Advancing nanomedicine efficiency through bioprinted tumoroid cultures in translational oncology research

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Advancing nanomedicine innovations for oncology is hindered by the limitations of regular cell cultures in mimicking the complex tumour microenvironment, and by the restricted observability of in vivo models. While organotypic cultures are substantially improving the tissue similarity, their inherent sample variability constraints their usefulness for reproducible treatment testing. We have been working on addressing the limitations of these existing preclinical models through the use of tissue-matched synthetic hydrogel cultures generated by an automated bioprinting platform. Bioprinting hydrogel-based tumoroid cultures from patient cells enabled the consistent fabrication of biologically relevant tissue models which recapitulated several key tumour architectures. By combining multiple cell types within these hydrogels, it became possible to create co-cultures resembling different tumour environments from dense tumour cores, tumour-stromal interfaces, and healthy tissue with migratory tumour cells. These complex in vitro models then allowed monitoring cellular drug uptake over time and assessing the impact on individual cell populations. Advanced 3D in vitro models created with the RASTRUM bioprinting platform therefore have the capacity to facilitate enhanced evaluation of nanoparticle targeting, penetration, cellular uptake, and drug release within a tissue relevant context.