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The shape of things to come: Resolving biological and palaeontological mysteries using microCT imaging

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The shape and structure of animals is fundamental to their survival, including how they move and feed: bone shape determines how forces are transmitted from muscles during running and flying, and the microstructure of a tooth dictates whether it will break when crushing food. Our ability to adequately capture the fine-scale 3D structure of biological materials has until recently been very limited, severely restricting the questions we could ask about modern and fossil animals. With the extensive availability of synchrotron and laboratory X-ray microcomputed tomography (microCT), we can now peer inside structures with astounding fidelity, revealing not only what is inside but also how many of these components work. MicroCT has the great advantage of allowing internal imaging of unique and irreplaceable fossil specimens that would otherwise need to be examined using destructive techniques. In this talk I will give examples illustrating the importance of microCT imaging to a range of biological and palaeontological questions. As X-ray imaging relies on differences in electron density among materials, it is most effective for imaging mineralised structures, including bone and teeth, as well as fossils. MicroCT has been used to reconstruct the anatomy of Australian fossil dinosaurs, mammals and reptiles, including the Victorian fossils of the ornithopod dinosaur *Leaellynasaura* and the Cretaceous mammal *Ausktribosphenos*. We have also learned a great deal about some of the earliest multicellular life and the earliest vertebrates (conodonts) from microCT imaging. Demonstration and exhibition of the tiniest fossils is now immensely easier with high-resolution 3D printing based on the microCT data. New advances in microCT allow high-resolution imaging of soft tissues using contrast agents that differentiate tissues, and we can use this to investigate development and evolution in embryos and juvenile animals. The data from quantitative 3D imaging can be the basis of new shape analyses, including the evolution of complexity in animals and predicting the shape of undiscovered fossils.

Keywords or phrases (comma separated)

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No

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No

What is your gender?

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