Abstract:
Rapid fabrication of real (albeit simple) living tissues by collagen plastic compression is now an established technology. It is unique since the constructs are engineered in minutes yet are genuine living tissues, comprising viable cells (one or many types) embedded within specific zones of a native collagen extracellular matrix. It addresses that traditional problem/tension of tissue engineering where strong synthetic polymers are largely not attractive as cell substrates and require slow, problematic cell seeding while native protein 3D substrates are cell friendly but frequently (always?) are exceedingly weak, over-hydrated hydrogels. Plastic compression is now in use within two separate families of applications; namely for en mass fabrication of 3D living tissue models for testing/screening AND for making clinical implants and support structures for surgery. This begs the question of where the RAFT technology can be usefully developed next.

We have identified two important areas for new uses, where progress is required. The first is in drug capture and controlled release, the second is in high mechanical strength constructs (greater than their current, immature-tissue like densities can provide). Towards this, we have developed (a) effective models of drug capture-release mechanisms and (b) practical methods for introducing reinforcing, mechanical elements to collagen constructs which do not degrade the main cell-friendly benefits of the process. Importantly, we have found that progress in both of these targets is underpinned by an increasingly subtle understanding of the ultra-filtration events during very rapid fluid expulsion which occur during collagen plastic compression.