Center for Health Sciences: Anatomy and Vertebrate Paleontology Track

Inferring Cranial And Abdominal Arteries of *Tyrannosaurus rex* Through Extant Phylogenetic Bracketing

CENTER FOR HEALTH SCIENCES
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MAIN POINTS

Our research compared cranial and abdominal arteries of humans and archosaurs (birds and crocodilians) with the goal of inferring the vasculature of *Tyrannosaurus rex*.

METHODS

We inferred arteries in *Tyrannosaurus* with extant phylogenetic bracketing (EPB), which assesses unknown traits in an organism based on its position in a phylogenetic tree between relatives with known features.

ANATOMICAL SOURCES

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Porter, W.R., Sedlmayr, J.C., and Witmer, L.M. (2016). Vascular patterns in the heads of crocodilians: blood vessels and sites of thermal exchange. Journal of Anatomy, 229 6, 800-824 .

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Witmer, L.M. (1995). The Extant Phylogenetic Bracket and the Importance of Reconstructing Soft Tissues in Fossils. in Thomason, J.J. (ed). Functional Morphology in Vertebrate Paleontology. New York. Cambridge University Press. pp: 19–33.

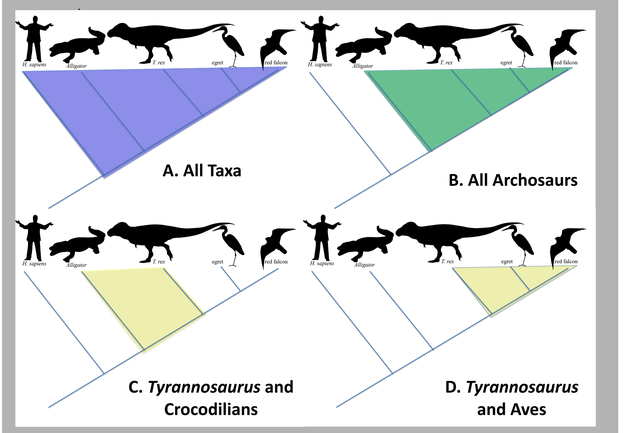
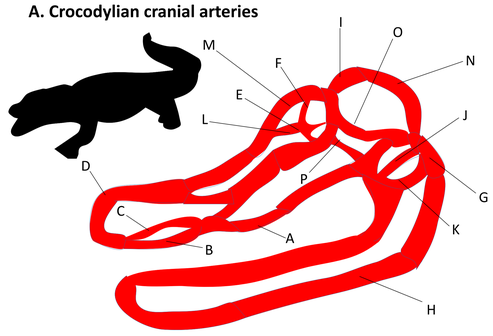


Figure 1. Through extant phylogenetic bracketing, we examined four taxa with humans representing the outgroup, birds as extant (living) dinosaur, crocodilians as distant relatives to dinosaurs, and *Tyrannosaurus rex* as our focal species. Purple represents arteries found in all taxa, green represents only archosaurs, and yellow represents arteries that were found in either bird or crocodilians.

RESULTS: LET'S PLAY THE EPB GAME!

Cranial arteries

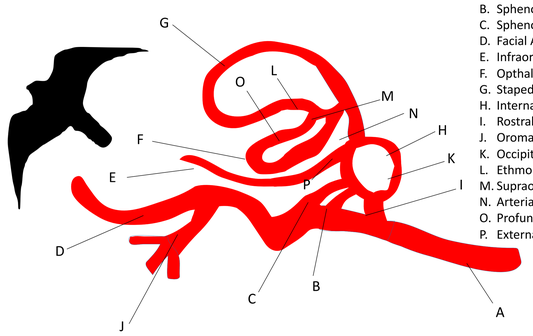
A. Crocodylian cranial arteries



Key: Crocodylian cranial arteries

A. Palatine Artery
B. Lateral Nasal Artery
C. Medial Nasal Artery
D. Maxillary Artery
E. Ethmoid Artery
F. Opthalmotemporal Artery
G. Common Carotid Artery
H. Oromandibular Artery
I. Temporoorbital Artery
J. Internal Carotid Artery
K. External Carotid Artery
L. Infraorbital Artery
M. Supraorbital Artery
N. Occipital Artery
O. Rostral Auricular Artery
P. Orbital Artery

B. Avian cranial arteries

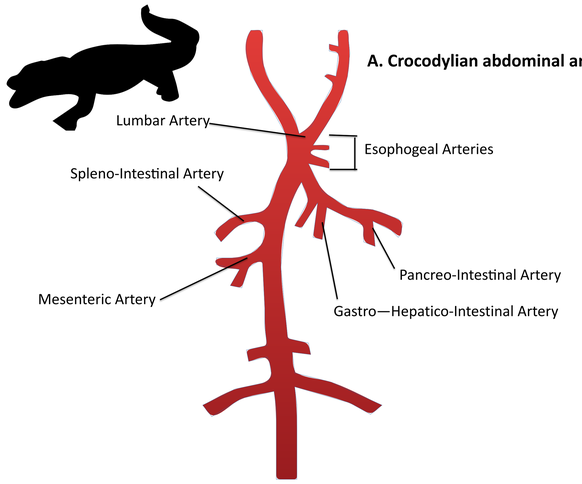


Key: Avian cranial arteries

A. Common Carotid Artery
B. Sphenopalatine Artery
C. Sphenomaxillary Artery
D. Facial Artery
E. Infraorbital Artery
F. Opthalmotemporal Artery
G. Stapedial Artery
H. Internal Carotid Artery
I. Rostral Auricular Artery
J. Oromandibular Artery
K. Occipital Artery
L. Ethmoid Artery
M. Supraorbital Artery
N. Arterial Rete Ophtalmicum
O. Profundus Artery
P. External Carotid Artery

Abdominal arteries

A. Crocodylian abdominal arteries



B. Avian abdominal arteries

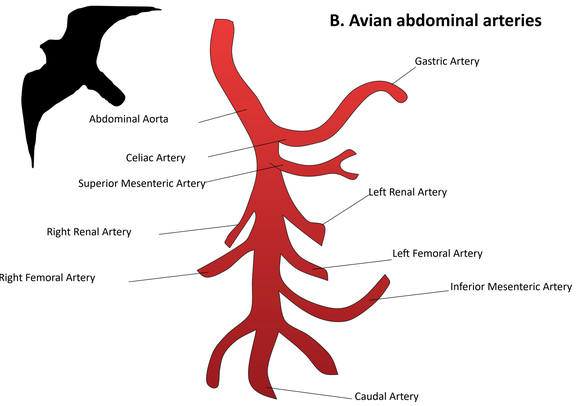


Table 1. Cranial arteries for all taxa

Structure Name	Humans	Crocodilians	Aves	*Tyrannosaurus*
facial artery	yes	yes	yes	yes
infraorbital artery	yes	yes	yes	yes
temporoorbital artery	no	yes	yes	yes
caudal auricular artery	no	yes	no	???
rostral auricular artery	no	yes	yes	yes
stapedial artery	yes	yes	yes	yes
occipital artery	yes	yes	yes	yes
pterygoid artery	???	yes	no	???
cerebral carotid artery	???	yes	yes	yes
common carotid artery	yes	yes	yes	yes
vagus artery	no	yes	no	???
mandibular artery	no	yes	yes	yes
orbital artery	yes	yes	yes	yes
palatomaxillary artery	no	yes	yes	yes
oromandibular artery	no	yes	yes	yes
palatine artery	no	yes	yes	yes
medial nasal artery	no	yes	yes	yes
lateral nasal artery	yes	yes	yes	yes
preconchal artery	no	yes	no	???
conchal artery	no	yes	no	???
postconchal artery	no	yes	no	???
common nasal artery	no	yes	yes	yes
supraorbital artery	yes	yes	yes	yes
ophthalmotemporal artery	no	yes	yes	yes
profundus artery	yes	yes	yes	yes
caudal lateral nasal artery	no	no	yes	???
caudal medial nasal artery	no	no	yes	???
caudal ventral nasal artery	no	no	yes	???
ethmoid artery	yes	no	yes	???
internal carotid artery	yes	yes	yes	yes
lateral palatine artery	no	no	yes	???
nasal artery	yes	no	yes	???
median palatine artery	no	no	yes	???
rostral lateral nasal artery	no	no	yes	???
rostral medial nasal artery	no	no	yes	???
sphenomaxillary artery	no	no	yes	???

Arteries present or inferred by EPB for: all examined taxa, all archosaurs, and birds or crocodylians and *Tyrannosaurus*.

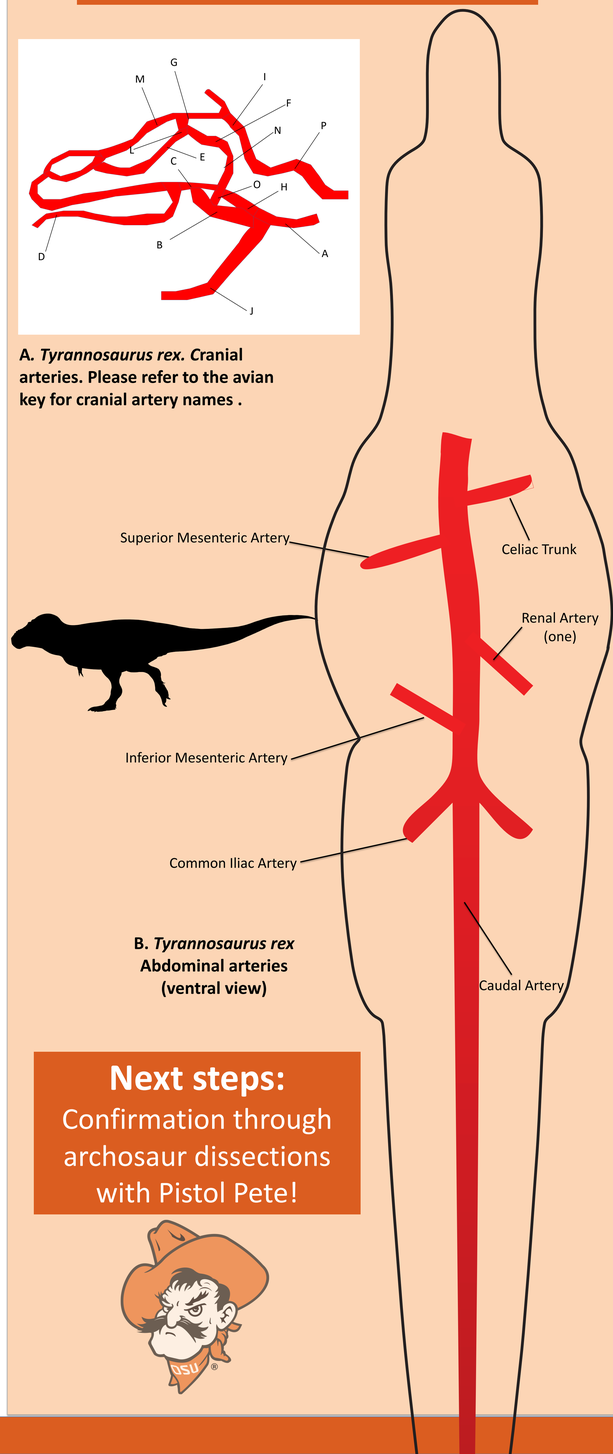
Modified from: Weil, A. and Smith, K., et. al., 2019. BIOM 5116 Gross Anatomy. OSU-COM.

Table 2. Abdominal arteries of all taxa

Structure Name	Humans	Crocodilians	Aves	*Tyrannosaurus*
proper hepatic artery	yes	yes	no	???
left hepatic artery	yes	yes	yes	yes
right hepatic artery	yes	yes	yes	yes
cystic artery	yes	no	yes	???
right gastric artery	yes	yes	yes	yes
common hepatic artery	yes	no	yes	???
gastroduodenal artery	yes	no	yes	???
celiac trunk	yes	yes	yes	yes
left gastric artery	yes	yes	yes	yes
splenic artery	yes	yes	yes	yes
short gastric artery	yes	yes	no	???
intestinal arteries	yes	yes	yes	yes
dorsal pancreatic artery	yes	yes	no	???
greater pancreatic artery	yes	yes	no	???
left gastro-omental artery	yes	no	yes	???
esophageal artery	yes	no	yes	???
dorsal proventricular artery	no	no	yes	???
left branch of celiac artery	no	no	yes	???
ventral proventricular artery	no	no	yes	???
right branch of celiac artery	no	no	yes	???
jejunal arerty	no	no	yes	???
pancreaticoduodenal artery	no	no	yes	???
esophagotracheobronchial artery	no	no	yes	???
ventral gastric artery	no	no	yes	???
ileocecal artery	no	no	yes	???
superior gastric artery	no	no	yes	???
superior proventricular artery	no	no	yes	???
inferior proventricular artery	no	no	yes	???
inferior gastric artery	no	no	yes	???
duodenojejunal artery	no	no	yes	???

Inferences for *Tyrannosaurus*

A. *Tyrannosaurus rex.* Cranial arteries. Please refer to the avian key for cranial artery names .



B. *Tyrannosaurus rex* Abdominal arteries (ventral view)

Next steps:
Confirmation through archosaur dissections with Pistol Pete!