

Laboratoire Jean Perrin

Volker Bormuth: volker.bormuth@sorbonne-universite.fr

Georges Debrégeas: georges.debregeas@sorbonne-universite.fr

Website: <https://labojeanperrin.fr/pages/6>

Development of a 3D Pose Tracking System for Fish Swimming under Fictive Inverted Gravity

The vestibular system plays a central role in spatial orientation, balance, and postural control by providing information about head acceleration and orientation relative to gravity. Studying how fish adapt their swimming behavior to altered gravitational cues offers a powerful approach to understanding the neural mechanisms underlying sensorimotor integration and postural control.

This project aims to develop a high-speed 3D pose tracking system to characterize swimming behavior in larval zebrafish exposed to fictive inverted gravity. By magnetic manipulating of vestibular sensory input, fish can be made to experience an apparent inversion of gravity, triggering a 180° body roll followed by stable upside-down swimming. This remarkable behavioral response provides a unique opportunity to investigate how vestibular information shapes swimming trajectories and postural adjustments.

The student will develop a multi-camera imaging system and computational tools for reconstructing the three-dimensional position, orientation, and posture of individual body parts (head, trunk, tail, and fins) of freely swimming fish. The system will be used to quantify swimming trajectories, body rotations, and corrective motor responses under normal and fictively inverted gravitational conditions.

The resulting platform will enable quantitative investigations of vestibular control and sensorimotor adaptation, providing new insights into how the brain integrates gravitational information to generate coordinated movements.