Online Proceedings

SESSION 2D

CURRENT TOPICS IN BIOENGINEERING

Session Moderator: Elain Fu, Bioengineering
231 MGH
3:45 PM to 5:15 PM
* Note: Titles in order of presentation.

Biologically Active Polymer-Binding Peptides: A Novel Platform for Biomaterials Interaction
Cameron Lee (Cameron) Nemeth, Senior, Bioen: Nanoscience & Molecular Engr
Mary Gates Scholar
Mentor: Deok-Ho Kim, Bioengineering
Mentor: Candan Tamerler, Materials Science & Engineering

Polymers represent a versatile class of chemical compounds that have a wide range of impact in the field of medicine as implantable devices, tissue engineering scaffolds, and drug delivery vehicles. Synthetic polymers such as polyurethane acrylate (PUA) have been used to provide mechanistic cues in the form of altered nanotopography to help guide migration and differentiation in stem cells. To promote cell-biomaterial interactions to elicit desired cellular responses, these surfaces still must be modified. Chemical crosslinking reagents have been applied to engineer surfaces to enhance biological performance; however, they have limitations due to non-ideal reaction environments as well as their low coupling efficiencies with bioactive molecules and their potential converse effects under physiological conditions. Therefore, controlling the surface properties remains a challenge to induce enhanced interaction at the biomaterial interface. Material binding peptides were shown to possess specificity and high affinity to several inorganic surfaces such as gold or silica while offering easy conjugation with biomolecules. This peptide-based surface functionalization, if applied to polymers, can provide a more efficient and robust method of providing biological cues to synthetic polymers. Herein, we demonstrate a simple single-step incubation process that promotes non-covalent binding of bifunctional peptides on polymer surfaces. One end of the peptide possesses high binding affinity for the polymer substrate while the other end contains a bio-functional motif such as the RGD domain, which allows integrin-mediated cell adhesion. When combined with the topographical cues of an anisotropically nanopatterned polymer substrate, a flexible platform can be established to pursue many different research thrusts, such as enhanced stem cell differentiation. Specifically, we plan to use the established platform to uncover the underlying mechanisms of adhesion, morphology, and differentiation in C2C12 mouse myoblasts.

POSTER SESSION 4

Commons East, Easel 73
4:15 PM to 5:45 PM

Antibody Binding Peptide Construct Assembles on Gold Surfaces through BioFunctionalization
Carina Alexa Arboleda, Junior, Mat Sci & Engr: Nanosci & Moleculr Engr
Mentor: Candan Tamerler, Materials Science & Engineering
Mentor: Marketa Hnilova, Materials Science & Engineering

Conventional methods of biomolecular immobilization on metal surfaces entail surface functionalization by chemically prepared self-assembled monolayers (SAMs) conjugated with the desired biomolecules. Many such methods require multistep reactions under harsh environments, lack material selectivity, have low biomolecule coupling efficiencies, and often result in random-orientation during the adsorption of target biomolecules. Furthermore, the behavior and the stability of these synthetic molecules under physiologic conditions are still not well understood. During the last decade, bio-functionalization of surfaces using material binding peptides has been demonstrated to avoid such limitations. These peptide-based biomimetic approaches were demonstrated to functionalize surfaces on a variety of materials under aqueous environments. They offer a promising alternative to conventional chemical surface functionalization techniques, while providing the additional advantage of material specificity that chemical-based linkers lack. Further bioconjugation with functional biomolecules to the materials binding peptides provides the self-assembly of the conjugated product on the material surface in a single step. Here, we design a peptide exhibiting a strong binding affinity to gold substrates while immobilizing antibodies on the surfaces. Biocombinatorily selected gold-binding peptides (AuBPs) were conjugated to an antibody-binding domain (FcBP). The binding characteristics of the resulting constructs, i.e. AuBP-FcBPs, on gold substrates were evaluated using Surface Plasmon Resonance (SPR) spectroscopy. The coupling of dif-

ferent peptide functional domains into a single fused peptide has the risk of inducing structural changes in the resulting molecule due to intermolecular interactions. It is therefore critical to determine whether functionality of each region was maintained. The SPR experiments were carried out at different concentrations and resulted in Langmuir adsorption behavior, allowing the calculation of the binding constants. The resulting bi-functional bioprobe molecule can be employed in a wide range of diagnostic and therapeutic applications.