GENOMICS

Top billing for platypus genome

Given the unique position of the platypus in the evolutionary history of mammals, the sequencing of its genome has been eagerly anticipated. A draft genome for this fascinating creature has now appeared in *Nature*. This and five concurrently published papers in *Genome Research* reveal that the mixture of mammalian and reptilian features that characterize the platypus are reflected at the genomic level. They also provide new evolutionary insights into topics ranging from the diversity and function of small RNAs to the origins of mammalian sex-determination mechanisms.

A female platypus, named Glennie, provided the genomic material for sequencing. Analysis of the resulting assembly identified 18,527 protein-coding genes — a typical number for a mammal. The platypus genome is distinguished by a very high CG content, which might be related to the prevalence of particular classes of repeat element.

Further analysis of the genome shed light on aspects of platypus biology that are absent in other mammals. For example, the platypus is the only mammal to use a spur-like structure on its hind limbs to deliver venom. Components of this venom were found to have evolved from duplications of a group of genes that were originally involved in antimicrobial defence, a process that also occurred, independently, in snakes — a striking example of convergent evolution.

The platypus genome also provides an excellent opportunity to investigate the evolution of features that are unique to mammals. Unlike the XY versus XX sex determination system of marsupials and placental mammals, the platypus has multiple sex chromosomes. One of the new *Genome Research* studies shows that the platypus X and Y chromosomes have extensive homology to bird sex chromosomes, whereas they are unrelated to the X and Y chromosomes of other mammals and lack *SRY*, the mammalian sex-determining gene. Another of the new studies looked at the evolution of testicular descent, a unique feature of therian mammals. Genomic comparisons between the platypus and other mammals revealed that the developmental pathway involved in this process evolved through a series of events involving gene duplication and diversification.

Both the *Nature* paper and two of the *Genome Research* papers provide new directions for studying the evolution and function of small non-protein-coding RNAs. It turns out that the platypus genome encodes microRNAs that it has in common only with other mammals; however, it also encodes others that are found in the bird and reptile lineage but not in other mammals. Interestingly, the platypus expresses a greater number of small nucleolar RNAs than its relatives, and the genes that encode a subset of them seem to have propagated by a process that is unique to the platypus, involving mobile retroposon-like elements.

The sequencing of this unique genome is bound to prompt many more studies of diverse aspects of mammalian evolution.

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ORIGINAL RESEARCH PAPERS Warren, W. C. *et al.* Genome analysis of the platypus reveals unique signatures of evolution. *Nature* **453**, 175–183(2008) | Whittington, C. M. *et al.* Defensins and the convergent evolution of platypus and reptile venom genes. *Genome Res.* 7 May 2008 (doi:10.1101/gr.7149808) | Murchison, E. P. *et al.* Conservation of small RNA pathways in platypus. *Genome Res.* 7 May 2008 (doi:10.1101/gr.73056.107) | Schmitz, J. *et al.* Retroposed SNOfall — a mammalian-wide comparison of platypus snoRNAs. *Genome Res.* 7 May 2008 (doi:10.1101/gr.7177908) | Veyrunes, F. *et al.* Bird-like sex chromosomes of platypus imply recent origin of mammal sex chromosomes. *Genome Res.* 7 May 2008 (doi:10.1101/gr.7101908) | Park, J. *et al.* Origin of INSL3-mediated testicular descent in therian mammals. *Genome Res.* 7 May 2008 (doi:10.1101/gr.7119108)

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