Recapitulation of cancer niches by microfluidic device and 3D bioprinting

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Thanks to advances in microfabricated cell culture and 3D bioprinting technology over the past decades, the ability to realistically simulate important biological steps in disease models including cancer has dramatically improved.

In this presentation, I will show our recent efforts to recapitulate tumor niches displaying angiogenesis and invasion using 3D bioprinting and microfluidic devices. For an example, Cancer Resistance Accelerator Chip (CRAC), consisting of approximately 500 hexagonal micro-compartments with antiparallel gradients of doxorubicin and cell nutrients, can rapidly induce drug resistance in U87 glioblastoma cells. Another example is 3D-bioprinted breast tumors showing angiogenesis and invasion. The last example is a miniaturized cell stretching device demonstrating with the beneficial effect of cyclic stretching on cell proliferation of fibroblasts.

These works demonstrate that miniaturized cell culture system is an alternative to existing 2D culture models for cell biologists as well as medical researchers who are interested in understanding complex cell behaviors in an in-vivo like condition.