

## 22. 3D architecture of axial muscle fibres in larval fish

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Fish swim by alternately activating their right and left axial muscles, thereby bending their body. The axial muscle fibres of adults are oriented in a complex helical pattern. In the front of the body, fibres make relatively large angles to the medial and horizontal planes, which may enable uniform strains across the transverse plane for particular body curvatures, supporting equal power contributions from all fibres. In the tail, fibres run more parallel, primarily stiffening the tail to transmit power towards the tail fin, rather than generating propulsive power. For larval fish, relatively little is known about fibre orientations. A previous study indicated that, in the anal region, the adult helical pattern is initially absent and develops over several weeks. However, no information is available on fibre orientations along the whole length of the body. How fibres at different locations contribute to power generation remains unclear. We made high-resolution 3D scans of 4 days post fertilisation (dpf) zebrafish larvae with fluorescent muscles. Fluorescence level variations allowed segmentation of individual fibres, for which we quantified size, orientation and curvature. Results show that axial muscle fibre sizes are similar, but that fibre orientation and curvature vary with location. This occurs along the length of the body, similar to fibre orientations in adults, and over the width of the body. Therefore, regional functionality may already occur in fish of 4 dpf. This study lays the groundwork for understanding how larval fish rearrange their musculature during development, and how this influences their swimming performance.