

Engineering Mucosal Barriers: From Organoids to Organs – on – Chips

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Mucosal barriers are the gateways to all internal organs, serving to transport oxygen, nutrients, and waste and at the same time performing enormous feats of protection against infection and other hazardous insults. The explosion of interest in the human microbiome – especially but not only that in the gut – has driven new interest in building human mucosal barrier models. This talk will highlight the development of synthetic “one size fits all” biomaterial hydrogels to engineer complex 3D epithelial-stromal-immune mucosal barriers, with a focus on the endometrium and the gut. A central feature of the approach is defining a parameter space capturing physical, biochemical, and cell-specific features. Semi-empirical exploration of the parameter space provides efficient definition of hydrogel formulations that foster both initial cell survival and proliferation and subsequent differentiated function. While some phenotypic functions are adequately captured in 3D static culture, complex functions involving microbiome-mucosa interactions or vascular-mucosa interactions require incorporation into micro- or meso-fluidic devices. Examples will emphasize how these approaches can be used to model chronic inflammatory diseases.