Immunomodulatory Materials For Implantable Medical Devices

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BRIEF DESCRIPTION

The foreign body response to biomaterial implants has been a major challenge in translating many medical devices into the clinic. The presence of inflammatory cells around the implanted device prevents its functional interaction with the surrounding tissue, and although some inflammation may be desirable to mediate the healing process, a persistent inflammatory response will eventually lead to device failure. This biomaterial-induced host response is a cascade of events that is initiated by the injury from surgical implantation, followed by protein adsorption on the biomaterial surface, and infiltration and activation of inflammatory cells (neutrophils, and monocytes/macrophages) in the tissue surrounding the implant. Extensive efforts to reduce foreign body response have been largely focused on preventing non-specific protein adsorption, based on the idea that if protein adsorption is prevented, the ensuing interaction with inflammatory cells, and their activation, will consequently be minimized. However, data suggests that simply preventing protein adsorption and macrophage adhesion is not sufficient to reduce the foreign body response, and that promoting specific interactions with immune cells may in fact improve the overall host response. In this work, we demonstrate that an immunomodulatory protein coating, which interacts with surface receptors expressed by immune cells, effectively reduces inflammation and prevents material-induced host response.

A key feature of the immune system is the ability to distinguish dangerous from non-dangerous entities, in order to specifically target and eliminate invading pathogens or apoptotic cells while preventing damage to healthy host tissue. Immune cells recognize molecular patterns displayed on the surface of pathogens by their specific receptors and become activated. In contrast, host cells express surface proteins that are specifically recognized by immune cells, leading to inhibition of inappropriate inflammatory immune activation and prevention of spurious activation on self tissue. These immunomodulatory molecules are required for maintaining homeostasis and preventing immune hyperactivity, and defects in their expression have been shown to lead to chronic inflammation, autoimmunity, or allergy.

University of CA researchers show that immobilization of a certain immunomodulatory protein onto a model biomaterial surface effectively inhibits material-induced host response.

SUGGESTED USES

This study provides critical evidence demonstrating that the immunomodulatory molecule coated onto biomaterial surfaces functions to mitigate the inflammatory response. Importantly, we observed an inhibitory effect using multiple in vitro and in vivo models. This work may potentially lead to a new paradigm for materials used in biomedical implants, where materials are designed to actively modulate local immune response through specific molecular interactions with surface receptors expressed by immune cells. This strategy is also currently being explored for the delivery of nanotherapeutics. Ultimately, the general strategy of coating biomaterials with immunomodulatory molecules to evade immune response to implanted materials may improve the efficacy of numerous medical devices.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,717,827	08/01/2017	2013-015

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OTHER INFORMATION

CATEGORIZED AS

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