Abstract

TITLE: Engineered Nanostructures of Lipopolysaccharide for Investigation and Regulation of the Activation of Dendritic Cells

Abstract Body: Dendritic cells (DCs) are unique antigen-presenting cells that elicit specific T-cell responses, which in principle, can be used for immune-based antitumor therapy. Current research and development frequently utilize lipopolysaccharide (LPS) solutions for stimulation of DCs, whose maturation can be monitored by measuring the release of TNF-α and IL-6. The morphology of DCs upon maturation is known to exhibit filopodia extension at the cellular periphery. This work presents LPS using surface supported arrays of nanodots with designed size and geometry. The LPS nanodots stand 9.1 ± 0.5 nm above surrounding, with a diameter of 240 ± 10 nm. The periodicity of the nanodots arrays ranges from 200, 300, 500, 700, to 1000 nm. Upon interactions with bone marrow-derived dendritic cells (BMDCs) from C57BL/6 mice, the activation status of the BMDCs is determined by “fix-and-look” approach using scanning electron microscopy (SEM) and atomic force microscopy (AFM). As shown in Figure 1, the nanostructure presentation of LPS leads to highly dendritized morphology, to much higher degree than soluble presentation of LPS ligands. These observations indicate that the BMDCs are highly activated, and that DC activation depends sensitively on the local arrangement of the ligands, which can be designed and produced using nanotechnology. Work is in progress toward understanding the biological status and immune functions of the two new morphology types of BMDCs. We will also discuss possible mechanism for the highly stimulated cells by nanostructures of ligands.

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Figure 1. SEM images reveal cellular morphologies of (A) immature BMDC, (B) mature BMDC after activation by soluble LPS for 24 h, and (C) highly-dendritized BMDC after activation by LPS nanostructures for 30 min. Inset in C is a characteristic AFM image of LPS nanostructures. Scale bars are as follows: (A) 6 µm; (B) 10 µm; (C) 18 µm; inset in (C) 500 nm.
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