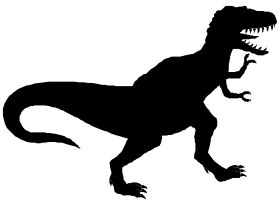

ScienceWatch – T. Rex in the Flesh?

Fossilization of plants and animals has provided us with a window to the past and is the chief means by which we learn about extinct organisms. Fossil formation is an extremely rare occurrence, requiring special conditions. First is rapid burial upon death, which retards decay. Volcanic eruptions and mudslides have served this purpose well. Second, water is required to permeate the very cells of the tissue with dissolved minerals like iron, silica or calcite that leach into intra and intercellular spaces. As the water evaporates the minerals precipitate out of solution and preserve the intimate three-dimensional structure of the once living tissue. In this fashion the tissue becomes mineralized, in effect, turned to stone.

Stone bones are usually what we see when we visit the Dinosaur Hall at the American Museum of Natural History. That's because hard tissue like bone and shell decay more slowly and are more likely to be fossilized than soft tissue. Nevertheless, fossilized dinosaur skin has occasionally been found and more recently some theropod dinosaur fossils discovered in China reveal remnants of fossilized feathers, supporting the dinosaur-bird hypothesis.

Now a team headed by Mary Schweitzer, who is affiliated with both North Carolina and Montana State Universities, has published a report in the March 25, 2005 issue of *Science* that describes the bones of a fossilized specimen of *Tyrannosaurus rex*, which contain well preserved, but not completely mineralized bone and bone marrow. The partially mineralized tissue was discovered because the long bones of the specimen had to be cut so they would fit into the helicopter for removal from the remote fossil site in Montana. Back at the laboratory in Bozeman, Schweitzer and her technician noted that the cut femur (thigh bone), which was originally 107 cm long (3.5 ft.), contained "unusual bone tissue" within the marrow cavity. Once they dissolved the surrounding mineral deposits with weak acid, they found a rubbery material resembling bone marrow. To their astonishment the acid treatment had exposed a soft tissue, which was flexible and resilient.

Microscopic examination revealed transparent, flexible, and branching blood vessels, some of which contained deep red, nucleated, cell-like structures that could only be red blood cells. Schweitzer was so incredulous of the results that she had to repeat the procedure 17 times before she believed it! Free-floating three-dimensional bone-forming cells known as osteocytes were also evident in the microscope. Next the researchers prepared ostrich bone similarly and found the living bird tissue to be "virtually indistinguishable" from the 68 million-year-old *T. rex* material – more support for the dinosaur-bird hypothesis. Using the same methodologies, the scientists isolated translucent blood vessels as well as osteocytes from fossils of two well-preserved tyrannosaurs and a hadrosaur. The exact conditions required for such remarkable preservation are as yet unknown, but certainly oxygen had to be excluded right after death.

The availability of these tissues opens up entirely new avenues to determine the evolutionary relatedness of dinosaurs to each other and to living organisms at the molecular level by using the analytical techniques of molecular biology. DNA sequencing of the dinosaur tissue is problematic because genetic material is readily degraded leaving only short DNA sequences - not enough to learn much. However, proteins are much more prevalent in tissues and are hardier than DNA. The team has already isolated protein fragments from the dinosaur bone and found them to be antigenic, i.e., they behave like proteins. Identifying the proteins from their fragments could provide answers to whether or not certain dinosaurs were warm-blooded since the presence of some key metabolic proteins makes the difference between being warm-blooded or cold-blooded. Undoubtedly we will hear more about this in the future, but don't expect *Jurassic Park* too soon.

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