

The climb to the pouch begins in utero

March 18 2013



Wallabies give birth to very immature, almost embryonic, young that complete most of their development attached to the teat, usually within a pouch. Credit: Kathleen Röllig

Scientists have visualised the short pregnancy of a small species of the kangaroo and wallaby family of marsupials, the tammar wallaby (*Macropus eugenii*), for the first time by high-resolution ultrasound. The study has shed light on a number of developmental events that are likely

to be fundamental to all marsupials. These include a very rigid program of embryonic and fetal development with very little variation in pregnancy length, specialised movements of the endometrium that roll the embryo around the uterus prior to attachment, and climbing movements of the tiny fetus up to three days before birth. This latter finding is one of the earliest developmental behaviours observed in a mammal and prepares the immature young for the journey to its mother's pouch.

Marsupials represent approximately 6% of all [mammal species](#) and include iconic pouched mammals of Australia such as the kangaroo, [wombat](#) and koala. Compared to eutherian mammals, which include more familiar animals such as the dog, cow and human, marsupials have ultra-short pregnancies and give birth to very immature, almost embryonic, young that complete most of their development attached to the teat, usually within a pouch. Kangaroos represent the largest extant marsupials and also give birth to the largest young. However, the newborn kangaroo still weighs less than one gram at birth and must climb blind and unaided from the [birth canal](#) to the pouch.

The [tammar wallaby](#) is one of the smaller species within the genus *Macropus*, which includes 14 species of kangaroos and wallabies, of which all but one species have the ability to halt the development of an embryo (embryonic diapause). It is a model species for understanding marsupial reproduction and evolution and its biology, especially its [embryology](#) and pre-natal development, is very well described. Tammar embryos in embryonic diapause can be reactivated during the breeding season (Jan-April) by removal of the sucking pouch young, which results in birth approximately 26 days later. While the hormonal and morphological changes surrounding this process have been intensively studied, it was not known how the marsupial embryo and fetus interacts with the mother in vivo. With this objective in mind, scientists from the Leibniz Institute for Zoo and Wildlife Research (IZW) in Berlin,

Germany, the University of Melbourne and the University of Sydney in Australia examined the prenatal development of tammar wallabies using high-resolution ultrasonography.

The short intra-uterine development of the tammar was monitored from reactivation of the 100-cell blastocyst in diapause to birth. After reactivation, the blastocyst could be visualised upon reaching a diameter of 1.5 mm. From at least halfway through pregnancy, there were strong rolling movements of the [endometrium](#) that massaged the expanding vesicle against the highly secretory endometrial surface. These unique movements possibly enhance exchange of uterine secretions and gases between the mother and embryo. This finding was surprising since in eutherian pregnancies uterine movements are usually suppressed so as not to disrupt implantation.

Once the reactivated embryos were detected by ultrasound, their developmental progress was constant until birth. Thus, blastocysts in diapause that reactivated first were born first and the birthing sequence amongst mothers could be predicted from the size and stage of their embryos.

Interestingly, the tiny tammar fetus displayed preparative climbing movements up to 3 days before birth that appeared as alternating grasping actions of the left and right forelimbs mimicking those required to climb to the pouch. The fetal forelimbs are well developed at this stage whereas the hindlimbs are still only buds. In eutherian mammals such highly coordinated movements occur much later during development.

The study has highlighted some fundamental adaptations of marsupials that are specific to their unique mode of reproduction. Future work will determine how widespread these adaptations may be within the Marsupialia.

More information: Drews, B. et al. (2013): Ultrasonography of wallaby prenatal development shows that the climb to the pouch begins in utero. *Scientific Reports* 3:1458. [doi: 10.1038/srep01458](https://doi.org/10.1038/srep01458)

Provided by Forschungsverbund Berlin e.V. (FVB)

Citation: The climb to the pouch begins in utero (2013, March 18) retrieved 19 April 2024 from <https://phys.org/news/2013-03-climb-pouch-utero.html>

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