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WILLIAM M REICHERT, PROFESSOR

Dr. Reichert's research interests include biosensors, protein mediated cell adhesion, and wound healing. In general, my research concerns the behavior of proteins and cells at surfaces. These phenomena are central to many aspects of biology and medicine, for example thrombus formation, inflammation, complement activation, immune recognition, wound healing, cell-cell recognition, and cell adhesion to artificial and natural substrates. Proteins and cells at surfaces are also important in many technological applications, such as separation and purification systems, biorecognition-based diagnostics, indwelling sensors, tissue engineering, and soon-to-be realized biologically integrated devices. More specifically, I have focused on protein adsorption, protein-ligand binding, and protein-mediated cellular adhesion at artificial surfaces from the perspective of developing new diagnostics and improving biomaterials.

Multianalyte thin film waveguide immunosensing. Myocardial infarction is the number one killer in the Western world. Drug abuse is arguably the number one social problem as well. Developing point-of-care diagnostics for the sensing of multiple blood borne molecules in a single sample is crucial to accurate and rapid diagnosis. Important emergency care applications of this technology are the detection of multiple drugs of abuse (e.g. cocaine and heroin) and the detection of cardiac proteins indicative of heart attack (e.g. CKMB, troponin I, myoglobin).

Biochip array fabrication and characterization. Now that the human genome is virtually decoded, biomolecular arrays primarily for genetic screening are arguably one of the highest impact biotechnologcal applications on the horizon with an economic payoff in the billions of dollars. The drive to develop on-chip genetic screening capabilities, and the promise of combinatorial drug discovery technologies has led to the development of automated microspot arrayers. Now, arrayer systems are quite reliable, capable of fabricating arrays of more than 1000 elements per square cm on a variety of substrates from glass to gold. We are working on ways to increase the array density by two or three fold to increase the information processed per biochip.

Endothelial cell adhesion to polymers. No small diameter (< 2 mm) synthetic vascular grafts will remain patent in vivo owing to thrombus formation in the vessel lumen. Seeding a layer of endothelium, the contiguous cell layer that lines all blood contacting tissues, on the graft lumen is a natural and obvious solution to this problem. Although seeding the grafts with cells is straightforward, exposing the seeded graft to flowing blood strips 80-90% of the cells from the graft surface within minutes. We are currently working on protein-mediated methods to improve the initial attachment, spreading and growth of endothelial cells on vascular graft materials.

Transport of analytes through tissue encapsulating subcutaneous implants. In normal subcutaneous wound healing of implants, if the implant is smoothed-surfaced, and chemically inert, then a densely fibrous, relatively avascular tissue capsule will form around the implant within a few weeks that effectively walls the implant off from the body. This process, called fibrous encapsulation, is usually considered the endpoint of a "tissue compatible" implant. However, if the implant is to release or detect molecules, such as drug delivery or sensing devices, the fibrous capsule imposes both diffusion and perfusion transport limitations that can render the implanted device ineffective. Currently, no implantable sensor performs reliably for periods of longer than 14 days, resulting in large part from the deleterious effects of normal wound healing. It has long been known that textured surfaces can disrupt fibrous encapsulation, resulting in a less densely fibrous, vascularized tissue that can persist up to several months. We are currently working on methods to increase the vascularity and decrease the fibrosity of the tissue that encapsulates implanted sensors.

Profiling of cytokines in wound healing tissues. Cytokines are the molecular "traffic lights" that signal the action and pace of the wound healing mechanism. A critical first step in developing a molecularly-based wound healing strategy is profiling the temporal array of cytokines that are released from macrophages into the wound healing bed. Using microdialysis we intend to sample

cytokines from the extracellular space and determine the expression level using a protein detection array fabricated in our lab. Once this information is determined we can begin to develop release mechanisms that can turn on and turn off specific cellular aspects of the wound healing cascade.

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Teaching (Spring 2010):

- BME 202L.001, *FUND. OF BIOMAT. AND BIOMECH.* Synopsis
- BME 202L.01L, *FUND. OF BIOMAT. AND BIOMECH.*
  Teer 116, Th 01:15 PM-04:15 PM
- ME 302.01, *BIOLOGICAL ENGINEERING SEM*

Education:

PhD, Michigan, 1982
MS, University of Michigan, 1980
BA, Adolphus College, 1975

Specialties:

Polymer and Protein Engineering
Sensing and Sensor Systems
Tissue Repair, Tissue Engineering
Biological Materials

Research Interests:

Reichert's research interests include biosensors, protein mediated cell adhesion, and wound healing.

Awards, Honors, and Distinctions

Catalyst for Institutional Change Award, Quality Education for Minorities Network, 2005
Dean's Award for Excellence in Mentoring, Duke University, Graduate School, 2005
Pioneer Award, Samuel DuBois Cook Society, Duke University, 2004

Recent Publications (More Publications)

H. L. Prichard and W. Reichert and B. Klitzman, *IFATS Collection: Adipose-Derived Stromal Cells Improve the Foreign Body Response*, Stem Cells, vol. 26 no. 10 (2008), pp. 2691 -- 2695 [abs].

Norton, L. W. and Yuan, F. and Reichert, W. M., *Glucose recovery with bare and hydrogel-coated microdialysis probes: experiment and simulation of temporal effects.*, Anal Chem, vol. 79 no. 2 (2007), pp. 445--452 .

Norton, L. W. and Koschwanez, H. E. and Wisniewski, N. A. and Klitzman, B. and Reichert, W. M., *Vascular endothelial growth factor and dexamethasone release from nonfouling sensor coatings affect the foreign body response.*, J Biomed Mater Res A, vol. 81 no. 4 (2007), pp. 858--869 .

Kim, D. H. and Smith, J. T. and Chilkoti, A. and Reichert, W. M., *The effect of covalently immobilized rhIL-1ra-ELP fusion protein on the inflammatory profile of LPS-stimulated human monocytes.*, Biomaterials, vol. 28 no. 23 (2007), pp. 3369--3377 .

Koschwanez, H. E. and Reichert, W. M., *In vitro, in vivo and post explantation testing of glucose-detecting biosensors: current methods and recommendations.*, Biomaterials, vol. 28 no. 25 (2007), pp. 3687--3703 .