

INVITED LECTURE T4

Reconstruction of *Danio rerio* early embryonic development by digital scanned laser light sheet fluorescence microscopy

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Mapping the behavior of cells during vertebrate embryogenesis is an important goal in developmental biology. We developed a light sheet fluorescence microscope and recorded nuclei localization and movement in entire zebrafish embryos for the first 24 hours of their development. Multiple views *in vivo* imaging allowed us to generate a database of cell positions, divisions, and migratory tracks. Our analysis of cell division patterns reveals a maternally-defined initial morphodynamic symmetry break, which identifies the embryonic body axis. We further derive a model of germ layer formation. 671 cells need to be followed in *C. elegans* embryogenesis, whereas the analysis of complex vertebrate embryos requires the tracking of 16,000 cells in an 18h-old zebrafish embryo. A volume of 1 mm³ must be recorded at least once every 90 seconds. The usually applied advanced fluorescence imaging techniques rely on confocal and multi-photon microscopes, which lack the combination of high-speed imaging and low photo-toxicity required for the fast recording of entire embryos over long periods of. In our recently developed instruments the specimen is illuminated along a single plane with a sheet of light. This arrangement provides three-dimensional optical sectioning and reduces the energy load on the specimen.