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A Combined Light Sheet Fluorescence and Differential Interference Contrast Microscope for Live Imaging of Multicellular Specimens[1]
RYAN BAKER, MICHAEL TAORMINA, MATTHEW JEMIELITA, RAGHUVEER PARTHASARATHY, Department of Physics, University of Oregon — We present a microscope capable of both light sheet fluorescence microscopy (LSFM) and differential interference contrast microscopy (DICM). The two imaging modes, which to the best of our knowledge have not previously been combined, are complementary: LSFM provides high speed three-dimensional imaging of fluorescently labeled components of multicellular systems, large fields of view, and low phototoxicity, while DICM reveals the unlabeled neighborhood of tissues, organs, and other structures with high contrast and inherent optical sectioning. Use of a shared detection path for both imaging modes enables simple integration of the two techniques in one microscope. To demonstrate the instrument's utility, we provide several examples which focus on the digestive tract of the larval zebrafish. We show that DICM can sometimes circumvent the need for fluorescent based techniques, augmenting the number of parameters obtainable per experiment when used alongside LSFM, and that DICM can be used to augment each experiment by imaging complementary features, such as non-fluorescent local environments near fluorescent samples (e.g. fluorescent enteric neurons imaged alongside the non-fluorescent gut wall), interactions between fluorescent and non-fluorescent samples (e.g. bacteria), and more.

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