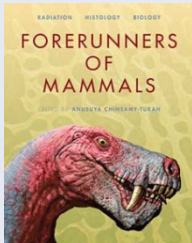




# Bone microstructure of the forerunners of mammals

**Book Title:**

Forerunners of mammals

**Book Cover:**

**Editor:**

Anusuya Chinsamy-Turan

**ISBN:**

978-0-253-35697-0

**Publisher:**

 Indiana University Press,  
 Bloomington, 2012, R860.00\*

\*Book price at time of review

**Review Title:**

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 forerunners of mammals

**Reviewer:**

 Roger B.J. Benson<sup>1</sup>
**Affiliation:**
<sup>1</sup>Department of Earth  
 Sciences, University of  
 Cambridge, Cambridge,  
 United Kingdom

**Email:**

rbb27@cam.ac.uk

**Postal address:**

 Department of Earth  
 Sciences, Downing Street,  
 Cambridge, CB2 3EQ,  
 United Kingdom

**How to cite this book review:**

 Benson RBJ. Bone  
 microstructure of the  
 forerunners of mammals.  
 S Afr J Sci. 2012;108(9/10),  
 Art. #1429, 1 page.  
[http://dx.doi.org/10.4102/  
 sajs.v108i9/10.1429](http://dx.doi.org/10.4102/sajs.v108i9/10.1429)

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Mammals are among the most conspicuous components of today's terrestrial ecosystems. They have colonised almost every environment on the planet's surface, including the poles and the open ocean, are adaptable and intelligent, and are fundamental to ecosystem function and agriculture. Many unique or specialised features have enabled their success – a warm-blooded physiology, maternal provision of milk, complex teeth, the ability to chew food, and numerous physiological and respiratory specialisations. These features distinguish them from reptiles, with which they shared an ancestor more than 300 million years ago. Fossil evidence has allowed palaeontologists to document the evolutionary origins of mammals from their earliest, reptile-like ancestors. *Forerunners of mammals*, edited by Anusuya Chinsamy-Turan, is a collection of articles that explains, and builds upon, our knowledge of this evolutionary 'stem group': the not-quite-mammals, or specifically, non-mammalian synapsids, that experienced their heyday 300–200 million years ago.

The story of these animals is global in scope, drawing on fossil evidence from every continent, and spanning more than a century of research. The messages are relevant to a wide scientific audience. But they should also be of particular interest to South African readers because an outstanding quantity of relevant fossils were collected from the Karoo and represent a key contribution to global knowledge (summarised in the second chapter by the South African palaeontologists Roger Smith, Bruce Rubidge and Merrill van der Walt). There are 16 colour plates that contain artistic reconstructions of ancient faunas and photos of some of the best fossils. These plates give an excellent sense of the world of the past, and the compelling natural beauty found in the fossil record. More specialised figures are scattered throughout the chapters.

The 11 chapters are peer-reviewed scientific papers written by palaeontological experts. They include both general reviews pitched at the level of a university undergraduate, and highly technical works on bone microstructure of primarily specialist interest. The most accessible chapters are concentrated towards the beginning and the end of the book. The first chapter, by Tom Kemp, provides an account of the diversity and evolutionary history of non-mammalian synapsids. The tenth chapter by Jørn Hurum and Anusuya Chinsamy-Turan begins with a crisp explanation of the oldest fossil mammals, and when key mammalian features can first be seen in the fossil record. The eleventh, and final, chapter is co-authored by John Ruben and colleagues. It provides a rational and clear account of how 'warm-bloodedness' works in mammals and birds, and what we can infer about its evolution in mammals using the fossil record. This chapter is my personal favourite. Although it provides little new information, it successfully synthesises complex data on a subject of great scientific interest in a complete but easily digestible form.

The central chapters (3-10) provide the meat of new scientific data and insight, focusing on bone microstructure, which is visible through a microscope when bones are sliced into thin or polished sections. Microstructural patterns provide a record of bone growth, analogous to tree rings, but with substantial added complexity. They can tell us many things including the age of an animal when it died, when it attained sexual maturity, how rapidly and continuously it grew, and sometimes aspects of its ecology, such as whether it was aquatic, or perhaps a digger.

My only criticism of this work concerns its rather generally framed title, which conceals its specialist content. The decision to depict dinosaurs on the back cover also seems devised to bring in the crowds – there is no doubting their popularity, but the book concerns mammalian ancestry, to which dinosaurs are irrelevant. However, withstanding these niggles, there can be no doubting the significance of this work from an academic or specialist context.

Chinsamy-Turan is an authority on bone microstructure in fossil animals. Her work, and that of others in this area, has doubtlessly provided substantial insights into the biology of extinct fauna. The unique value of this book is that it provides a state-of-the-art picture of scientific knowledge on pre-mammalian bone microstructure, and what it tells us about past faunas and the origins of mammalian biology. More accessible works on mammalian origins are available. For example, Tom Kemp's *The Origin and Evolution of Mammals* (2005) is an excellent undergraduate-level textbook. However, from an academic perspective, Chinsamy-Turan's *Forerunners of Mammals* is a great contribution to the science of palaeontology that will be an enduring point of reference on the subject.