High-throughput 3D imaging of zebrafish embryos in flow

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Miniature model organisms such as Zebrafish are widely used for biomedical research and drug discovery. Recently light sheet microscopy was tremendously used for 3D zebrafish imaging, owing to its minimization of the photobleaching and toxic. However, current geometry cannot allow high throughput imaging, due to the time-consuming sample mounting methods.

Here we present a new light sheet imaging geometry which is capable of high throughput 3D imaging of zebrafish embryos flowing through a capillary tube. A special sample chamber with a Fluorinated Ethylene Propylene (FEP) tube was designed to load and image the embryos. Zebrafish embryos flowing through the capillary tube in chamber were illuminated with a sheet of light, and fluorescent signals were captured by a sCMOS camera. To correct the fluctuation of fluid speed, a near-infrared LED light source and a second camera was used to take the bright field image. This system can load and image samples continuously with speed of around 30s to get 3D imaging of each embryo, including the time for sample loading and dispensing. Our system provides a high throughput 3D imaging tool which could be used for development biology and drug screening based on miniature model organisms.