IDENTIFICATION OF POSSIBLE BLOOD-DERIVED HEME COMPOUNDS IN *TYRANNOSAURUS REX* TRABECULAR TISSUES

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Because of the vital role hemoglobin plays in gas exchange, it has long been the focus of studies in the field of molecular biology. The amino acid sequence of this protein has been determined for a large number of taxa, making it an important tool in phylogenetic studies. In addition, this protein may be a useful indicator of physiology and metabolic rates.

At the core of hemoglobin is the heme unit. The chemical structure of this molecule, a porphyrin ring with one iron atom at its center, is an extremely stable unit, and chlorophyll-derived porphyrins have been positively identified in sediments dating to the Carboniferous. The interactions between the iron atom and its surrounding elements gives heme characteristic signatures by certain analytical techniques.

Six independent lines of evidence point to the presence of heme-containing compounds and/or hemoglobin breakdown products in extracts of *Tyrannosaurus rex* trabecular tissues. These include signatures from nuclear magnetic resonance (NMR) and electron spin resonance (ESR), which indicate the presence of a paramagnetic compound consistent with heme. In addition, UV/VIS spectroscopy and high performance liquid chromatography (HPLC) data show bone tissue extracts absorbing at 410 nm, again consistent with heme compounds. Surface-enhanced resonance Raman (RR) profiles display the four "marker bands" which identify heme molecules. Finally, rats were injected with dinosaur extracts to stimulate an antibody response. When the antiserum generated by these animals was tested against purified avian hemoglobins, strong antibody-antigen binding was detected.

Taken together, the most parsimonious explanation of the evidence is the presence of blood-derived hemoglobin compounds preserved in these dinosaur tissues.