373g Adsorption of Proteins to Functionalized Alkanethiols Self-Assesmbled Monolayers for Improving Biocompatibility

Morgan B. Abney, Kimberly W. Anderson, and Leonidas Bachas

Long term implantable devices are a focus of increased interest and investigation. A major challenge with this area of research is the biocompatibility of these devices. Platelet and protein fouling of the surfaces not only degrades performance of the devices but can also lead to an immunological response that can be detrimental to the patient. The overall objective of this study is to design an implantable device that mimics a biological surface resulting in controlled cell adhesion or immunological indifference. To create these devices, we are investigating the controlled immobilization of proteins and protein fragments to surfaces. One protein that is currently under investigation is fibronectin. Fibronectin is a ~450,000 Da adhesion protein and has a role in several extracellular matrix (ECM) functions that include binding fibrin, heparin, and collagen. In addition, the primary task of the protein is attaching cells to the extracellular matrix. The structure of fibronectin is comprised of three repeating elements (FNIn, FNIIn, and FNIIIn where n is the repeat) and an optional variable unit (V) that form a monomer chain. Current research is focused on the purification of the ninth and tenth type III module (FNIII9-10) which contains the cell adhesion site. In addition, because no cysteine exists in this domain, the site of attachment to the surface can be controlled by adding a single cysteine to the molecule. Controlled immobilization of this protein and its fragments are accomplished using self-assembled monolayers (SAMs). The monolayers are formed by using functionalized alkanethiols followed by a covalently attached linker. One linker that is under investigation is the P1 protein found on the surface of the bacteria Treponema Pallidum, the known cause of syphilis. This protein is believed to bind fibronectin to the bacteria while maintaining natural orientation, allowing it to attach to cells in the human body. In addition, it has been suggested that this protein may also use fibronectin for antigenic disguise. In this study, we have employed surface plasmon resonance (SPR) spectroscopy to investigate the adsorption of whole fibronectin and fragments of fibronectin to surfaces. In addition we have also determined how this adsorption affects the adsorption of other plasma proteins. These results along with the formation of the SAMs and the corresponding protein adsorption will be discussed.