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Embryology and post-hatching development of the monotremes

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Summary

Although the embryology of the monotremes has been studied for more than a century, the difficulties of obtaining embryonic and hatchling specimens and the problems of correlating embryonic stages with the time since conception have hindered the establishment of precise timetables of monotreme development. Monotreme development is naturally divided into intrauterine, incubation and post-hatching phases, lasting between ~3 and 4 weeks, 10 days, and between 4 and 5 months, respectively. Like marsupials, monotremes have an extended intrauterine phase of development, and are hatched with immature forebrains, but also with a suite of special adaptations to facilitate survival in the nest or pouch. The newborn monotreme (puggle) has a brainstem sufficiently mature to handle the requirements of lung ventilation and the limited movements required to maintain position in the nest or pouch and locate the mothers nipple-less mammary areolae. Post-hatching life also involves a protracted period of dependency, during which the young monotreme relies on milk from maternal mammary glands, while gaining fat reserves, establishing thermoregulation and achieving central nervous system maturity. Segmental organisation of the brain appears to be similar in monotremes to therians, but gene expression patterns have not been analysed in the monotreme nervous system.

The history of monotreme embryology

Much less is known about monotreme reproduction than any other group of mammals (Griffiths 1999). In large part this arises from the difficulty of breeding monotremes in captivity. All three genera of monotremes have been maintained in captivity since the early 20th century and yet very few monotreme young had been bred and raised in zoos and wildlife