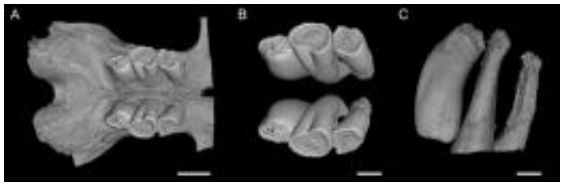
Mole rat dental structure similar to a shark

11 October 2011, by Deborah Braconnier



X-ray synchrotron microtomographic 3D rendering of the upper dentition of a young specimen of Heliophobius. Image: PNAS, doi:10.1073/pnas.1109615108

(PhysOrg.com) -- Sharks are capable of continually growing new teeth. As the teeth age, they fall out and new ones move forward similar to that of a tooth conveyor belt. Humans, and most mammals, on the other hand are only given two sets of teeth and must make them last. However, researchers have found there are exceptions to this rule and a new study published in the *Proceedings of the National Academy of Sciences* shows that the silvery mole rat is one of the exceptions.

It was first noted by Stuart Landry back in 1957 that these moles had more molars than the average rodent, but it was never investigated further. That is until Helder Gomes Rodrigues from the University of Lyon began this current study.

For this study, Rodrigues looked at the skeletal remains of some 55 mole rats and discovered that the molars at the back of these rodent's jaws seem to move forward. As they move forward, they erupt upward and are worn down through normal wear and tear. By the time a molar reaches the front molar row, they have been completely eroded and seem to be absorbed back into the jawbone.

The only other mammals with this similar ability to make more teeth are three different manatee species and a pygmy-rock wallaby. However, the mole rat seems to be the only one that has the set-up where the teeth move forward and upward. The other mammals have molars that sprout up, move to the front and fall out, similar to human baby teeth.

While it is believed that the manatee and wallaby have evolved to replace teeth due to the hard elements in their diet, the mole rat feeds on soft tubers and plants. Rodrigues believes that an explanation for this evolution to replacing molars in the mole rat may have something to do with digging rather than eating. While they primarily dig with their front incisors, they grind things with their molars and swallow abrasive dust. However this is still just a theory and the real reason behind this evolution of multiple molars still remains a mystery.

More information: Continuous dental replacement in a hyper-chisel tooth digging rodent, *PNAS*, Published online before print October 10, 2011, doi: 10.1073/pnas.1109615108

Abstract

Contrary to their reptilian ancestors, which had numerous dental generations, mammals are known to usually develop only two generations of teeth. However, a few mammal species have acquired the ability to continuously replace their dentition by the constant addition of supernumerary teeth moving secondarily toward the front of the jaw. The resulting treadmill-like replacement is thus horizontal, and differs completely from the vertical dental succession of other mammals and their extinct relatives. Despite the developmental implications and prospects regarding the origin of supernumerary teeth, this striking innovation remains poorly documented. Here we report another case of continuous dental replacement in an African rodent, Heliophobius argenteocinereus, which combines this dental system with the progressive eruption of high-crowned teeth. The escalator-like mechanism of Heliophobius constitutes an original adaptation to hyper-chisel tooth digging involving high dental wear. Comparisons between Heliophobius and the few mammals that convergently acquired continuous dental replacement reveal that shared inherited traits, including dental mesial drift, delayed eruption, and supernumerary molars, comprise

essential prerequisites to setting up this dental mechanism. Interestingly, these dental traits are present to a lesser extent in humans but are absent in mouse, the usual biological model. Consequently, Heliophobius represents a suitable model to investigate the molecular processes leading to the development of supernumerary teeth in mammals, and the accurate description of these processes could be a significant advance for further applications in humans, such as the regeneration of dental tissues.

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