

## Dawn of the Dinosaurs: Archosauromorph Evolution in the Terrestrial Triassic

The Triassic Period (252–200 million years ago) was a key time during Earth's history, which saw major changes among vertebrate communities living on land.

This included the evolutionary radiations of dinosaurs and a diverse range of closely related reptiles such as pterosaurs and crocodylians, which together form a group called Archosauromorpha. Archosauromorphs, primarily in the form of dinosaurs, dominated ecosystems on land for the remainder of the Mesozoic (~200–65 million years ago).



Our research focuses on understanding the timing, patterns and driving factors of the dinosaur and archosauromorph radiations during the Triassic. We use a variety of different approaches.

Fieldwork in Portugal, South Africa, Poland and Argentina is focused on discovering new fossils of early dinosaurs and their relatives. Systematic work involves travel to museums in countries such as Russia, the USA, China, Australia and South Africa to collect detailed data on the anatomy of dinosaurs and other archosauromorphs.

This work has the goal of understanding the diversity and evolutionary interrelationships of Triassic archosauromorphs, and requires us to build evolutionary trees using morphological cladistics.

Our macroevolutionary and biogeographical work combines evolutionary trees with data on the diversity, morphology and distribution of Triassic archosauromorphs to understand large-scale evolutionary patterns. For example: how rapidly were the gigantic body sizes of dinosaurs acquired? Why were certain groups of archosauromorphs restricted to particular geographical regions?

Palaeobiological work uses techniques such as CT scanning, histology and finite element analysis to understand sensory and functional adaptations.

### Members of staff involved:

**Richard Butler** ([/staff/profiles/gees/butler-richard.aspx](http://staff/profiles/gees/butler-richard.aspx))

### Research students:

- **Martín Ezcurra** (<http://www.birmingham.ac.uk/schools/gees/people/dr-students/ezcurra-martin.aspx>)
- **Roland Sookias** (<http://www.birmingham.ac.uk/schools/gees/people/dr-students/sookias-roland.aspx>)

### Project funding:

- German Research Foundation (DFG) Emmy Noether Programme Award (BU 2587/3-1 to Richard Butler)
- Marie Curie Career Integration Grant (PCIG14-GA-2013-630123 ARCHOSAUR RISE to Richard Butler)
- National Geographic (Young Explorer grant to Martín Ezcurra)

### Publications

**Butler RJ**, Rauhut OWM, Stocker MR, Bronowicz R. 2014. Redescription of the phytosaurs *Paleorhinus* ("*Francosuchus*") *angustifrons* and *Ebrachosuchus neukami* from Germany, with implications for Late Triassic biochronology. *Zoological Journal of the Linnean Society* 170: 155–208.

**Butler RJ**, Sullivan C, **Ezcurra MD**, Liu J, Lecuona A, **Sookias RB**. 2014. New clade of enigmatic early archosaurs yields insights into early pseudosuchian phylogeny and the biogeography of the archosaur radiation. *BMC Evolutionary Biology*.

**Ezcurra MD**. 2014. The osteology of the basal archosauromorph *Tasmaniosaurus triassicus* from the Lower Triassic of Tasmania, Australia. *PLOS ONE* 9: e86864.

**Ezcurra MD**, Scheyer T, **Butler RJ**. 2014. The origin and early evolution of Sauria: reassessing the Permian saurian fossil record and the timing of the crocodile-lizard divergence. *PLOS ONE* 9: e89165.

Fiorelli LE, **Ezcurra MD**, Hechenleitner EM, Arganaraz E, Taborda JRA, Trotteyn MJ, von Baczko MB, Desojo JB. 2013. The oldest known communal latrines provide evidence of gregarism in Triassic megaherbivores. *Scientific Reports* 3: 3348.

Nesbitt SJ, **Butler RJ**, Gower DJ. 2013. A new archosauriform (Reptilia: Diapsida) from the Manda beds (Middle Triassic) of southwestern Tanzania. *PLOS ONE* 8: e72753.

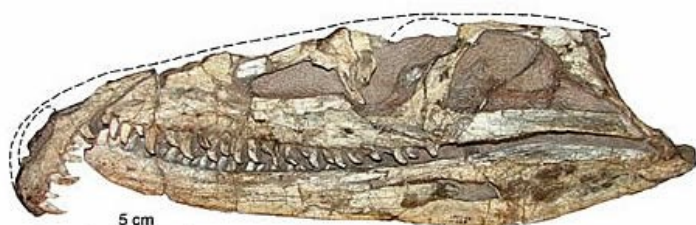
Niedźwiedzki G, Brusatte SL, Sulej T, **Butler RJ**. 2014. Basal dinosauriform and theropod dinosaurs from the middle-late Norian (Late Triassic) of Poland: implications for Triassic dinosaur evolution and distribution. *Palaeontology*.

**Sookias RB**, Benson RBJ, **Butler RJ**. 2012. Biology, not environment, drives major temporal patterns in terrestrial tetrapod body size. *Biology Letters* 8: 674–677.

Sookias RB, Butler RJ, Benson RBJ. 2012. Rise of dinosaurs reveals major body size transitions are driven by passive processes of trait evolution. *Proceedings of the Royal Society B* 279: 2180–2187.

**Sookias RB**, Sennikov AG, Gower DJ, **Butler RJ**. 2014. The monophyly of Euparkeriidae (Reptilia: Archosauriformes) and the origins of crown Archosauria: a revision of *Dorosuchus neotus* from the Middle Triassic of Russia. *Palaeontology*.

Toljagčić O, **Butler RJ**. 2013. The Triassic/Jurassic mass extinction as trigger for the Mesozoic radiation of crocodylomorphs. *Biology Letters* 9: 20130095.



## Key periods of data collection/fieldwork activity:

September 2011 – December 2014

## Opportunities (e.g. PhD proposals):

Postdoctoral-level researchers interested in getting involved in this research project should contact Richard Butler to explore possibilities through EU and other funding sources.

Brazilian postdoctoral researchers interested in short visits to Birmingham to develop research collaborations should contact Richard as special funding opportunities may be available.

PhD opportunities will be listed on the CENTA webpages in the winter of each year. Potential PhD applicants from China or Brazil should contact Richard directly as additional funding opportunities may be available. We are also happy to host PhD students from other Universitas 21 universities as short-term visitors.

Richard regularly supervises MSci and BSc Geology/Palaeobiology and Palaeoenvironments research projects within this general research area.



## More information

- [Archosauomorph Research Group \(http://www.archosauomorpha.com/home\)](http://www.archosauomorpha.com/home)
- [Follow Richard Butler on Twitter \(https://twitter.com/ButlerLabBham\)](https://twitter.com/ButlerLabBham)
- [Birmingham Brief article on Richard Butler's research \(http://www.birmingham.ac.uk/news/thebirminghambrief/items/2014/01/dawn-of-the-dinosaurs-understanding-the-triassic-world.aspx\)](http://www.birmingham.ac.uk/news/thebirminghambrief/items/2014/01/dawn-of-the-dinosaurs-understanding-the-triassic-world.aspx)
- [Article in The Conversation on Martín Ezcurra's research \(http://theconversation.com/how-i-found-the-worlds-oldest-communal-toilets-21397\)](http://theconversation.com/how-i-found-the-worlds-oldest-communal-toilets-21397)
- [Article in Buzz magazine on Richard's research \(https://intranet.birmingham.ac.uk/buzz/documents/public/Buzz-148-Feb-March-2014.pdf\)](https://intranet.birmingham.ac.uk/buzz/documents/public/Buzz-148-Feb-March-2014.pdf)

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