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Peripheral nervous system, spinal cord, brainstem and cerebellum

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Summary

The monotremes have a similar number and disposition of cranial nerves to other mammals, but the openings for the exit of those nerves from the skull and musculature supplied by the cranial nerves are somewhat different (see also Chapter 15). Development of the peripheral nervous system begins during the early incubation phase of development (~5.0–5.5 mm greatest length or GL) when the neural crest cells begin migration through the trunk. Peripheral nerves grow into the limb buds from ~6.0 mm GL and rapidly establish the main nerve branches. Adult spinal cord structure in the monotremes is similar to that of therians and the grey matter at the centre of the spinal cord can be subdivided into Rexed's laminae according to similar criteria. The short-beaked echidna has remarkably sophisticated dorsal column sensory pathways (for proprioception) that are comparable in size to primates and placental carnivores. Spinal cord development in monotremes follows a similar developmental trajectory to marsupials, with the motor centres in cervical level spinal cord reaching functional maturity before other systems.

The monotreme brainstem is organised along very similar lines to other vertebrates, but in the platypus there are some specific features that reflect the enlargement of the trigeminal sensory system due to electroreception. Monotremes have some anatomical differences in the distribution of catecholaminergic, serotonergic and cholinergic nerve cell groups compared to therians, but these have not yet been convincingly linked to functional diversity.

The monotreme cerebellum has sometimes been described as reptilian or even (and this makes no evolutionary sense!) avian, but it is clearly mammalian in structure with similar cellular structure and