HOKKAIDO UNIVERSITY

AMBITIOUS LEADER'S PROGRAM

Fostering Future Leaders to Open New Frontiers in Materials Science

Ambitious 物質科学セミナー

″ Controlling Cell Fate through Physicochemical Cuing Generated by Nanoscale Surface Modifications and Functionalization ″

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Millions of devices made from diverse biocompatible materials are placed in humans each year. These devices, which include orthopedic implants and vascular stents, are relatively effective but still need significant improvement. To design improved biomaterials, cellular and molecular events at the material-host tissue interface must be better defined and controlled. Since cells grow and thrive on nanostructured extracellular matrices, and the various cell/matrix/substrate interactions that regulate gene expression take place on the nanoscale, the focus has been on nanoscale surface functionalization. In this context, we have developed a simple oxidative chemical treatment that produces a unique, nanoporous sponge-like network on various medically-relevant metal surfaces. The created surfaces are exciting because they selectively influence cell activity, elicit distinctive gene sets, and guide the differentiation of stem cells along desired pathways without exposure to any molecular signals.

The ultimate objective of our group is to create a new generation of biomaterials with ‘intelligent surfaces’ capable not only of providing selective cues to cells but also of responding on demand to the evolving local tissue conditions. We believe this will need the synergistic nanoscale physical modification and molecular patterning of implant surfaces, a challenge that requires the collaborative effort of scientists in biomedicine and chemical sciences and engineering.

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