

High-throughput imaging of zebrafish embryos in flow

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Abstract:

Miniature model organisms such as Zebrafish are widely used for biomedical research and drug discovery. However, currently screening and sorting were usually conducted by manual operation using traditional microscope, which required imaging big workload. The low efficiency hinders large-scale genetic/drug analysis and screening which is actually one of main advantage of using miniature small animal models.

This study introduces a high-throughput fluid-imaging-system designed to image Zebrafish embryos flowing through a capillary tube. The system contains a high-speed imaging module and high-resolution 3D imaging module. In high-speed imaging module, Zebrafish embryos flowing through a capillary tube were illuminated with a sheet of light, transmitted and fluorescent signals were captured using two linear charge-coupled device (CCD). This system can image dozens of zebrafish embryos per second. An image algorithm was developed to recognize each embryo and to perform automatic analysis. Dead and living embryos can be distinguished and sorted automatically according to the gray level distribution. Statistics of morphological characteristics of embryos at different growing stages can also be conducted. Pre-sorted Zebrafish embryos can be further imaged and analyzed by the next high-resolution 3D imaging module. The module use light-sheet geometry where excitation and collection objected positioned perpendicularly to minimize the photobleaching and toxic. Electrical tunneling lens were used to adjust the focus plane which enable high-speed 3D imaging up to 50 section planes per second.