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Microfluidic techniques for encapsulating gastric organoids

We investigated the use of microfluidics, in which small volumes of fluid are precisely manipulated in a lab-on-a-chip device, to manipulate the growth of gastric organoids. Organoids are populations of stem cells grown into tissue spheroids which mimic in vivo organs and systems. The focus of our research is on human gastric organoids, which are grown from gastric epithelial cells within Corning Matrigel Basement Membrane Matrix. We use specialized microfluidic devices to encapsulate these cells within different geometries, varying between 100-450 μm in diameter. The first technique is to make a thin PDMS film with an array of holes that is used like an "ice-cube tray" to make different 3D shapes. The second technique is to use a standard drop-making microfluidic device to form drops of Matrigel that encase cells. The viability of the cells were examined within the different geometries. By isolating and supporting a single human gastric epithelial cell within a Matrigel shape that can grow into an organoid, that organoid can be more easily analyzed, specialized, and transported. A potential application is to design and bioprint an organoid with ports, allowing easier introduction of drugs or removal of waste products from the organoid. Research is done under Connie Chang in the Center for Biofilm Engineering, in collaboration with Diane Bimczok in Microbiology and Immunology at Montana State University.