

Remote-Controlled Hydrogels for Scheduling Vaccine Administration

Raphael Gubeli (AG Wilfried Weber)

Vaccination represents a highly efficacious and efficient strategy to reduce worldwide morbidity and mortality saving millions of lives per year. However, most vaccination regimes require multiple injections inherently associated with a risk of infection as well as with the requirement of medical personnel and a functional supply chain management. We present a novel vaccine depot that is triggered to release its cargo and to induce protective immunity by the simple intake of an orally available small molecule thus replacing repeated injections by oral medication. To this aim, we designed a depot exclusively synthesized from compounds routinely used in human therapy. Responsiveness of the depot to a specific small-molecule stimulus was conferred by the grafting of protein-small molecule interactions on polyethylene glycol (PEG). We demonstrate the functionality of this biohybrid depot by the incorporation and stimulus-inducible release of vaccines. Upon implantation of the vaccine-loaded depot into mice, we were able to release the vaccine in a time-controlled manner by the oral administration of the small-molecule stimulus finally resulting in successful immunoprotection. Additionally, good tissue compatibility of the vaccine depot was demonstrated by fine histological analysis. This study represents the first application of a pharmacologically controlled biohybrid material for the scheduled induction of immunization and might represent a feasible strategy for the simplified administration of numerous vaccines and pharmaceuticals.