

Neural Canal Ridges: a Novel Osteological Correlate of Post-Cranial Neurology in Dinosaurs

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Bony ridges occur on the walls of the neural canal in caudal vertebrae of numerous sauropod dinosaurs. These neural canal ridges (NCRs) are anteroposteriorly elongated but do not extend to the ends of the canal. To date, we have observed NCRs in caudal vertebrae of *Alamosaurus*, *Apatosaurus*, *Astrophocaudia*, *Brontomerus*, *Camarasaurus*, and *Diplodocus*.

Numerous similar structures occur in extant vertebrates:

- (1) Neurocentral joints are ventral to NCRs in sauropod caudal vertebrae, and NCRs occur in unfused juvenile arches. Hypothesis rejected.
- (2) Attachment scars from ligamentum flavum occur at the ends of the dorsal roof of the canal, not the midpoint of the lateral edges, and this mammalian ligament was probably absent in dinosaurs. Hypothesis rejected.
- (3) Smooth ridges separate the spinal cord from the dorsal spinal vein and paramedullary airways in some crocodylians and birds, respectively. However, these septa persist to the ends of the canal, giving it an 8-shape, unlike the discrete NCRs of dinosaurs. Hypothesis rejected.
- (4) Bony attachments for denticulate ligaments occur in some non-mammalian vertebrates. The dura mater around the spinal cord fuses to the periosteum of the neural canal in non-mammals, so the denticulate ligaments that support the spinal cord can leave ossified attachment scars. These spinal cord supports have been identified in teleosts, salamanders, and a juvenile lizard, and they are the best match for the morphology of the NCRs in sauropod vertebrae.

Functions of NCRs remain obscure. Denticulate ligaments are largest in regions of the vertebral column that experience strong lateral flexion. The hypothesis that NCRs supported the spinal cord of sauropods during lateral tail-whipping is attractive, but inconsistent with our recent discovery of NCRs in a hadrosaur caudal. NCRs are a new osteological correlate of the peripheral nervous system in dinosaurs, and highlight the need for more study in this area.