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Advances in imaging technologies

10-P001.

Studying ancient Australians: 3D anatomical atlases of Lungfish and Wallabies

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The Australian Lungfish and the tammar wallaby are important species in the study of vertebrate evolution. The tammar wallaby, *Macropus eugenii*, is the most amenable marsupial kangaroo species for research due to its small size, its ability to breed in captivity and readily handled. It is also the subject of a genome sequencing project. The tammar is the best studied marsupial, especially for its, reproduction and development including sex determination and sexual differentiation, lactational physiology, genomic imprinting and immunology, providing valuable insights into the evolution and function of these processes both within marsupials and also in eutherian mammals (including mice and humans).

The endangered Australian lungfish, *Neoceratodus forsteri*, is a key for the study of tetrapod evolution, representing the closest living fish species to the tetrapod common ancestor. Lungfish development is therefore of significant interest for comparative studies with extant tetrapod species.

The study of these species is currently limited by the scarcity of embryonic information due to the difficulties of obtaining samples. To address this lack of information we are creating a 3D anatomical database covering development of these species that can be used as an anatomical reference and for comparative anatomy. Using optical projection tomography we create a complete 3D model from a single specimen that can be rendered and virtually sectioned. As no physical sectioning is required only a single sample is used to create virtual sections in any desired plane, allowing vast amounts of information to be gathered from each sample.

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Regional cardiac wall motion in zebrafish embryos

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Cardiac wall anatomy and motion may be different among individual chamber regions and are altered in disease states in humans, such as coronary heart disease. This study aims to analyse the cardiac wall motion and velocity of different regions of the ventricle in zebrafish embryos (3 days post fertilisation).

Using light microscopy (x400) ventricle regions (inner mid, outer mid, outer near bulbus arteriosus (BA), inner near BA and apical region) were tracked using a video edge detection system (Ionoptix) to determine contraction velocity (CV), relaxation velocity (RV) and wall motion amplitude (WMA).

Zebrafish ($n = 22$) had a heart rate of 156.3 ± 6.4 bpm and an ejection fraction of 37.0 ± 1.7%. CV and RV were significantly faster at the apical region than at all other regions measured ($P < 0.05$). WMA was greater at the apical region than all other regions ($P < 0.001$). No differences were found between other regions. CV (mean 178.2 ± 15.5 lm/s, $n = 9$) was greater than RV (mean 127.2 ± 15.3 lm/s, $n = 9$) at the outer near BA region, but for other regions measured RV was faster than CV (apical region: mean RV 365.2 ± 32.4 lm/s, mean CV 261.7 ± 23.4 lm/s, $n = 13$).

This study has shown differences in regional wall motion in the wild-type zebrafish embryo ventricle. Firstly, all three parameters were increased at the apical region compared to other regions. Secondly, the outer near BA region had a faster CV than RV, while the opposite was true for other regions. This suggests that, even at this early embryonic stage, there are differences in functional contributions of different regions to cardiac contraction.

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10-P003.

Analysis of morphogenetic branching using optical projection tomography

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The branching of epithelial and endothelial tissues during mammalian development is essential to the core function of the kidneys, lungs and vasculature. The ability for branched tissues to increase the surface area within organs to deliver nutrients and remove toxins is important for maximum efficiency of this exchange. A failure in branching can therefore have a detri-