Droplet Based Microfluidics for Biomimetic Immunomodulation

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Immunomodulation is a process by which an agent can modulate or control the immune system by inducing, augmenting, or suppressing its function. Augmentation of the immune system would be desired in cases of infection, whereas suppression would be desired to circumvent the inflammatory response to "foreign" implanted or injected medical devices (stents, grafts, drug delivery devices, etc.). Currently, mitigation of the foreign body response involves coating implants with anti-inflammatory drugs. However, these drugs can prolong and aggravate wound healing. To address this problem, a novel biomaterial was created by combining the bioabsorbable property of Poly(lactic-co-glycolic acid) (PLGA) with the anti-inflammatory property of an immunomodulatory protein naturally expressed in the body. The immunomodulatory protein inhibits immune activation while also allowing the biomaterial to mimic natural components of the body and thereby be recognized as part of the self. The novel biomaterial was produced in the form of microparticles (microspheres and microcapsules). Droplet based microfluidics was used to generate microparticles using single and double emulsion methods. These immunomodulatory microparticles were assessed to see whether they could alter macrophage activation as macrophage are one of the gatekeepers of inflammation and the foreign body response.