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## **Pathogen-associated molecular patterns on biomaterials: A paradigm for engineering new vaccines**

**Tarek M. Fahmy**

Department of Biomedical Engineering, Yale  
University, USA

Vaccine development has progressed significantly since Jenner and Pasteur, moving from whole microorganisms towards subunit vaccines containing only their antigenic proteins. Since subunit vaccines are often less immunogenic than whole pathogens, adjuvants must amplify the immune response, ideally establishing both innate and adaptive immunity. Biomaterials, including liposomes, solid biodegradable polymers, and natural polymers, in vaccines promote appropriate responses. These well-defined platforms feature easily manipulated physical properties, allowing for controlled delivery of antigen and immune stimulatory factors and the addition of pathogen associated molecular patterns (PAMPs) to target immune cells. Overall, modifying biomaterials engineers immune responses both quantitatively and qualitatively, considerably enhancing vaccine efficacy. Here we discuss advances in both immunology and biomaterials that have brought biomaterial particulate-based vaccines to reality.