

# [Evolution of pregnancy](https://assignbuster.com/evolution-of-pregnancy/)

The Evolution of Pregnancy

325Mya amniotes diverged into two distinct lineages; diapsids and primitive mammals(Brawand et al. 2008), which is believed to have occurred due to different environmental factors with few similarities surviving today. The mammalian lineage further spit into the prototherian mammals (monotremes) and the therian mammals (eutherians and marsupials) approximately 179Mya (Brawand et al. 2008), with the main reproductive differentiation being the extent of oviparous and viviparous nature of the two individual lineages (Rothchild 2002).

Interestingly, the vitellogenin gene that was found to be present in the amniote is responsible for being the precursor for the proteins that make up the composition of the yolk (Babin 2008) found in oviparous animal’s eggs. This gene began with two counterparts VIT1 and VITanc (Brawand et al. 2008) 350Mya before the divergence of the amniotes and through evolution it was determined by (Menkhorst et al. 2009; Kin et al. 2014) that the VITanc duplicated into VIT2 and VIT3 along the mammal lineage. The functionality of the loss of VIT3 gene 179Mya could be the reason for the split into the prototherian and therian lineages as it could have given rise to the viviparious nature of the therians. Furthermore, within this therian lineage there was a loss of the VIT1 independently for both the eutherian and metatherian lineages (Brawand et al. 2008), hence could indicate why the eutherians are more reproductively differentiated than the metatherians (marsupials) in comparison to the early amniotes (Rothchild 2002).

Additionally, the decreasing reliance on vitellogenin could be attributed to the elaboration of the placenta (Vincent et al. 2015), an organ that develops in the uterus during pregnancy that functions to provide oxygen and nutrients to the fetus (Wagner et al. 2014). There is uncertainty surrounding the reasons as to why this structure originally developed, however it could be due to the increase in survivability of the young through viviparious birth, hence making viviparity the evolutionary advantage. This is supported by Rothchild’s (2002) statement “ viviarity has appeared in many forms among many members of every vertebrate class except brids, and that virtually every case of similarity is proably die to convergence or parallelism than of an evolutionary trend”.

Regardless of why, the endometrial stromal cells required for the placental production were believed to be present in therian mammals prior to their divergence (Vincent et al. 2015). The eutherian mammals have evolved to undergo decidualization (Lynch et al. 2011), the process of remodelling of endometrial stromal cells during pregnancy or in some species as part of their normal sexual cycle, which produces the placenta and many other traits specialised for prolonged pregnancy (131day mean) (Vincent et al. 2015), explaining the loss the shell and yolk characteristics. Contrarily, marsupials also have a type of placenta in the absence of decidualisation (Wagner et al. 2014), however it is formed by the yolk sac which only allows the fetus to attach for a limited time during pregnancy (Menkhorst et al. 2009), resulting in a shorter gestation period (25day mean) (Vincent et al. 2015).  Contrarily, Babin (2008) determined that monotremes lack the ability to form a placenta, hence reflecting their oviparous nature.

Furthermore, in contrast to the eutherian mammals, oviparity is still present in the marsupial and monotreme mammals (Roberts et al. 2016), therefore still utilise an egg coating, which is thought to be a left-over trait of reptiles (Guillette 1993), persisting traditionally until hatching in the monotremes. In marsupials, as they also have a placenta, the conceptuses are enclosed in the shell coat as the zygote passes through the utero junction and inter the uterus where the coat deposition continues until the somite stage (Menkhorst et al. 2009; Renfree 2010), hence shed before birth. Additionally, the marsupials only have white yolk within their eggs (Roberts et al. 2016)

that functions to provide the extra-celluar matrix that contains hyaluronon stabilizing proteins for epithelial construction (Menkhorst et al. 2009) indicating they can now rely on the placenta for nutrients therefore permitting the loss of yellow yolk.

Unlike the marsupials, monotremes, specifically the platypus, have been found to contain a VIT2+3 hybrid gene that is thought to have evolved under selective pressures (Brawand et al. 2008; Lynch et al. 2008), keeping the most important coding so that the egg can be reduced in size but is still functional for birth. The eggshell consists of three parts; the white yolk, the germinal plasma and the yellow yolk (Menkhorst et al. 2009), which functions to provide nutrients in the form of protein, lipids and carbohydrates (usually glycogen) (Wildman et al. 2006). The yellow yolk is believed to have decrease substantially from the first amniotes due to the loss of vitellogenin1 and the ability to provide most of the nutrients for the young through lactation after pregnancy. This is supported by the presence of caseins in the milk of monotremes, a protein which emerged in the common mammalian ancestor and has VIT-like functionality by providing essential amino acids and binds calcium and phosphorus, required for skeletal growth, to the young (Brawand et al. 2008). Lactation originated from the simple egg-wetting function in ancestral mammals but evolved toward a new nourishment resource, developing the presence of casein, therefore permitting the Vitellogenin gene reduction Renfree 2010hjgfv.

Furthermore, monotremes are at the base of the mammalian tree which offers a unique opportunity to understand major aspects of mammalian genome evolution (Menkhorst et al. 2009). This is specifically interesting when observing their oviparous nature and their ability to lactate as this is considered to be the intermediately state of evolution from egg laying to eutherian viviparity (Wagner et al. 2014), however their mechanisms of functionality are relatively unknown. The echidna, a monotreme, is to be studied to provide insight into these intermediately pregnancy characterises and their behaviour to store their egg in a posterior facing pouch until hatching as this foreshadows that of the marsupials, who keep their young In the pouch for extended periods of time (Wagner et al. 2014). These individual behaviours of the echidna could provide further insight into the evolutionary differences between the prototherian and therian lineages and also the divergence of the amniote 350Mya.

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