

Chapter 53

Evolutionary Aside 53.1--Evolution of Milk

The platypus is one of the most wonderful and bizarre animals in the world today. It is a monotreme, the sister taxon to all other living mammals and presumably representative of one of the earliest stages in mammal evolution (see chapter 35). Indeed, the platypus is a mixture of many mammalian and nonmammalian traits. On the mammal side, it has hair and produces milk, so there is no doubt that it is a mammal. On the other hand, it has a variety of nonmammalian traits: it lays eggs and doesn't have nipples. The structure of its pelvis shares many similarities with reptiles, and, of course, it has the duck bill and webbed feet. Also, the male has a spur on its hindleg, which can inject very potent venom. In addition, platypuses have a very weird sex-determination system, involving 10 chromosomes instead of 2 (X and Y), as in all other mammals.

Analysis of the platypus genome is beginning to highlight how some of these traits have evolved. For example, the platypus has no mammary glands. Rather, it simply exudes milk, which the young lap up. The mother platypus also curls around the eggs to help them incubate. For this reason, scientists had speculated that lactation first evolved as a means of secreting moisture to keep the eggs from drying out, or as a source of chemical defense against microbial infection of the eggs, and only later was modified to provide nutrition to the offspring. Given these possibilities, the question arises whether what we understand as milk in mammals evolved prior to the divergence of monotremes, or whether these traits evolved later on. However, the normal constituents of mammal milk—sugars, lipids, etc.—are present in platypus milk, and when the platypus genome became available, comparison of the genes responsible for milk production revealed that they are essentially the same genes used by other mammals. Milk may have evolved to prevent desiccation of eggs, but if so, it happened quickly enough that milk served its current purpose by the time that monotremes diverged from other mammals.