Dynamic Visualization of Embryogenesis (#1247)

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Our research aims to dynamically visualize and characterize embryonic development at sub-cellular resolution. Our primary focus in living animals is determining how the brain and heart forms and develops. We have developed transgenic, fluorescent protein (FP) expressing Coturnix quail as an experimental system. Coturnix quail offer advantages in the small size of its egg, the moderate size of the breeding adults, and its short generation time.

We continue to develop techniques for performing *in toto* imaging that allow us to systematically image vertebrate embryos throughout their embryonic development at single-cell resolution using in vivo time-lapse, multispectral laser microscopy. We are also developing advanced software to recognize and track cells in 4-dimensional, xyzt image sets. The goal of *in toto* imaging is to image and track all cell movements and divisions during embryogenesis and to digitize this data quantitatively at the level of the cell. We also plan to integrate the gene expression and cell migration data obtained with laser microscopy into a microMRI acquired digital Quail Developmental Atlas.

A. Computational Biology of Neural Cell Behavior

To increase our knowledge of how neural cells and their precursors are patterned in space and time, we are using dynamic computational imaging, in vivo, in conjunction with a new array of elegant molecular tools tailored for use in wild-type and transgenic quail embryos. In particular, we are using the synapsin-H2B.GFP, synapsin-GFP, and PGK-H2B-chFP transgenic quail to dynamically study forebrain and midbrain formation along with neural crest cell migration and differentiation.

B. Computational Biology of Vascular Cell Behavior

To increase our understanding of how endothelial cells and their precursors are precisely patterned in space and time, we are using high speed dynamic computational imaging, in vivo, in conjunction with a new array of elegant molecular tools tailored for use in wild-type and transgenic quail embryos. In particular, we are using the TIE1-H2B.YFP and PGK-H2B-chFP transgenic quail to study vasculogenesis and cardiogenesis.