Multiplexed Microfluidic Analytical Platform (M-MAP)

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An in-vitro tumor model that behaves similarly to in-vivo tumor tissue is essential for the development of targeted cancer therapies and treatment plans. 2D models have been the standard for pre-clinical studies in the past; however, studies show that they lack translatable models of tumor microenvironments. 3D multicellular tumor spheroids (MTS) models are a more accurate model due to similar interactions of cell architecture and oxygen gradients found in-vivo. However, they need constant perfusion of nutrients in the extracellular matrix (ECM) to sustain the viability of deeper cell layers for determining the efficacy of cancer therapies. A single-channel additive-manufactured monolithic device developed by Markoski et al. (2021) pioneered a biologically compatible platform design with 3D printable microfeatures for the sustainment and research of MTS. However, drug development calls for high throughput alongside replicable experiments, and consequently, there is a need for a multiplexed design that would allow for the standardization of multiple samples testing under uniform conditions. A four-channel device was then designed from a literature review within the last decade and of prior work and then successfully fluidically validated through COMSOL simulation. Prior MTS creation and imaging procedures were updated for regularity and an affordable perfusion setup was prototyped to prepare for physical biological validation of the platform via the insertion of created MTS. Ultimately, this multiplexed 3D spheroid-optimized platform has potential to broaden the accessibility of tools for drug development research and opens new directions in the fields of affordable personalized medicine and oncology.