

Abstract Submitted
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**Bio-Fluid Dynamics in a Centimeter-Scale Diagnostics Incubator
with Integrated Perfusion**¹ J. VUKASINOVIC, D.K. CULLEN, A. GLEZER,

M.C. LAPLACA, Georgia Institute of Technology — Growing demands for long-term incubation of biologically faithful, three-dimensional neuronal and other cultures during extended physiological studies require efficient perfusion platforms with functional vasculatures that mimic the *in vivo* condition in a thermally regulated environment. While thermostatically controlled incubation baths with capillary action perfusion are available, their use is confined to specific experimental conditions. The interstitial nutrient and gas delivery remains diffusion limited over the long term and cultures decay metabolically. To overcome these problems, we describe simple fabrication and experimental characterization of a compact, diagnostics incubator that allows *in situ* monitoring of culture activity with a superior control of critical biological functions using convectively enhanced heat and mass transport. To overcome intercellular diffusion barriers culture is exposed to a direct flow of media issuing from an array of micro-nozzles that are directed normal to the substrate upholding the culture, and further improved by 3-D convection induced by jet interactions and biased, peripheral perfusate extraction through an array of microchannels as demonstrated by microPIV measurements.

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