Engineering the molecular dynamics of polymeric biomaterials for regulating cellular functions

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个人简介：

The dynamic properties of polymeric biomaterials at molecular level impart significant impact on the cellular behaviors. Developing tunable molecularly-dynamic biomaterials is highly instrumental to the fundamental investigation on cellular responses to the dynamic cues in extracellular environment. In particular, cellular adhesion is controlled by the dynamic ligation process of surface receptors, such as integrin, to adhesive motifs, such as Arg-Gly-Asp (RGD). Remote control of adhesive ligand presentation can offer benefits in regulating cell-implant interactions, thereby immune responses or tissue regeneration in vivo. Herein we present a strategy for modulating nanoscale ligand oscillations by adjusting the frequency of an oscillating magnetic field to modulate the adhesion and specialization of stem cells and macrophages. We grafted RGD ligand-bearing superparamagnetic iron oxide nanoparticles (SPIONs) to a substrate via a long flexible linker. We demonstrate that a low oscillation frequency of the magnetic field stimulated the adhesion and differentiation of stem cells as well as the adhesion and M2 polarization of macrophages in vivo. In stark contrast, a high oscillation frequency inhibited the adhesion and differentiation of stem cells and the macrophage adhesion, but promoted M1 polarization of macrophages in vivo. Our system offers the promising potential to manipulate cellular adhesion to implanted biomaterials and their function, such as inflammation or tissue repair.

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