Breaking Barriers in Bioprinting

Team 10: **Thang Le, Tiffany Lukmantara**

Technical Advisors: **Seung-Schik Yoo (BWH & Harvard Medical School), Kavin Kowsari (BWH & Harvard Medical School)**

Given the significance of unprecedented biomimicry for artificial organs and tissues, there is an unmet need for a 3D bioprinting technique that can facilitate rapid printing while supporting high cell viability. Conventional extrusion or droplet dispensing printing is too time-consuming due to the constraint of layer-specific molds and exposes cells to high shear stresses at the nozzle. The photo-crosslinking technique addresses these limitations by crosslinking two-dimensional (2D) layers in a single exposure through modulation of the light source. However, existing photocrosslinking-based methods rely on cytotoxic ultraviolet-sensitive photoinitiators. The goal of this study is to develop a novel 3D bioprinting technique that eliminates the use of toxic components and cell-damaging UV irradiation. We propose to funnel through different compositions of biocompatible monomers, photoinitiators, and co-initiators to formulate an optimal bio-ink and utilize an organic light-emitting diode (OLED) microdisplay as a visible light modulator to photocrosslink 2D layers. Human cells will then be embedded into these hydrogel layers using the CleCell U-FAB machine. In this study, we discovered an optimal bio-ink with a rapid photocrosslinking time of 1 minute and demonstrated successful attachment of cerebral endothelial cells on multi-layered three-dimensional (3D) hydrogel structures fabricated using the OLED platform and CleCell U-FAB machine. This integration of an innovative biocompatible ink with a high-throughput OLED printing platform carries great potential in the wide range of tissue engineering applications and is a step closer to mimicking the complex biological shapes and structures of the human body.