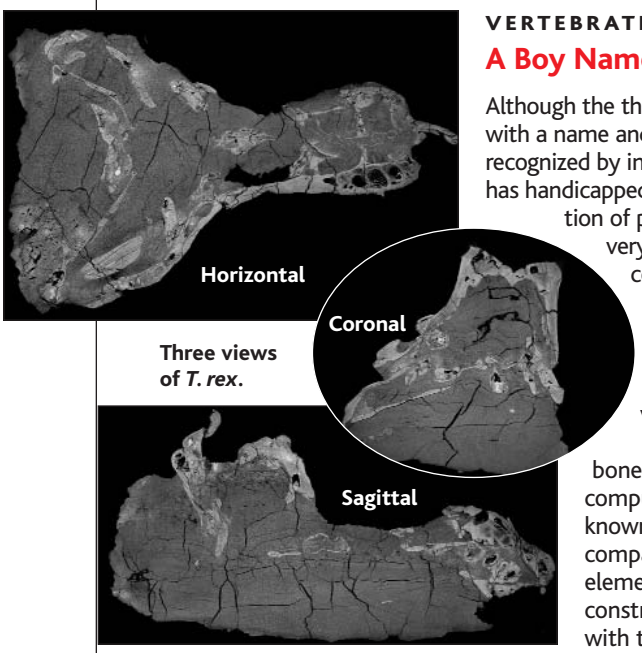
# EDITORS' CHOICE

edited by Gilbert Chin




Three views of *T. rex*.

CREDITS: (LEFT) BROCHU AND KETCHAM, *J. VERTEBR. PALEO.* **22 (4)**, SUPPL. (2003); (RIGHT) PROTA *ET AL.*, *PROC. NATL. ACAD. SCI. U.S.A.* **100**, 5366 (2003)

VERTEBRATE PALEONTOLOGY

## A Boy Named Sue?

Although the theropod *Tyrannosaurus rex* is extremely popular, with a name and shape (huge head, massive tail, bipedal) that are recognized by innumerable 5-year olds, the scarcity of its remains has handicapped our understanding of the species. The combination of popularity and scarcity has made *T. rex* material very valuable, and none more so than the large, nearly complete, and well-preserved specimen known as "Sue." The tale of its 1990 discovery in the badlands of South Dakota, the disputes over its ownership, and its eventual purchase by the Field Museum of Natural History have been covered in various media (including multiple books).

Brochu and Ketcham offer a detailed bone-by-bone description of the taxon. High-resolution x-ray computed tomographic analysis reveals previously unknown aspects of the skull. The monograph and accompanying CD include profuse illustrations of skeletal elements, orthogonal slices, and three-dimensional reconstructions. Sue's morphology is largely congruent with those of other specimens, and most of the observed differences seem pathological. Contrary to earlier speculations, the individual was not bitten by another theropod or hobbled by its abnormal left fibula, and its sex cannot be determined. — ShJS

*J. Vertebr. Paleo.* **22 (4)**, suppl. (2003).

DEVELOPMENT

## Pros and Cons of Male Fertility

The male testis and female ovary arise from a common bipotential gonad during mammalian embryogenesis. Abnormal testis development and resulting infertility are hallmarks of a human disorder called adrenal hypoplasia congenita (AHC), an X-linked syndrome associated with mutations in an orphan nuclear receptor called DAX1. Mouse models of this condition have suggested contrasting roles of DAX1 in gonad development. Adult male mice deficient in DAX1 exhibit pathology similar to that of AHC patients, yet DAX1 has also been called an "anti-testis" gene because overexpression in mice supports female sex determination.

Two studies by Meeks *et al.* argue for a "pro-testis" DAX1 in early gonad development. Testes of DAX1-deficient mice were smaller in size as compared to those of wild-type mice, with incomplete formation of testis cords, which are the earliest structural feature that discriminates testes from ovaries and are the precursors of seminiferous tubules. In particular, DAX1 regulates the differentiation and organization of the peritubular myoid cells that define testis cord boundaries. The appearance of ovary-like gonads in DAX1-deficient male mice was only observed in a genetic background that sensitized mice to sex reversal. The influence of DAX1 on gene expression may provide further information on testicular development, degeneration, and infertility. — LDC

*Development* **130**, 1029 (2003); *Nature Genet.* 10.1038/ng1441 (2003).

MINERALOGY

## In the Eye of the Beholder

Tiger's eye is the popular name for gem-quality quartz-rich material composed of gold to brown fibrous bands that exhibit chatoyancy (lustrous color changes with an undulating narrow band of white light, like a cat's eye). Blue tiger's eye (also called hawk's eye) gets its blue color and chatoyancy from crocidolite, an asbestiform amphibole. In tiger's eye, the brown colors are derived from the hydrothermal alteration of the crocidolite to goethite. Both gems were thought to be produced by pseudomorphism, in which quartz replaces most of the crocidolite while retaining its fibrous structure (like petrified wood or mineralized fossils).

After 125 years of this textbook explanation, Heaney and Fisher have determined that tiger's-eye is formed instead by a repetitive crack-seal mechanism. Host rock that contains crocidolite is fractured by stress and heat; silica-saturated fluids enter the crack; and, while crocidolite grows out from the host rock, columnar quartz grows around and between the crocidolite. Thus, tiger's eye records the structural and thermal path of the host rock and can be used to reconstruct tectonic events. — LR

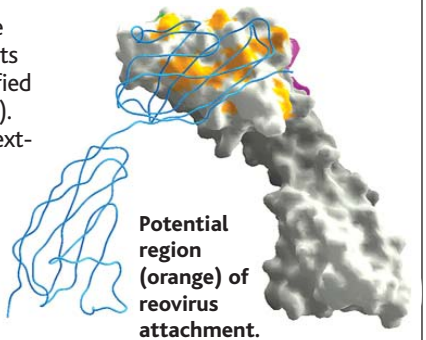
*Geology* **31**, 323 (2003).

CELL BIOLOGY

## Entry Portals

Internal layers of epithelial cells can serve not only as barriers between fluid compartments as in the cardiovascular and gastrointestinal systems, but also as obstructions to foreign agents, such as viruses.

Nevertheless, it is necessary to incorporate mechanisms for passing molecules (cytokines) and cells (leukocytes) across these barriers to deal with inflammatory responses, and this requires regulated and reversible disassembly of the intercellular barriers. The integral membrane protein junctional adhesion molecule (JAM) forms oligomeric assemblies at tight junctions between epithelial cells. Prota *et al.* describe the high-resolution structure of the extracellular portion of human JAM1 and propose that the differences in monomer-monomer contacts between mouse and human JAM reveal potential sites of dissociation. Unfortunately, it appears that viruses have targeted these same sites. The adenovirus fiber protein is known to infect by binding to the cellular coxsackievirus and adenovirus receptor (CAR), the



**Potential region (orange) of reovirus attachment.**

CONTINUED ON PAGE 705

structures of JAM and CAR are similar, and the attachment protein s1 of reovirus and the fiber protein of adenovirus are structurally similar as well. — GJC

*Proc. Natl. Acad. Sci. U.S.A.* **100**, 5366 (2003).

GEOCHEMISTRY

## Water in the Basement

Highly saline subsurface waters, not constrained to specific types or ages of the aquifer rocks in which they reside, are common in deep wells, mines, and boreholes. It is generally thought that these brines are marine in origin and were later concentrated to their present salinity, but how this concentration occurred has been an unresolved question. The answer is of practical relevance because the suitability of some of the proposed sites for nuclear waste storage is based on the assumption that the saline waters are very old, Early Phanerozoic or even Precambrian. Such an old age would imply that the deep waters are practically stagnant and that waste stored there would not be mobilized after dissolution.

Starinsky and Katz argue that the saline brines in crystalline rocks in the Canadian, Fennoscandian, and Bohemian Shields are neither old nor stagnant. They propose that they represent waters of marine origin that were concentrated by seawater freezing during the Pleistocene glacial periods and infiltrated into their present sites under a highly dynamic flow environment. In their model, the cryogenic brines formed intermittently during and between glacial periods, with the repeating advance and retreat of the ice sheets as a major control on the direction and intensity of brine flow. These results should raise concern about the planning and construction of high-grade nuclear waste repositories in such rocks. — HJS

*Geochim. Cosmochim. Acta* **67**, 1475 (2003).

DRUG DESIGN

## Tearing Down to Rebuild

Biologically active natural products combine the specificity that is characteristic of biological molecules with the reactivity of short-lived, in situ–generated intermediates. In the case of neocarzinostatin, the enediyne core is encapsulated within a stabilizing protein; on exposure to thiol, it becomes a potent DNA-cleaving agent with antitumor potential. Chatterji *et al.* describe the deconstruction of leinamycin, which can be activated by glutathione under intracellular conditions. The core component is a 1,2-dithiolan-3-one 1-oxide heterocycle with a distant, unconjugated C=C bond. Ring opening by thiol leads to the formation of an episulfonium ion (the sulfur analog of an epoxide) and facile alkylation of guanosine. By stripping away the bells and whistles (and thus losing specificity toward DNA), these authors demonstrate that the heterocycle core is indeed the chemically sufficient moiety. — GJC

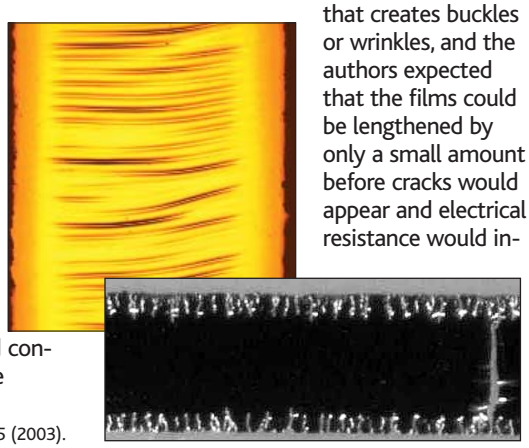
*J. Am. Chem. Soc.* 10.1021/ja029169y (2003).

MATERIALS SCIENCE

## Fabricating Prestressed Conductors

For stretchable sensors, electronic textiles, and connectors to actuators, it would be desirable to have metal contacts that tolerate large reversible stretching. However, free-standing metal films begin to crack when stretched by only 1%, and those on substrates can be deformed by only a few percent before losing their conductivity.

One way around these limitations is to build some "slack" into the metal films. Lacour *et al.* adhered gold films to rubbery polydimethyl siloxane substrates via a thin intervening layer of chromium. These gold films start off under a compressive stress that creates buckles or wrinkles, and the authors expected that the films could be lengthened by only a small amount before cracks would appear and electrical resistance would increase. Unexpectedly, the resistance increased linearly up to a strain of about 8%, at which point small cracks began to appear along the edges of the films. At a strain of 15%, cracks spread across the width of the films, but the resistance stayed finite until a strain of almost 23%. The authors suggest that a conductive layer, one atom thick, remained at the bottom of the fissures. — MSL



**Wrinkles (upper) and cracks (lower) in gold films under compressive and tensile stress.**

*Appl. Phys. Lett.* **82**, 2404 (2003).

CREDITS: LACOUR *ET AL.*, *APPL. PHYS. LETT.* **82**, 2404 (2003)